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The Yellow Flag of Quarantine: An Analysis of the Historical and Prospective Impacts of Socio-Legal Controls Over Contagion

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by

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DEDICATION

I dedicate this Dissertation to Drs. Raymond Harbison and Giffe Johnson, who actively supported my long quiet quest to complete this work and to obtain the Ph.D. in the field that inspires me most, public health.

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ABSTRACT

Under the ancient threat of morbidity and mortality from infectious diseases, human societies have responded for thousands of years by imposing social containment measures. Even before theorists and laymen recognized the existence of pathogenic organisms, or fully understood the principles of contagion, many societies and individuals did empirically infer that such diseases were transmissible from human to human (as well as sometimes between animals and humans). Having few effective technological measures to prevent or treat contagions, they did devise a variety of socio-behavioral procedures for separating overtly ill persons or suspected disease-carriers from nominally uninfected people. These methods included various kinds of quarantines and isolations. By the early years of the American republic, all of the states and many other jurisdictions had the legal power to impose them, and they have long remained on the codebooks of much of the country even as secular trends and bio-scientific

advances appeared to reduce the dangers of epidemic disease in the Developed World.

In recent years, however, there has been a recognized resurgence of infectious diseases in Western countries, and such developments as microbial resistance to antibiotics are threatening present-day control technologies. Under these circumstances, it is hypothesized here that societies must plan for the renewed usage of the ancient socio-legal contagion-controls, including quarantines and isolations, at least as part of a multi-pronged response to the renewed challenge of epidemics. However, the existing quarantine/isolation laws do not universally reflect modern scientific understandings of disease processes, and they have always conflicted with other socio-ethical and political "goods" such as individual liberties and commerce.

Thus, it is submitted here that it has become crucial to understand the historic character of quarantine-type measures on a "macro" plane, in order to learn from past errors, and to help develop modern quarantine/isolation laws and practices that reflect current bioscientific and legal thinking. The instant Dissertation analyzes the longstanding system of socio-legal controls over contagion, presenting a hypothetical structure that distinguishes them along several "Dimensions." In addition, it presents a functional schema that would help public health policy-makers, legislative drafters, and administrators to address individual contagions in terms of another set of "Dimensions," which would be more responsive to evolving bio-scientific and jurisprudential thought. To that end, this Dissertation presents a simple Algorithm that can be utilized when developing contagion-control laws that can be closely fitted to particular contagions, their specific manifestations, and their epidemic phases.

INTRODUCTION

"The commander of a vessel … on his or her arrival in any of the waters of this state, shall immediately hoist and keep his or her colors in the shrouds of the vessel as a signal that he or she has come from some infected place or has infection or contagion on board."

--R.I. Gen. Laws 23-9-14 (currently in effect)

To prevent the spread of contagion, "[t]he department of health may, if it considers it proper, take possession or control of the body of any living person, or the corpse of a deceased person…."

--Cal. Health & Safety Code 120140 (current California law)

"All cities and towns of this state shall have the power to … set up … hospitals … and pesthouses anywhere in the county … and cause persons afflicted with contagious, infectious or pestilential diseases to be removed to such hospitals or pesthouses … and to cause persons who have been exposed to such diseases … to be removed to some suitable place of detention and detained for a reasonable length of time.

-- Code of Ala. 11-47-134 (currently on Alabama's code books)

"The board [of health of a city] shall at once place in a conspicuous position[,] on the premises where … a person is isolated or quarantined[,] a placard having printed on it, in large letters, the name of the disease…."

--Page’s Ohio Rev. Code Ann. 3707.08 (currently in force)

A ship trapped in a harbor for forty days, stricken by deadly infectious disease, flying the yellow banner of quarantine to warn everyone away…. A sick person bearing the overt stigmata of a dreaded disease, ritually denounced and driven out of his community for life…. A house barricaded, with armed guards around it, to keep outsiders out and the inmates in, with a placard on the window warning of “Quarantine!”…

A. Summary of the Historical Theory of This Dissertation

Throughout history, infectious pathogens have played a vast and profound role in human social systems, as they threatened mankind with disease, disability, death, and social disarray. Epidemic and pandemic diseases such as leprosy, plague, yellow fever, smallpox, diphtheria, typhus, typhoid, cholera, tuberculosis, syphilis, and polio induced fear by their very names.

For centuries, however, the human response to contagion was hobbled. Basically, most societies and theorists lacked the conceptual systems and technical methods to comprehend the existence of pathogens and their transmissibility. (In fact, the very notion of pathogenic microbes, and the principle of contagion itself, remained highly controversial in Western medicine well into the 19th century). Often, people attributed the causation of epidemics to such factors as miasmas, celestial misalignments, or divine retribution for collective sin. Nor, at a practical level, did medical practitioners have many effective preventives or therapies to address infectious diseases. Human ills were prevented or treated by nostrums and practices that were sanctified only by ancient authority, creeds, and traditions. Most of these actions were ineffective (except for the placebo powers of belief), and morbidity and mortality from infection remained high.

Long before the "Germ Theory" became the dominant explanatory paradigm for infectious diseases in Western culture (identifying these disorders as the frequent outcomes of complex interactions between pathogens and their human hosts), some theorists, rulers, and laypeople *did* infer the process of contagion on empirical grounds alone. Without clearly understanding the dynamics of infection and epidemic disease, they could sense, in a rough sort of way, that these plagues somehow spread from person to person (or sometimes from animals to people). In response, polities developed various socio-behavioral methods for controlling contagions, some of which would eventually be called "**quarantines**" and later, "**social**

distancing" (*see* discussion below, Chapter I). These comprised a broad spectrum of occupational and assembly restrictions, banishments, and incarcerations of alleged disease-carriers. The strictest types of procedures would take some of the following forms:

In many places, communities would drive out sick **individuals** and allegedly exposed persons into a state of temporary or permanent exile. Historically, for example, so-called "lepers," syphilitics, and "phthisics" (TB sufferers) were prime targets of such official actions (reflecting a complex admixture of public health fears, religious-moral beliefs, and revulsion towards some physical symptoms). Some societies established "leper colonies," "lazarettos," "pesthouses," "quarantine camps," "sanatoria," and "isolation hospitals," and they sometimes sent armed policemen to haul infected persons into such institutions by force. On occasion, jurisdictions would take the ultimate step—and execute infected people or quarantine-breakers.

On a wider scale, health officials would sometimes barricade entire **households** inside their dwellings, along with the sick persons themselves, place quarantine placards on their doors, and sometimes post flags or emblazon red crosses on the buildings (during the Great Plague of London in 1664, signs on those stricken homes would plead

"May God Have Mercy on Us"). Eventually, the American colonies and later states and territories would also employ such practices against smallpox and other feared scourges. In some jurisdictions, the authorities would make provision for treating and feeding the home confinees; in other localities, they would simply leave the ill and the potentially ill inside their sealed homes to die. Armed guards ("*vi et armis*") would make sure that the doomed inmates stayed within the walls.

At a yet-wider scale, some apprehensive polities would also suspend community functions and close public facilities in **whole areas** afflicted by plagues, and they would bar vehicular traffic in or out of infected places. They might blockade buildings and whole neighborhoods—throwing *cordons sanitaires* around those geographical areas. (Sometimes, the collective-safety motives of such civic actions were complicated by other social attitudes and politics, including a dislike of minorities. For example, major district quarantines were thrown over the Chinatowns of Honolulu and San Francisco as recently as 1900 when *Yersinia pestis* plague broke out in those neighborhoods—and the motives in implementation may have reflected a mixture of public health zeal and prejudice against Chinese immigrants.)

Fearful states, territories, provinces, and central governments also sometimes quarantined fellow **states, territories, and provinces**. (As always, human motives could be mottled—commercial competition and power-conflicts were sometimes other goals for such quarantines.)

In deep and abiding fear of *Yersinia pestis* plague and other diseases, many **nation-states** also developed a hodgepodge system of international quarantines to prevent the importation of epidemic diseases from foreign countries. Over the centuries, a haphazard body of customary international law arose to further these ends. (For example, although there was considerable variation in practice, international maritime custom gradually institutionalized the "**yellow jack**"—a yellow, or yellow-and-black banner that suspected or infected ships at sea would have to fly from their main masts to show that they were under quarantine. It is the leit-motif of this Dissertation.) A government might proclaim that another country was plague-infested, or declare that the other country did not practice strict enough controls over internal and imported contagions, and it would thus impose strict quarantines over that country's flag vessels. (Since collective human behavior is often complex, though, disease-control might once again be only one goal in such state actions—others might be national hatreds, power politics, and commercial rivalries.)

As a more global perspective increased in the late 19th Century, a number of countries began to participate in **international conventions** to control pandemics through global sanitary and quarantine regulations. Over the next century and a half, and through wars and changes of international bodies, these regulations were slowly and episodically revised.

Thus, over the centuries, collective fears and beliefs about contagion (plus other social goals) built up a heterogeneous body of local, state/provincial/territorial, national, and international quarantine laws that long remained on codebooks across the world. Since law-development tends to move at a different pace from science-development, these laws sometimes continued to enshrine long-outmoded concepts of contagion, which did not reflect the changes in scientific understanding of this natural process. (Examples of this were the laws to control leprosy, or "Hansen's Disease." Out of a combined revulsion for the symptoms of this disease, religious condemnation, and fear of transmission, many polities imposed harsh constraints on victims of the disease for centuries. Some, including several U.S. jurisdictions, continued to invoke these laws well into the 20th century, even as science was coming to realize that the disease--for all its sometime fearsomeness—was not highly contagious. *See* the discussion below.)

In terms of their general impact on controlling contagion, quarantines (and related methods) have varied greatly throughout history. Sometimes they have failed to abate plagues, and the diseases have broken through the socio-legal barriers and saturated populations. On other occasions, however, social-containment methods have abruptly stopped, or at least reduced, the impact of pestilence. In such cases, their value in preventing suffering, death, and social chaos could not be gainsaid.

In almost all cases, though, quarantines have been born of desperation, and they have always required social trade-offs that were never easily accepted. To protect communal interests in the collective avoidance of disease, they could trammel individual interests in life, liberty, marriage, property, and the right to travel freely. At a wider level, quarantines could also impede the free flow of commerce within and between nations, impair comity between jurisdictions within countries, and raise sovereignty conflicts between countries. (While there were *some* commonalities of interest between the quarantined and everyone else, these were usually not many….) During extremities of public and official terror, states often resorted to compulsory quarantine measures—but they were usually buffeted, opposed, and circumscribed by the conflicting social, economic, political, and legal interests. These conflicts went on well into the dawn of the modern age.

Eventually, as Western societies modernized, collective host resistance against pathogens improved, and chances for host exposure to the microbes decreased. These secular trends followed "macro" socio-economic developments such as improving levels of nutrition, better working conditions, and cleaner housing. In addition, broad public health ("PH") measures such as urban sanitation, organized clean-water and sewage-disposal systems, and arbovector controls began to reduce the threat of epidemics. For its part, Western biomedical science increasingly understood the mechanisms of pathogenic disease, and it introduced new targeted methodologies for controlling it, such as diagnostic tests, vaccines, and antimicrobial agents.

Within several decades from the late 1800s to mid-1900s, these multiple societal developments made epidemic infectious disease decreasingly important in Western life. First, the dramatic pestilences of plague, smallpox, diphtheria, cholera, and yellow fever began to recede in incidence and impact. (The Spanish Influenza of 1918-1919 was another widely-lethal epidemic event, but its spread was limited in time.) By the first half of the 20th century, public and official attention was able to focus more and more on previously "background" chronic contagions like TB. After the development of vaccines and immune sera, and the antibiotic revolution of the 1930s through 1950s, poliomyelitis—the great child-crippler--may have been the last major scourge to terrify the general public in Western nations, and the Salk and Sabin vaccines virtually vanquished this contagion in those countries within ten years after 1954.

The last four decades of the 20th century saw a period that will be called here "**the Window Era**" of freedom from pestilence in the West: For perhaps the first time in most of human history, several generations grew up without facing constant major risks from severe epidemic disease (except for less-lethal pandemics of influenza and some venereal diseases). Infant mortality rates dropped, life spans increased, and chronic, non-contagious diseases became the greatest concerns. (This change in the dominant causes of morbidity and mortality of modernizing countries has been labeled the "epidemiological transition.") In the face of these trends, many people in the Developed World started to think that contracting an infectious illness, and dying from it, was an affront--a sign that some individuals or society had failed in their duty to protect them, rather than seeing it as an unavoidable hazard of life. During this "Window Era," too, many people thought of the old rough-and-ready quarantines as no more than ancient stories from the lives of grandparents. (This was a view shared in some more educated circles. In a 1967 speech, for example, the U.S. Surgeon-General declared that modern science had successfully conquered pestilential diseases, making them only a concern of the past, and he urged agents of public health to focus their future efforts on managing non-communicable disorders (Stewart WH, *cited by* Magnus, 2008).

Meanwhile, during those decades of comparative quiescence on the epidemic front, the ***general laws of individual liberty*** evolved in a number of countries, including the United States, with legislatures and courts extending wider substantive and procedural rights in contexts such as searches and seizures, imprisonment, and involuntary institutionalization for mental disease. By the 1960s, there was, in many legal subject areas, a generally wider conception of the rights of personhood as against the interests of the community. Mainly, these developments took place in non-quarantine areas of law.

On the other hand, the old laws of quarantine themselves actually remained in the codebooks of many jurisdictions (including all U.S. states and territories, and many of the country's localities), as well as in international laws and treaties, during the "Window Era." For decades, they remained largely unreviewed and unrevised. In recent years, some quarantine statutes and regulations have been updated to reflect changing views on individual rights, mainly regarding procedural due process. However, these laws have continued to accord great written authority to health officials to impose controls to stop the spread of disease across populations, overriding many individual freedoms when deemed appropriate. In practice, of course, the ancient laws were rarely applied during the decades of the "Window Era."

Despite the foregoing complacency about contagion felt by many Westerners during the "Window Era" of the mid-20th century, natural reality at a micro-ecological level did *not* justify beliefs that such diseases were mere figments of the past:

First, numerous infectious diseases had never actually been eliminated in the Third World during the years from 1960 through 2000: Even while the industrialized countries greatly reduced such ancient scourges as meningococcal meningitis, tuberculosis, cholera, malaria, trachoma, dengue fever, and *Yersinia pestis* plague, they remained endemic in many parts of the Developing World during those decades, causing at least sporadic cases, plus periodic outbreaks of severe morbidity and mortality.

Moreover, it has since become increasingly recognized in the West that old pathogens were still evolving during the "Window Era" (such as some strains of *Staphylococcus aureus*), and "new" pathogens were emerging as overt threats to mankind (such as the flavivirus that causes Ebola Haemorrhagic Fever)--due to a complex web of human and natural forces. (Among many other interrelated contributors to this trend, there were changing host susceptibility and exposure factors, such as over-population, wars and migrations, human entries into enzootic ecosystems, and rapid global travel--and such pathogen evolutionary factors as increasing virulence and antibiotic resistance. Environmental factors, such as global warming, have also been posited to play a part.) During the 1980s, HIV/AIDS became the first major sign of this ominous development in micro-ecology (although, for all its widespread and deadly impact, it was a relatively slow-moving epidemic, and much of the general public could view it as mainly a scourge of marginalized sub-populations). However, other signs of returning plagues followed in the ensuing two decades, including the Severe Acute Respiratory Syndrome ("SARS"), which struck eastern Asia and Canada (plus a few other areas) in 2002-2003.

Now, many scientists, policy-makers, and members of the public foresee a storm-tossed future in the arena of infectious diseases. One widely-feared pandemic hazard may be avian influenza caused by a mutation of the A/H5N1 virus, enabling it to spread easily between human hosts. Another much-discussed danger is the theoretical possibility of epidemics spawned by bio-warfare and bio-terror, drawing on technologies like the creation of chimeras (which might include bioengineering bacterial genomes to resist antibiotics, and restructuring viral genomes to defy extant vaccines). This particular field of research has been appropriately described as "public-health-in-reverse." Even without avian flu or bio-terror, however, the current dynamics of the complex ecology in which pathogens interact with other organisms, including animal and human hosts, raises legitimate concerns about epidemics as a renascent threat to global health.

As a result of this web of trends, the “Window Era” may now be closing. In this context, old questions reappear about the appropriateness of quarantines and other socio-behavioral controls in the abatement of communicable diseases. These questions need to be addressed in light of modern scientific evidentiary standards and in light of modern legal and socio-behavioral thought.

B. <u>Objectives and Structure of this Dissertation: Hypothesis</u>

This Dissertation will address the following question: In the face of renascent epidemics, should quarantine-type methodologies play a significant role in the human response? If so, in what form?

1. <u>Hypothesis</u>

It is submitted here that quarantines and other socio-legal controls over contagion have a definite role to play in future public health efforts to impede the transmission of pathogens between human hosts—but it is a role that needs to be appropriately informed and qualified.

It is further submitted that prospective usage of such contagion-controls first requires a broad-scale and thorough knowledge of their historic applications, in order to draw insights from their efficient and appropriate usages in the past --and also from their flawed historical implementations. This Dissertation will provide such a review and analysis of historic usages of quarantines and related measures. To further this process of inquiry, analysis, and preparation, this Dissertation will also propose a structured approach to quarantine-associated socio-behavioral controls over contagion (utilizing the concept of "Dimensions," as shall be further discussed below).

In the light of historic experience, moreover, it is stressed that socio-legal controls must be implemented, *in futuro,* in ways that reflect current bioscientific understandings of contagion, particularly current knowledge of the specific features of individual communicable diseases. In addition, the set of contagion-control procedures should reflect a thorough recognition—and a balancing--of other socio-legal factors that currently pertain to such actions, including contemporary developments in constitutional law relating to individual liberties, and modern social scientific data on the socio-cultural impacts of such measures. This Dissertation will present a hypothetical Algorithm which can be used by policy-makers and statutory/regulatory draughtsmen to apply tailored scientific knowledge to each contagion, its forms, and its epidemic phases. This system of questions to be asked regarding each disease will also rely on disease "Dimensions."

C. Stages in the Assessment of Quarantines

Basically, quarantines and other socio-behavioral control methodologies are complex procedures that raise a multitude of issues at many levels of analysis. They can be assessed from at least three major perspectives: the bio-scientific, the legal and/or ethical, and the socio-cultural. This dissertation will focus primarily on the first set of factors, which are fundamental to the whole process of quarantining, but a consideration of all of the factors would be necessary for legislators and health officials determining whether to promulgate, revise, or implement quarantine laws:

1. Bio-scientific Considerations of Quarantines

A priori, it is important to evaluate the potential bio-scientific value of quarantines in curbing the transmission and spread of communicable diseases. It would not be appropriate to retain such procedures without examining their scientific validity just because they had been used so extensively in the past and still remained on so many modern codebooks. If it were ultimately determined that quarantines were actually no more than relics of the past that modern science and technology had outmoded, there would not be any point in retaining them as public health tools.

In fact, there is some paucity of rigorous data about the effectiveness of quarantines in many circumstances; it has not been widely possible to assess them under conditions of tight experimental control (and, indeed, there might be some ethical concerns about doing so). However, historical and observational accounts *do* exist regarding the power of quarantines in the face of some past epidemics. (The quarantining of American Samoa during the Spanish Influenza of 1918-1919 was one such episode; some quarantines imposed in Asia during the 2002-2003 SARS epidemic provided other notable examples. *See* the accounts in Chapter I, *below*.)

On the whole, it will be submitted here that quarantine-type methods of public health control *can* have a genuine potency in slowing, ameliorating, or even abating plagues, and they should not be jettisoned because of their often-blunt features, very long histories, and sometimes questionable applications in the past. Recent events have shown that even though these public health devices may seem to be crude, archaic, and historically erratic compared with such current-day technologies as vaccines, antimicrobial drugs, phages, and immunotherapy, nevertheless, isolation and quarantine procedures, plus some more limited social distancing mechanisms, have a very definite role to play as part of a multi-pronged counter-strategy against pathogens. But that role must be an examined, scientifically-valid, and nuanced one that is appropriate to specific disease circumstances. The discussion in Chapter II, *below*, will aim to present such a targeted assessment that fits quarantine laws to the needs of particular contagion challenges.

2. Legal-Ethical Considerations of Quarantines

Even when, as here, it is concluded that quarantines and other socio-behavioral and legal instruments are scientifically-supportable parts of a public health response to outbreaks, a full inquiry can not end there. There remain other levels of analysis to consider, including questions of law and justice:

Throughout history, quarantines and other socio-behavioral controls have almost always provoked deep tensions and conflicts between the collective health and safety (at least as quarantiners construed it) and competing socio-legal "goods"--such as individual freedom, the free flow of commerce, regional autonomy, and national pride and sovereignty (at least as quarantinees, civil libertarians, merchants, and foreign offices interpreted them). At different times, and in different places, jurisdictions have put differing emphases on these often-divergent social interests, moving the "balance" in one direction or the other on the "scales" of policy favor. This was true with regard to the basic substantive question of whether or not to quarantine at all, and it also pertained to the specific procedural implementations of those quarantines. …There is nothing simple about such balancings—but all too often they have been made within the contexts of crises and chaos, inadequate planning and information, and sub-optimal conditions of social equity and governance.

a. Quarantine Conflicts between Individuals and Collectivities

In juxtaposing the collective safety *vis-à-vis* the interests of individuals in liberty (and the interests of merchants in free-flowing commerce, among other divergent interests), it seems arguable that there needs to be *some* fundamental deference to the survival of communities (even if one does not necessarily ascribe to a utilitarian ethic of providing "the greatest good for the greatest number"). The old Anglo-American common law had a maxim in this battle of the legal interests: "*Salus populi suprema est lex!*" ("The health of the people is the supreme law!"). Of course, it should be stressed that this principle was always an over-simplification, which did not address the actual need to balance the equities in situation-specific ways, particularly at the procedural level of implementation. Here, enlightened law-making and law-administration might be advised to follow the doctrine of "the least restrictive alternative" ("LRA") (*see* the discussion below).

b. Quarantine Conflicts between Jurisdictions

A collateral legal issue in quarantines concerns the tensions that these contagion-control procedures have often provoked (or—more realistically—exacerbated) between *different governmental jurisdictions*: Beyond the classic conflict between individuals and communities, history has often seen wider tugs-of-war between localities and states (or territories or provinces), between co-equal regional authorities, between regional authorities and central governments, between whole nations, and between individual nation-states and a rising international "community." (There were many such conflicts in past history. *Yersinia pestis* plague, in its long and deadly challenge to mankind, has frequently pitted nations against one another, as they tried to bar its return to their shores with maritime quarantines. More recently, the 2002-2003 outbreak of SARS also triggered many inter-jurisdictional conflicts throughout the world, including tensions within Canada between the City of Toronto, the Province of Ontario, and the Canadian National Government in Ottawa—as well as with the World Health Organization ["WHO"] in Geneva.)

While the ***federalized governance systems*** of countries such as Canada, the United States, and Australia have some advantages in responding to localized outbreaks of disease—to the extent that such systems confer a measure of autonomy-of-action to local governments that are closest to incipient events of this kind, they may face an adverse trade-off when epidemics become wider in scope: In the latter circumstances, federalized polities may face very real dangers of fragmented or overlapping authority and disparate resources. Quarantines and other contagion-control measures taken in one jurisdiction might contradict actions taken in a higher, co-equal, or lower jurisdiction. (These dangers became very real in 1918-1919, when the fragmented American system of governance led to a widely disparate response to the influenza pandemic. At one point, for example, the U.S. Surgeon General issued an order closing down public places in the state of Indiana to stop the spread of flu, and the state's Health Department acquiesced. However, the Health Commissioner of Indiana returned from a trip out-of-state, and he promptly countermanded the federal order--asserting that the U.S. government could not tell him what to do. The Indiana State Health Department then overruled its own Commissioner, and reinstated the federal directive. Immediately around these battling state officials, meanwhile, the municipal authorities of Indianapolis instituted their own ban on public gatherings within the city limits. The public confusion caused by these various governmental actions did not help abate the pestilence. *See* www.1918.pandemflu.gov/your_state/indiana.html.)

3. <u>Social and Pragmatic Considerations of Quarantines</u>

In addition to the foregoing bio-scientific and socio-legal considerations, quarantines raise other considerations, highly pragmatic in nature: Just because quarantines *can* impede the spread of pathogens through a susceptible human population, and just because legitimate legal and ethical arguments *can* be made for imposing them to protect the public's health, it does *not* necessarily follow that humans will comply with them. (In reality, they often have not.)

Into this arena now come a variety of issues that can be informed to some extent by social scientific understandings of human behavior: The extent to which individuals, small familial and social groups, and larger populations comport with public health directions to practice quarantines can depend on many independent variables. Since quarantines can be onerous, stigmatizing, frightening, and even dangerous to people subjected to them, there often have to be strong reasons to induce their participation.

While inducements to accept quarantines are often legal compulsions, especially in individualistic cultures like the one in America, most Western health officials would clearly see such actions as a last resort, and they would prefer to use more positive types of reinforcement for cooperation to the extent practically possible. For example, when trying to get victims of active tuberculosis to comply with medication regimens, many state laws would initially offer them the option of "directly observed" outpatient treatment, and they would only escalate to home confinement or compulsory institutionalization when the tuberculosis patients would not acquiesce to the more liberal regimes of care (*see* the discussion of the culpability dimension of quarantines, and the "LRA," *below*).

At an even more "hands-off" level, public health authorities may try to appeal to the "enlightened self-interest" of potential quarantinees. For example, they might use "social marketing" methods to encourage flu-infected or exposed persons to "self-quarantine" by invoking concerns for the safety of extended family members or workplace friends. These methods of invoking civic duty may have a greater chance of success in more communitarian and/or authoritarian cultures like those of Mainland China and Singapore. (During the 2002-2003 SARS epidemic, for example, Singapore managed to get a large number of potentially-infected citizens to submit to extended home confinements or even institutionalization for the greater good of the island community. While the city-state's laws verged on the draconian, public compliance seems to have been voluntary for the most part. That might not happen so readily in the United States, however.)

A wide sense that quarantine laws are at least being imposed benevolently, intelligently, "transparently," and equitably might mitigate some quarantinees' anger and resistance—but, in all likelihood, such program characteristics would still not preclude most angry opposition, and some degree of coercion would probably have to be imposed in many circumstances.

D. Summary Statement of Purpose

1. A Need to Prepare a Multi-Pronged Plan in Advance of Crises

Thus, with epidemics approaching, while some of the defensive weapons of modern medicine (such as chloroquine, methicillin, and vancomycin) are losing their clout, it might prove necessary to consider some of the ancient quarantine controls, at least as part of a multiple-containment strategy in certain circumstances. In other words, when the nuclear weapons fail, defenders may need to dust off the old harquebuses (or, at least, they may need to prepare for battle against pathogens using the whole panoply of PH weapons, both Mediaeval and modern).

In advance of the coming plagues, however, it is also crucial to review the hoary legal weapons of quarantine to try to ground them as much as reasonably possible on modern scientific understandings of contagion and epidemics. Moreover, it is important have a balanced understanding of the potential socio-legal impact of those historic tools. Out-of-control epidemics can be profound disrupters of human life, individually and collectively—but so can these PH response-instruments themselves. Policy-makers and citizens would be well-advised to recognize and prepare to handle the conflicts between social "goods" that they will surely engender. Modern policy-makers, lawmakers, and administrators need to conduct a broad and informed review of quarantines, taking into account present-day concepts of civil liberties, civic powers, and ethics. It is also important for planners to anticipate the public resistance that quarantining and other social-distancing measures will inevitably generate, and to prepare measures (such as "social marketing" campaigns) *ante hoc* to ameliorate it as best as reasonably possible.

It would be prudent to plan a coordinated approach to contagion-containment that would be responsive to local conditions at the outbreak sites—but that could also transcend local, regional, and even national boundaries as needed for a coordinated response to epidemics and pandemics. The many conceptual and pragmatic issues need to be addressed, and the laws practiced, before deadly events force their implementation.

Optimally, the PH response to a developing epidemic would be a situation-specific version of one of several pre-planned scenarios, with a complementary use of several procedural responses to the particular threat. The chosen scenario would be tailored as best as possible to the distinctive features of the disease (at least to the extent that this could be understood). Possibly, this multi-pronged response would emphasize different response measures at different stages of epidemic development (such as quarantines during the initial phase of the outbreak, possibly associated with chemoprophylaxes—if these are available, even as vaccines are being developed, followed at a later stage by a mass or targeted vaccination campaign). Of course, it is unlikely that mankind's actual response to a burgeoning plague will follow a rational and preplanned script, as past episodes have too often shown. But the goal is to introduce as much order as can reasonably be done.

It is highly preferable that such reviewing, weighing, planning, and drafting of laws, rules, and policies be done in the relative quiet before plague ships (and airplanes) appear over a national horizon.

2. A Need for Inter-Disciplinary Cooperation in Quarantine Preparation

As part of this epidemic preparation process, it might be added that several professions (as well as the general public) will have to participate in revising and drafting quarantine laws, as well as in their ultimate implementation. Among others, these professions will have to include bio-scientists, social scientists, public health administrators, law enforcement officials, and lawmakers in the executive, legislative, and judicial branches of multiple levels of government. These are professions with differing traditions, languages, and even world-views, and they often do not communicate very closely together.

In the face of recent events (including the terrorist attacks of 2001 and the anthrax mailings of the same year, as well as the A/H1N1 influenza pandemic of 2009), as well as in fear of future events (particularly avian flu), there has been some degree of rapprochement between these professions, and some degree of collective planning in some places. However, it remains variable in much of the U.S. and elsewhere.

It is hoped that this Dissertation will have some modest value in providing some common concepts and a workable *lingua franca* that can help surmount the barriers between professions that must come to work together.

When fast-moving and lethal epidemics return to the West, there will inevitably be some chaos, but PH’s goal should be to manage it and mitigate it as much as prudent preparation permits. There will also inevitably be controversy when contagion-controls are used, but effective planning might moderate its extremity.

E. **Content of Dissertation Chapters**: **Some Proposed Working Taxonomies**

To advance the pragmatic purpose of promulgating scientifically-based quarantine (and other social-distancing) laws, this Dissertation will propose some hypothetical "taxonomies" of quarantines and contagions: One taxonomy will analyze quarantine-type procedures in terms of a set of fundamental characteristics (or "***Dimensions***"), and a second taxonomy will identify a separate set of functional "*Dimensions" of communicable diseases*. It will be posited that these sets of dimensions would constitute a number of independent (though sometimes-overlapping) spectra along which individual socio-legal control procedures and individual diseases can vary. The goal will be to develop laws that are nuanced to reflect the general characteristics of individual contagions.

1. **Chapter I: A Taxonomy and History of Quarantines**

Chapter I of this Dissertation will address the quarantine/social distancing procedure "facet" of the present topic, briefly defining those control methodologies. It will analyze and structure them in terms of five basic "*Dimensions"* of "Breadth," "Depth," "Temporality (or duration)," "Protective Purpose," and assessed "socio-legal Culpability of quarantinees."

In a sequence of Sub-sections, this Chapter will illustrate the foregoing "Dimensions" of socio-legal contagion-control, and their specific types, in two fundamental ways:

a. Historical Backgrounds of Each Quarantine "Dimension" and Type

First, each Sub-section of Chapter I will present abbreviated *historical accounts* of each type of quarantine along the various Dimensional spectra—which will also highlight the biomedical and socio-legal issues that such quarantines can raise. Through this structure, the Dissertation will show how a set of particularly dreaded epidemic diseases (*viz.,* leprosy, the *Yersinia pestis* plague, smallpox, yellow fever, cholera, the venereal diseases, TB, Spanish Influenza, and SARS) helped shape this body of law. Particular focus will be given to several *archetypal quarantine events* that took place in the United States and its territories at the dawn of the modern age, since they encapsulated many of the issues that would rise again if quarantines are re-imposed *in futuro.* This historical overview is important in providing a deeper understanding of the truly ancient character of these PH procedures—which may, for all of that, still have an important role to play in the disease-wars of this millennium.

b. Some Present-Day Examples of Each Dimensional Type of Quarantine

Next, each Sub-section of Chapter I will also cite some examples of present-day American quarantine laws that fit the various Dimensions and types. This will show that many of these quarantines are more than curious figments of past ages—they remain active law on the books of certain jurisdictions that could be invoked again in the face of future epidemics. Thus, they would require re-examination and reconsideration in the quiet time before plagues return to American shores.

2. <u>Chapter II: A Taxonomy of Contagious Diseases (Strictly Functional</u>)

Chapter II of this dissertation will focus on the second major "facet" of this topical area—the targeted contagious diseases themselves. This chapter will structure those diseases in terms of the second set of fundamental "*Dimensions*." It will be noted that some of these proposed Dimensions of contagion are already familiar to theorists and practitioners of the PH-related sciences, although the approach adopted here may differ from their general concepts and practices. Among other differences, the goal here is not necessarily to follow classificatory systems used in basic microbiology, but to emphasize the important functional characteristics of the diseases in how they interact with the human species in social and legal contexts. While the proposed system will comport with the underlying scientific understanding of contagions (which is a crucial objective here), it will particularly stress attributes of diseases that can be pragmatically applied in the formation and structuring of control laws, policies, and management strategies. This approach will hopefully permit the introduction and application of cost-benefit analyses, theory, and management to the formulation of balanced socio-legal methodologies for controlling contagions.

Some of the Dimensions of contagion to be discussed in Chapter II will pertain to the general nature of the diseases themselves, associated particularly with their pathogenic agents (as they interact with human host and environmental variables). These will include notably the diseases' normative "Severity," "Efficiency of Transmissibility" (including their respective "Reproductive Number" and other variables of epidemic dynamics), "Modes(s) of Transmission," and "Duration" (particularly presence, frequency, and usual normative duration of asymptomatic carriage).

Another sub-set of Disease Dimensions will focus on the biomedical and PH status of the communicable diseases under present scientific conditions, *viz.,* the extent to which their aetiology is currently known, their diagnosability with existing clinical/laboratory techniques, their preventability with present technologies, and their treatability with extant therapeutic agents.

Ultimately, the foregoing taxonomy of disease will generate an Algorithm, or at least a series of roughly sequential questions, which can provide guidance on whether or not quarantines would be useful control devices--and, if they could be, then what types would be optimal under the particular circumstances involved.

a. Realistic Qualifications to the Above Objectives

The basic aim here will be to reflect the current consensus state of biomedicine and public health science when formulating or updating disease-control laws—to the best that this can be reasonably done under normal scientific, executive, legislative, and administrative conditions. In reality, however, this objective is subject to constraints at several points in the process of law-development: at the scientific end of the process (as will be discussed further below), it is fully recognized here that the foregoing Dimensions of disease are not scientifically incontestable, invariable, or immutable. As is widely recognized, the state of scientific understanding is often subject to intense disagreement, with competing theories and debated data. At the time that quarantine laws are being made or revised, for example, disease dynamics, aetiologies, diagnostic tests, prophylaxes, and therapeutics may be unknown or unavailable, or they may only be understood or available in a sub-optimal form. Even when there is a period of broad consensus on some principles, the complexity of nature usually requires the recognition of multiple exceptions to those rules. Moreover, the present scientific situation will likely change with time (either by ideological and methodological evolution or revolution), so the "reality" (or at least the Kuhnian "paradigm") that is widely construed at a particular point in time may quickly become only yesterday's reality.

Nor can it be assumed that the policy-making and law-making stage of the process will necessarily be smooth and rational, based on a clear-eyed access to scientific thought and data, or on an insightful and non-ideological application of it. (In the general PH arena, the present-day battles over immunization laws illustrate this reality: Too often, general doctrinal belief-systems, emotions, and narrow political-economic goals enter into the process, clouding the admission of scientific light on the issue of whether or not to immunize children, whether or not to compel it, and, if so, under what circumstances.)

The best that could be realistically sought is a reasonably rational and systematic mechanism for the periodic review of laws, and a process, set up *ante hoc*, that would allow policy-makers, law-makers, and administrators to access current scientific thought on communicable diseases. This would hopefully reduce the long-term enshrinement of ancient assumptions that science has passed by. One possible systemic approach would involve regular legislative/executive consultation with scientific advisory committees composed of recognized leaders in the field. (This approach can have drawbacks, of course. For example, it might put a premium on orthodox scientific thought at the expense of heterodoxical thought and research that may create tomorrow's understandings. Still, it would hopefully keep law reasonably close to bioscience as it developed.)

CHAPTER I: QUARANTINES AND OTHER SOCIO-LEGAL PROCEDURES FOR CONTROLLING CONTAGIONS-- A PROPOSED TAXONOMY

A. Preliminary Considerations of Nomenclature

1. Range of Methods of Contagion-Control

At this juncture, it is important to briefly note the range of possible methodologies by which public health can combat communicable diseases (particularly in their epidemic forms), and to mention the terminology that will be used here to describe these measures:

In the broadest sense, “weapons against contagions” can range from the most technologically primitive to the most sophisticated, and these have tended to follow a historical path from the oldest to the newest (though, as shall be noted throughout this work, a number of future situations may call for the use of the oldest methods). From a technological perspective, this spectrum of measures would include the ancient quarantines themselves at one end--and modern-day methodologies such as immunizations and anti-microbials at the other. (Other measures would include the set of anti-infection procedures used especially in nosocomial settings, which are sometimes termed "*barrier protection techniques.*" These would include the proper use of masks, gowns, and gloves, as well as simple handwashing, alcohol hand-rubs, and decontamination. Finally, this widest and most general category of procedures used to abate infectious transmission might even encompass such methods and instrumentalities as sewage-disposal systems and vector-management programs.) Taken together, this very broad panoply of methodologies will be denoted here as "*contagion-controls.*"

Within this most encompassing category of contagion-control methods, some sub-categories may be identified, although the terms are used somewhat variably in the literature: In recent years, a number of authors have started referring to the non-technological weapons against contagion as "*non-pharmaceutical interventions*" ["NPIs"] (also, "*community mitigation*"). (*e.g.,* Aiello AE, "Research findings from nonpharmaceutical intervention studies for pandemic influenza and current gaps in the research," *Amer. J. Infect. Cont., 38(4), 251-58 (5/10)*). These terms will be used here where necessary, though they are not very informative. Perhaps a better label for this set of PH methods would be "***socio-legal contagion-controls***" (or "**socio-behavioral controls**") since they consist mainly of measures that seek to reduce the spread of pathogens across human population groups by legally managing human host behavior.

As shall be discussed further below, the set of *socio-legal contagion controls* can range from the most voluntary to the most compulsory, and they can extend from the loosest and most permissive to the most restrictive and draconian. At one end of this gamut would be PH exhortations to practice good hygiene in the personal and community interest (often using modern "social marketing" techniques). Some "in-between" actions would include the closure of public places and enjoinders to stand apart from other people. Finally, there would be the strict-confinement quarantines and isolation measures themselves.

The term "***social-distancing***" is increasingly used in the social-scientific and medical literature to describe some interpersonal contagion-controls. Different writers also use this term in different ways, encompassing classic quarantines or not. So far, however, it has not been widely used in American PH legal statutes (although one Indiana state law does allude to it; Burns Ind. Code Ann. s 16-41-9-1.6 [2011]). In the instant Dissertation, "social distancing" will be used in a broad sense (since it is a good and evocative term for this panoply of non-technological contagion-controls), but it will be particularly used to refer to the subset of protective measures--such as school closures or mandating staggered work schedules--that do not impose the most severe or intense quarantine-like restrictions.

a. Partial List of Contagion-Control Modalities

A partial list of contagion-controls, not meant to be exhaustive, might include the following procedures that can be used to reduce the transmission of pathogens between individuals and across populations:

(1) <u>Longer-term interventions</u>

(a) Infectious waste-control facilities and systems

(b) Vector-abatement programs

(c) Nosocomial infection-control procedures, including barrier-protection techniques and decontamination methodologies. (Usage of gowns, gloves, goggles, masks and respirators where appropriate.)

(d) Disease surveillance and reporting systems (active and passive)

(2) <u>Epidemic-control and prevention interventions</u> – <u>Technological</u>

(a) Vaccination

(b) Chemoprophylaxes (*e.g.,* antimicrobial drugs, antiviral agents)

(3) <u>Epidemic-control and prevention interventions – Socio-Behavioral</u>

(a) Social education

(b) Individual restrictions on employment

(c) Bans on public gatherings

(d) Closures of public places, such as government buildings, schools and colleges, sports arenas, taverns, churches.

(e) Discontinuation or limitations on public transportation

(f) Physical spacing directives

(g) Workplace closures and/or telecommuting

(h) Quarantine and isolation

The main focus of this Dissertation will be the classic quarantine/isolation types of socio-behavioral contagion-controls, since they most clearly raise issues of bioscience, social science, ethics, law, and public policy. However, some due notice will also be given to less-restrictive procedures, especially under circumstances where contagion-control and epidemic abatement plans involve multi-pronged (or "layered") responses.

So-called "**self-quarantining**" methods will be considered to a limited degree in this Dissertation, since they are part of the panoply of social controls over communicable diseases, and their efficacy and effectiveness are subject to some bioscientific assessment. However, they clearly do not carry the "baggage" of socio-legal concerns that compulsory procedures can carry, so they will not be central to the present discussion. Of course, the voluntary types of social contagion-controls and the compulsory ones would usually not be implemented disjunctively; in most modern jurisdictions, they would more likely be part of a total epidemic-response "package," either employed simultaneously or sequentially (with "softer, " persuasion-type approaches being preferred initially, and the "club" of compulsion being held back for instances of non-cooperation).

2. <u>Another Note on Nomenclature: Definitions of "Quarantines"</u>

a. Brief History and Etymology of "Quarantines"

De facto quarantines probably date back thousands of years in various places, particularly with regards to certain infectious diseases. As shall be seen, for example, leprosy (or "Hansen's Disease") provoked socio-legal responses that ranged from expulsion from communities, to permanent home confinement, to incarceration in "lazarettos," to exile on remote islands (as well as to summary execution in some polities). However, these procedures were not generally labeled "quarantines" until at least the Middle Ages in Europe.

The term "***quarantine***" itself originated during the desperate 14th century years of the "Black Death" (or "*la Mortallegra Grande"—"the Great Dying,"* as the Italians then called the apocalyptic pandemic), when some maritime city-states along the Mediterranean littoral tried to keep infected ships, cargoes, and travelers from entering their ports. The authorities in several of those jurisdictions, including Venezia (Venice) and Ragusa (modern-day Dubrovnik), began requiring that vessels wait in their harbors for long periods of time before obtaining the right to land (especially if they were carrying passengers who were obviously diseased, or if they had sailed from foreign ports known to be stricken with outbreaks of plague). Based on crude observation, officials inferred that there was some period of time before plague symptoms became manifest, and some time before the symptomatic illness would run its course to recovery or (more usually) to death. In addition, it was then thought that certain cargoes were particularly prone to carrying the unknown element of plague, so they required long exposure to God's purifying air and sunlight before these items became safe. Presumably, mandating such lengthy time delays would ensure that the ships and those aboard them could no longer transmit the plague to the cities. In practice, the lengths of time of confinement in the harbors were variable, but thirty or forty days and nights were often imposed. The old Venetian word for the forty-day period was "*quarantena,*" which may have derived from the French term "*quarantaine*" (which itself originated in the Latin word for "forty," "*quadraginta*"). In all probability, this choice of time period was inspired more by religious tradition than by any empirical knowledge of incubation periods, but the term "*quarantine"* stuck. It was eventually adopted by the English in the 17th century, and polities gradually applied it to a wide variety of loosely-related contagion-control procedures. (*See, e.g., Merriam-Webster's Student Dictionary*, *www.wordcentral.com*, accessed 10/13/11; *also see* Tyson P, "A short history of quarantine," *Nova, www.pbs.org/wgbh/nova/body/short-history-of-quarantine.html*, accessed 10/13/11.)

b. Focus on Quarantines of Humans Only

It may be added at this juncture that many infectious diseases affect animals and plants, some of which are of significance to human consumption needs, commercial and economic concerns, and even macropolitics and international affairs. (Even bio-warfare and bio-terror could be practiced against the animate and inanimate food sources of enemy nations—and they sometimes have been. For example, the bellicose powers of World War I restrained themselves in few ways in their drive to win, using weapons such as flamethrowers and poison gas against enemy combatants; although these nations did not resort to biological warfare to any notable degree, there were some reports that the Kaiser's Germany tried to introduce glanders in cattle destined for use by the Allies.) To try to inhibit the spread of contagion in commercially-important animals and plants, many countries and lower-level jurisdictions have set up complex legal systems of animal and plant quarantines. These procedures can have significant impacts on human societies, especially when the diseases in question are zoonoses, such as SARS in civet cats and avian influenza in poultry—with a potential for severe human impact at a later stage of zoonotic development. Nevertheless, such quarantines are outside the scope of this Dissertation, since they raise many bio-scientific, societal, and legal issues that are not involved in human quarantines, and they fail to invoke many of the issues that arise in the latter (such as individual human liberties).

3. <u>Quarantines in Present-Day American Law--Definitions</u>

Every American state and territory has a body of human quarantine statutes in its codebooks, and some have additional quarantine-related regulations in a separate set of administrative codes. (In addition, numerous lower-level jurisdictions, including some "home rule" counties and chartered municipalities, have also promulgated contagion-control ordinances and administrative rules.) Historically, most jurisdictions have defined these PH procedures in a roughly similar way, though there have been variations in specific terminology (which could sometimes have significant socio-legal impact in implementation).

One important variation involves the distinction between "**quarantines**" *per se* and "**isolation**," which is worth examining in a little more detail because it can have some major impacts on PH policy and administration at the interface of law and science.

a. “Quarantine” vs. “Isolation”: A Definitional Difference with Policy Implications

(1) <u>The Unitary Concept of “Quarantine”</u>

In traditional medical lexicons, a “quarantine” was defined as “a strict isolation imposed to prevent the spread of disease” (dictionary.reference.com/quarantine, accessed 10/19/11). In other words, the words “***quarantine***” and “***isolation***” were essentially used interchangeably here. In this formulation, “quarantine” was a simple and undivided concept, referring to the sequestration of *any* individuals or groups who were obviously--or possibly—capable of transmitting infectious diseases to other people (after the development of the “Germ Theory,” these would be individuals or groups who were thought to be infected with pathogens). It thus encompassed a broad array of persons whose only common feature was known or suspected exposure to a communicable disease, leading to this evident or questionable state of infection. They may, individually, have had a spectrum of symptomatology that ranged from the “totally” asymptomatic, who appeared “well” to observers--to the openly and desperately ill, who might be coughing violently into the ambient air.

Some American jurisdictions still employ this basically unitary definition of "quarantine." For example, the State of Hawai'i still defines it rather simply as

> [t]he compulsory physical separation, including the restriction of movement or confinement of individuals or groups *believed to have been exposed to or known to have been infected* with a contagious disease, from individuals who are believed not to have been *exposed or infected*, by order of the department [of health] or a court of competent jurisdiction.

(Haw. Rev. Stats. 325-8(a), 325-20(a); emphases added).

(2) <u>Distinguishing between "Quarantine" and "Isolation"</u>

On the other hand, some present-day parlance in public health distinguishes between "*quarantine"* for exposed persons who are nominally "healthy," and "*isolation*" for exposed persons who are "overtly ill." As part of the spate of recent state legislation against bioterrorism and other public health emergencies (q.v.), numerous American jurisdictions have adopted this relatively standardized definition for "quarantines" and "isolation." While individual states and territories have varied the specific wording of this basic definition to fit different local emphases (which can also have differing practical implications), the usual definitions are similar to the ones in North Dakota's Century Code Annotated. This code defines "*quarantine*" (*per se*) to mean

> the physical separation and restrictions on movement or travel of an individual or groups of individuals, *who are or may have been exposed to a contagious or possibly contagious disease* and *who do not show signs or symptoms of a contagious disease* from nonquarantined individuals to prevent or limit the transmission of the disease to nonquarantined individuals

(NDCA s 23-07.6-01, subsec. 6; italics added), and it defines

"*isolation*" to mean

> the physical separation and restrictions on movement or travel of an individual or groups of individuals *who are infected or reasonably believed to be infected* with a contagious or possibly contagious disease from nonisolated individuals, to prevent or limit the transmission of the disease to nonisolated individuals

(No. Dak. Cent. Code Ann. s 23-07.6-01, subsec. 3; italics added).

A number of other jurisdictions (e.g., 10 Guam Code Ann. s 19104; LSA-R.S. s 29:762 (13); Mont. Code Ann. s 50-1-101; Nev. Rev. Stats. s 441A.115; Or. St. s 433.001(5), (10); Va. Code Ann. s 32.1-48.06) echo this distinction between "quarantine" and "isolation," although their specific wording can vary. For its part, South Carolina gives more detail for certain contexts, identifying the quarantinees as "*healthy* people who have been potentially exposed to a contagious disease," while isolates are "individuals known or suspected (*via signs, symptoms, or laboratory criteria*) to be infected with a contagious disease" (SC Stat. 44-4-130 (N); emphases added).

(3) <u>Arguments for and against a Unitary definition of Quarantines</u>

Various fundamental arguments could be made favoring and disfavoring the use of unitary and binary conceptual definitions of "quarantine/isolation," and these definitions could have significant policy implications:

(a) Arguments Favoring a Bifurcated Conceptual Approach to "Quarantines" and "Isolations"

On the one hand, very pragmatic grounds could be advanced for adopting the current binary definition of "quarantines" and "isolations" used most widely in public health and state laws. Fundamentally, PH laws and practices need to consider the *differing points of view of the primary parties* involved in a quarantine/isolation: Certainly, ***PH authorities*** have clear goals in preventing any infected persons from passing pathogens on to a larger society, so they would likely want to throw a wide net around *all* theoretically exposed persons—whether presently ill or not. However, the ***confinees*** themselves have legitimate interests of their own, which may overlap the collective interest—but often do not.

In many cases, "**quarantinees**" will be possibly-exposed people who still feel well (or *mostly* well) and who will not readily accept the living conditions and restrictions of strict hospital settings. More importantly, these people will also not want to be placed in the same "isolation" quarters as the demonstrably diseased, since they may reasonably assume that—while they might *theoretically* have already been "exposed to illness" in the community--they might not have *actually* been infected in this way, and they could *still* avoid the contagion if they are not intermingled with the actively ill in an isolation unit. At the very least, they will expect a "quarantinee" public health status (and appropriate separate lodgings and conditions) somewhere between the assumedly unexposed citizenry *and* the confirmed infectious isolates. (South Carolina's updated quarantine law recognizes this medical need to separate quarantinees from isolates, instructing the state's Department of Health and Environmental Control that "individuals isolated because of objective evidence of infection or contagious disease *must be confined separately* from quarantined asymptomatic individuals…" [SC Code 1976 Ann. s 4-4-530(B)(2), emphasis supplied].)

For their part, many *ill people themselves* would also resist being isolated in infectious-disease institutions. (At least, this would be true to the extent that they remain alert and protective of their own self-interests; in any case, their significant others would have such concerns on their behalf.) Many such symptomatic persons would want to remain at home in familiar surroundings. Moreover, some might believe that their own malady was not really severe and communicable—and they, too, would object to being put in communal wards with the contagiously-ill. At the very least, they would want to be isolated in sophisticated treatment facilities that would best restore them to health.

Historically, quarantining jurisdictions have varied in how well they reflected these differing confinee interests: In the centuries after the Black Death, some countries and city-states along the Mediterranean littoral--including Marseilles, Leghorn, and Messina--developed relatively elaborate maritime quarantine facilities ("*lazarettos*") that routinely confined all crews and passengers of ships from plague-infected countries (*see below, this Chapter*). To some extent, these lazarettos would lodge seemingly healthy quarantinees in separate quarters within the grounds, while segregating the overtly-sick confinees in special buildings (although the latter facilities could hardly be considered quality hospitals in which the sick could get well). Over the centuries, though, *most* quarantining jurisdictions have thrown "healthy" infection "suspects" into common quarters with the overtly ill—under conditions that were highly insalubrious for everyone.

Some recent discussions of quarantines have underscored the distinction between "quarantining" the exposed and "isolating" the sick. For example, some authors have argued that "isolation" of the sick is generally justifiable, while "quarantining" of the asymptomatic is controversial (Day T, *et al.,* "When is quarantine a useful control strategy for emerging infectious diseases?" *Amer. J. Epid., 163*(5):479-485 [2006]). In their view, some contagions such as SARS do appropriately call for *isolation* of the overtly ill—but they do not justify wholesale *quarantining* of the merely exposed, as Mainland China and some other polities did in 2003.

In addition, one of these groups of writers has posited, on a theoretical basis, that quarantines and isolations can almost work inversely to one another in the course of an epidemic (Day, *et al.* 2006). They have suggested that in some epidemic situations, effective *isolation of the overtly ill* will reduce the value of quarantining of the asymptomatic "well." Conversely, if isolation of sick persons proves inefficient, *quarantines* could be effective--provided that several circumstances are present. (These criteria would be: Initial cases of the disease could produce multiple secondary cases; there was a high probability that the exposed but symptomless individuals will be placed in quarantine; there was a high probability that these quarantinees will not transmit infection while in quarantine; there was a high probability that the quarantinees will be promptly isolated if they develop signs and symptoms of the disease; and the asymptomatic period of the disease was neither too short nor too long).

(b)Arguments Favoring a Unitary Conceptual Approach to "Quarantines"

Having said the above, it must nonetheless be noted that there may also be some legitimate arguments against adopting the sharply binary distinction between "quarantining-the-exposed" and "isolating-the-sick":

In biomedical reality, the distinction between simple "exposure-to-disease" (calling for "quarantine") and "sickness" (calling for "isolation") may not be as robust as some present-day state laws attempt to assert. It is more realistically a process continuum than a dichotomy (in terms of time and clinical manifestations), a spectrum rather than a bright line in the sand:

First, "healthiness" or "wellness" itself is a hard and vague status to define—and it may prove deceptive. The process of host-exposure-to-pathogens can actually involve a sequence of events that extend from "contamination" (surface contact with pathogens), to sub-clinical infection, and only sometimes to overt and severely symptomatic illness. At a subtle and sometimes barely detectable level, a physiological conflict may really be developing in a seemingly "healthy" host's body between the pathogens and his immune system, which may, or may not, culminate in some degree of symptoms. During that time, this individual may be silently incubating an infection that makes him dangerous to others.

Moreover, when "overt" symptoms do appear, they can be subjective and subtle: Simple cephalgia (headache), a feeling of "malaise," or a "scratchy throat" might simply reflect stress (perhaps induced in suggestible minds by the *fear* of a threatened contagion), or they *might* be the prodromal symptoms of a lethal bout of influenza or some other epidemic disease. While "*signs*" of illness might in principle be more objectively observable than subjective "*symptoms*," even they can have a range of interpretations—for example, the presence of a body temperature in the 98.7° - 99.9° F range might be defined as a "fever" or not, depending on an individual's baseline temperatures and on an diagnostician's own premises. And it might not necessarily signify that the individual had contracted the particular feared disease. During the early days of the SARS outbreak in 2003, for example, there were no quick and effective diagnostic methods for this new contagion, so PH authorities in various countries started "rough-and-ready" thermal screenings of travelers at the borders or even inside the countries. However, this methodology was not very specific to the targeted disease, and its diagnostic efficacy could be legitimately questioned (*see* discussion below).

In contagion-control practice, too, perception of "signs and symptoms" in an individual disease "suspect" may be only as good as the observer and the tools available to him. During an epidemic, for example, decisions about who to allow aboard an airplane may devolve upon US Transportation Security Administration screeners based on no more than spot-observations of people in a line (or on questions posed to would-be travelers regarding their subjective state of health). Such non-medical observers might watch for gross stigmata of disease such as skin lesions or violent coughing; in so doing, they might overlook subtle incipient signs and symptoms such as faint sweating and headache, or they might too-aggressively assume that sufferers from a common cold have SARS or avian influenza.

(c) The Usage of "Quarantine" in this Dissertation

In light of the above discussion, this Dissertation will adopt a nuanced approach to the definition of "quarantine": For ease of reference, it will use the term "quarantine" to encompass *all* confinements of allegedly- infected people (whether or not they were floridly symptomatic). This would be especially useful when describing historical practices during the centuries when "quarantines" were not distinguished from "isolations." On the other hand, this Dissertation *will* acknowledge the present-day distinction between the two confinement procedures when this is appropriate, since it might impair policy analyses to overlook this distinction.

B. A Practical Model of Disease-Control Methods by "Dimensions"—General Description

This Dissertation proposes a taxonomic model for quarantine-type contagion-controls, which will hopefully elicit their fundamental distinctions, and help clarify when they should be used. Like contagious diseases themselves (*see* Chapter II, *below*), quarantines and other socio-legal disease-control methods have some fundamental features that could be considered semi-independent "Dimensions."

It may be practical to consider these methodologies as varying in terms of their Dimensions of (1) "**Depth**," (2) "**Breadth**," (3) "**Duration**," (4) "**Objectives**," (or "Purposes"), and (5) the "**Culpability**" of the persons subjected to them. (Other attributes would also be present.)

1. "<u>Depth" of Quarantines (Severity</u>)

First, a public health contagion-control methodology could be said to vary along a Dimension of *"Verticality" (or "Depth")*, which refers to its intensity or *Severity* (just as contagions themselves can differ on their own "Severity" Dimension [*see* Chapter II, below]). The "Depth" Dimension is a continuum from the mildest forms of behavioral restriction (*e.g.*, placement on disease registries for surveillance purposes), to intermediate steps (*e.g.*, "modified quarantines" against leaving an area or practicing certain trades), to the harshest measures (*e.g.*, "strict" or "total" quarantines in closed institutions—including even prisons), as shall be discussed further below.

2. "<u>Breadth" of Quarantines (Individuals and Areas Covered</u>)

Second, a disease-control method can also be characterized in "*Horizontal*" terms, which refers to its "*Breadth*" or width of covered individuals or of space itself. The subjects can be people (as well as plants and animals), conveyances, structures, and geographic areas: the narrowest of isolation measures or quarantines are imposed on individual persons. (Archetypal examples were historic quarantines placed over solitary victims of leprosy and tuberculosis, *see below.*) They can also cover groups of persons, varying in numbers (though it can readily be seen that the definition of multiple covered persons can potentially raise special legal and social concerns).

Distinguishable are those quarantines that are applied to vehicles or vessels, such as ships, trains, motor vehicles, and aircraft.

Classically, too, quarantines can be thrown over varying spaces and jurisdictions: In widening concentric circles, laws may enable health authorities to quarantine parts of a building (such as an isolation room or ward within a hospital), whole buildings (typically, homes, sanatoria, or official “pest-houses”), institutions (including entire worksites, hospitals, schools, and colleges), neighborhoods or districts, municipalities, parts of counties, whole counties, states or territories or provinces, countries , and groups of countries. Generally speaking, the wider the “breadth” of quarantines, the more difficult they can be to implement, legally, socially, and pragmatically. (This

Dimension of quarantines will be described in more detail below.)

3. "Temporality" of Quarantines (Duration)

Just as there is a Temporal Dimension to diseases and their infectiousness (*see* Chapter II), there is also a *Time Dimension* to the public health methods used to control them—which can have major consequences in practice: For example, a health officer may place strict quarantines over a smallpox victim and over a sufferer from multi-drug-resistant tuberculosis, set to last for the duration of their respective illnesses or infectious periods. --In the first case, the quarantine would likely last for weeks (ending with the recovery or death of the patient); in the latter case, however, the quarantine could go on for years or even decades.

4. "Objectives" of Quarantines (Who Is Being Protected?)

Next, disease-control methodologies also vary in terms of their immediate *"Objectives"* or *"Purposes."* This Dimension addresses the questions of "Who is quarantining whom? Whom do the quarantines aim to protect?" Classic quarantines aim to constrain exposed and infected persons in order to protect the collective community from their infections; however, other disease-control methods are imposed on *unexposed and uninfected* persons themselves—in order to keep them from contracting pathogens from the infectious. (There is some overlap between these types of methods and their objectives.) Regardless of goals, the methodology of each type of action could vary from light to harsh.

a. Protective Quarantines

At one end of the protective continuum, many state and territorial laws direct health authorities *to protect the uninfected and unexposed* from exposure to pathogens by closing public places and forbidding public gatherings during disease outbreaks. These partial or modified quarantines would be relatively limited types of constraints. More severe/intensive measures could include home-confinements and evacuations to protect the confinees (as shall be shown below).

5. "Culpability" of Quarantinees (in a Legal Sense)

The final "Dimension" of quarantines addresses the explicit or implicit way in which a society and its legal system regards the moral and/or legal "*Culpability*" of quarantined persons: In their most basic form, quarantines, isolations, and lesser social-distancing measures are "neutral" about the morality and legality of the restricted persons. They are, in this case, strictly elemental, non-criminal measures by which communities preserve themselves from destruction by contagions and the infectious persons who carry them. However, quarantinees and isolates sometimes defy the directions of health departments and courts, or break health regulations, and their behavior now develops a more culpable character under the law. At the other end of this spectrum of "*Culpability*" would be individuals who transmitted their infections to others by reckless conduct--or even by intention (such as bioterrorists). This extremity of conduct is somewhat distinctive from the rest, and it is not central to this Dissertation, but it does deserve mention and will be noted in the subsection discussing this Dimension of quarantines.

C. The Independence of the "Dimensions" of Contagion-Controls

Finally, it is important to stress that these "Dimensions" of contagion-controls are not isomorphic. While they often overlap to a certain degree, they are independent dimensions in many respects—which can have important consequences for the implementation of these measures, and for their outcomes in curbing contagion and in socio-legal effects. For example, it will be seen that some behavior controls may be stringent (intense in the scale of "Depth")--but apply to few people or geographic areas (limited in the scale of "Breadth"), or vice-versa. Also, they might vary in how long they are maintained—from days to lifetimes, irrespective of their how stringent they are or how many people they control. The contagion controls may also have features of "Purposes" and implied "Culpability" that can overlap the other Dimensions, but do not necessarily follow them closely (for example, some very strict, restrictive quarantines, which highly disrupt individuals' lives, might be imposed on them for their own protection, rather than to protect society from them).

D. The Dimensions of Contagion Controls: Detailed

1. "Depth" of Quarantines

As was noted above, the panoply of socio-behavioral controls over contagion can first be distinguished on the "Dimension" of "Depth," or "verticality,' which refers to the intensity or severity of the procedures, and the degree to which they restrict the subjects' behavioral freedom: These restrictions can range from limited to extreme.

a. "Modified" or "Partial" Quarantines

Some nonpharmaceutical contagion-controls only impose limited restrictions on people, and these have sometimes been designated "modified" or "partial" quarantines. (Alternatively, they could be categorized as non-quarantine “social distancing” procedures.)

(1) <u>Occupational restrictions to control contagions</u>

A form of individual modified quarantines narrows the field of activities that individuals can do, most commonly involving choice of *occupations* or occupational functions. Examples would include proscriptions against work in food service trades by persons who are infected with the *Salmonella typhi* bacterial agent of typhoid or by the virus of hepatitis A. Teaching and daycare work are other occupations that are often legally barred to carriers of certain diseases, including active tuberculosis.

(a) Some Historical Examples of Occupational Restrictions

(i) The case of “Typhoid Mary” Mallon

The historical case of “Typhoid Mary” Mallon presented a stark example of an occupational restriction to control contagion, and it will be further discussed below.

(ii) People ex rel. Barmore v. Robertson

The 1922 Chicago case of *People ex rel. Barmore v. Robertson*, 302 Ill. 422, 134 N.E. 815, also involved a typhoid carrier. In this instance, the typhoid carrier was a boardinghouse keeper, whose house was quarantined and placarded to keep her from infecting any more boarders.

(iii) School Bd. of Nassau Co., FL v. Arline

In the much more recent (1987) case of *School Bd. of Nassau Co., FL v. Arline,* 480 U.S. 273, 107 S.C. 1123, 94 L.Ed.2d 307, the U.S. Supreme Court decided an associated issue pertaining to a schoolteacher who was dismissed from her job after developing bouts of active TB. The Court ruled, *inter alia,* that this teacher's contagious disease constituted a handicap within the meaning of Section 504 of the Rehabilitation Act of 1973, 29 U.S.C. s 794, which entitled her to some protection against employer discrimination—and thus dismissal--for her disability.

(b) Some Present-Day U.S. Occupational Restriction laws

Almost all American states and territories (as well as many smaller jurisdictions) continue to authorize "modified" or partial quarantine measures to restrict infected individuals' practice of certain professions or trades. For example, Arizona authorizes its cosmetology board to take disciplinary action or deny a renewed license to cosmetologists who practice their trade while knowingly carrying an infectious or communicable disease (Ariz. Rev. Stat. s 32-572.A.1), and an Arkansas statute likewise forbids massage therapists from working when they can transmit such diseases to their clients (Ark. Code Ann. s 17-86-302(a)(4)).

(2) Public Place Closures and Bans on Public Gatherings

An important type of modified quarantine involves the closure of public places and the banning of public gatherings. The settings that are closed can include places of amusement (such as pool halls, saloons, and theaters), schools and colleges, and even places of worship. This measure has often been used during major outbreaks (with varying degrees of success in different times and places).

It is important to stress here that such closures and bans do not rank high in the spectrum of potential restrictiveness: Persons subjected to them essentially retain the right to roam the world--save for the interdicted places, and they retain the right to circulate--so long as they do not congregate *en masse*.

That said, it should nonetheless be recognized that such official actions can still be controversial--and they have indeed been so historically, especially when certain institutions are closed: For example, people have raised social, political, and legal objections to the official closure of churches. In the U.S., it might be claimed that such actions contravene the provision in the First Amendment to the Constitution that prevents governmental restrictions on the freedom of worship. Even the peaceful assembly of citizens is protected by this amendment to the Constitution.

(a) Some Historical Examples of Public Place Closures and Bans on Public Gatherings

Numerous American jurisdictions imposed public place closures and bans on public gatherings in 1918 and 1919 to try to stop the spread of Spanish Influenza, and they provoked some sharp resistance in several areas (*see, e.g.,* www.1918.pandemicflu.gov, accessed 6/2/11). In Rhode Island, for example, PH officials ordered closure of churches, incurring the wrath of some clerics: A Roman Catholic priest, William I. Simmons, opposed this measure, urging people to "assemble in their place of worship and implore the assistance of God, in supplication and prayer." (On the other hand, a Massachusetts Presbyterian minister countered that people could pray at home as readily as in church.) In a similar episode on the other American coast, the Seattle, Washington city administration banned religious gatherings for a period of two weeks at the height of the pandemic, and some churchmen objected. (In response, the mayor snapped back that "religion which won't keep for two weeks is not worth having.")

(b) Some Present-Day U.S. Laws for Closing Public Places During Epidemics

In addition, numerous U.S. jurisdictions assert their authority to ban public gatherings during epidemic outbreaks: For example, New Mexico explicitly empowers its state health department to "close any public place and forbid gatherings of people when necessary for the protection of the public health" (N. Mex. Stats. Ann. 1978 s 24-1-3.E). For its part, Utah also confers like powers on *local* health departments within its borders (Utah Code Ann. 1953 s 26A-1-114(1)(e)). (*See also* Colo. Rev. Stats. 25-1-506(1)(d), 25-1-708(1)(d); Burns' Ind. Code Ann. 16-20-1-24, 16-19-3-10; Kan. Stats. Ann. 65-119; Md. Pub. Safety Code Ann. 14-3A-03(d); Mich. Comp. Laws 333.2453(1), 333.2253; Minn. Ann. Stats. 144.12(1)(9); Mississippi Code Ann. 21-19-17; Mont. Code Ann. 50-2-118(2), 50-2-116(1)(c); Tenn. Code Ann. 68-2-609(2),(3); Utah Code Ann. 26-1-30(2)(i); 18 Vt. Stats. Ann. 126(d)(5); W.Va. Code Ann. 16-3-1; Wisc. Ann. Stats. 252.02(3); Wyo. Stats. Ann. 35-1-240).

(c) Analysis of Laws Closing Public Places and Banning Gatherings

On balance, it is evident that modified quarantines, like all socio-legal contagion-controls, have the potential of conflicting with other major public interests. Certainly, they should be implemented with foresight, advance planning, and sensitivity to the facts of a situation. Nevertheless, it is also submitted that such measures can play a vital role in abating epidemics under certain circumstances (and there is some degree of empirical evidence to support this conclusion). Weighing the equities, it is arguable that the modified quarantines are mild enough on the spectrum of severity as to require a lower threshold of benefit before they can be implemented, and many epidemics—such as the past Spanish Influenza or the potential future avian flu--would have enough severity (*q.v.*) to cross that threshold.

Ultimately, it is submitted here that PH officials need to act with sensitivity to social, religious, and legal rights--but in a pandemic as deadly and widespread as the Spanish Influenza, *salus populi suprema est lex.*

b."Strict" Or "Classic" Quarantines

To the extent that many non-specialists faintly remember quarantines from decades before the "Window Era" of the late 20th century, they usually think of "strict" or "classic" quarantines. These measures involved major constraints on the liberties of quarantinees, with confinement in closed settings to prevent the transmission of pathogens.

(1) Location of the Quarantine or Isolation

The locus of confinement of strict quarantines or isolations could range in severity from the individuals' own homes, to closed wards within general hospitals, to special isolation hospitals, to remote islands, colonies, or settlements. At its most extreme, it could actually include confinement in jails (as shall be shown below).

These specific loci can have major practical consequences—both in terms of individual patient health and in terms of contagion-control: From the perspective of the confinees themselves, retention in the home would probably be preferable in many cases, since it would impose fewer legal and procedural constraints on them, and it would allow them to remain in familiar surroundings with their significant others. These conditions could be psychologically beneficial (and, as a result, they could also confer some subtle physical benefits on the patients). In addition, if quarantinees or isolates had been misdiagnosed and they did not, in fact, have a deadly disease, they would clearly gain from not being placed in an isolation hospital with actual infectious sufferers from such a malady. It is true, of course, that patients' homes might not always provide the facilities, trained personnel, or equipment for the optimal treatment of complex infectious diseases. Clearly, individual circumstances would vary in these respects. On the whole, however, diseased persons, suspected diseased persons, and their families have often resisted—sometimes fiercely—historical seizures and forcible transportation to public isolation facilities. (*See* the discussion below.)

From the perspective of society, on the other hand, confinement and treatment *in situ* of the infectiously ill may not confine their contagion as effectively as would a specially-designed isolation facility. This certainly depends on the nature of the specific homes and the isolation centers involved in particular cases. On balance, it is likelier that better disease containment *would* be provided by carefully-designed isolation hospitals or wards within general hospitals (which might include such engineered facilities as reverse air flows, plus trained personnel practicing barrier nursing techniques). This is not always true, of course, since the nosocomial spread of infections is not a rare phenomenon. (It certainly was a major component of the SARS crisis of 2002-2003, *below.*) In any event, it should be stressed that some facilities are singularly inappropriate for contagion-containment; these would include penal institutions--but that did not prevent PH officials from using them for this purpose on some occasions in the past.

(a) Historical Illustration of Various Types of Quarantine "Depth": A Close-Up View of the Case of "Typhoid Mary" Mallon

The story of "Typhoid Mary" Mallon is a classic illustration of the application of partial and strict quarantines in the case of one person. In its outlines, it is a well-known tale, and Mary Mallon's name has become synonymous with a certain kind of contagious process, but the legal and procedural details of the episode are nonetheless informative on the "Depth" Dimension of quarantine.

Mallon was an Irish immigrant who arrived in the U.S. in 1883, where she practiced the trade of cook in private households around New York City. During the next twenty-four years, cases of typhoid fever appeared in a succession of homes where she worked. Whenever typhoid started, Mallon would quit and move on to another employer. Eventually, one homeowner contacted a pioneer sanitarian named George Soper, who began to trace the association between Mary Mallon and the string of typhoid outbreaks in the region (the concept of asymptomatic carriage of pathogens was not well-understood at that time).

In 1907, Soper finally tracked the cook to a prosperous home in Manhattan, where one resident had died of typhoid, and he demanded that she submit samples of her body fluids for testing. A large, feisty woman, Mary Mallon lunged at the sanitarian with a kitchen knife, and he promptly departed the premises. She then fled again. However, Soper soon regained Mary's track, and he arrived at her new workplace with a phalanx of New York constables, who ordered her to surrender to the health department. When she refused, the five men hauled her kicking, screaming, and fighting into a paddy wagon, where they had to physically hold her down all the way to the Willard Parker Hospital for Contagious Diseases. At the hospital, it was eventually determined that Mary Mallon's colon was a living culture tube for *Salmonella typhi*, although—as her conduct had shown---she was scarcely impaired herself by the continuing infestation.

Mary Mallon was then consigned to a small hut on lonely North Brother Island in New York Harbor, within sight of the looming city but entirely cut off from it. She refused to undergo the cholecystectomy that was proposed by the health authorities as a means to decrease her excretion of *S. typhi*, and she instead fought her confinement in judicial forums all the way to the U.S. Supreme Court. After her legal protests failed in 1910, Mary Mallon grudgingly consented to a New York Health Department order that she never again work as a cook, and she was released under partial (occupational) quarantine.

Now, however, the previous pattern recurred: Moving about under an alias, Mary Mallon resumed her culinary occupation in various homes and institutions, and outbreaks of typhoid followed her everywhere. With the relentlessness of Inspecteur Javert in *Les Miserables*, Soper followed the typhoid-carrier to a Westchester household, and seized her once more. This time, however, there were to be no official reprieves. Mary Mallon remained strictly quarantined on North Brother Island for the rest of her long life, finally dying alone of cardiovascular disease almost a quarter of a century later. (*See, e.g.,* www.britannica.com/EBchecked/611790/Typhoid-Mary, accessed 1/22/2012; Leavitt JW, *Typhoid Mary: Captive to the Public Health*

[1996]; Okin P, *The Return of "Typhoid Mary": The Past and Prospective Impact of Quarantines in the Face of Recurring Epidemic Diseases* [unpublished manuscript, 1987].)

(b) Some Present-Day U.S. "Strict" Quarantine Laws

Every American state and territory (as well as some lower-level jurisdictions such as certain counties and large incorporated cities) retains strict quarantine laws on its codebooks today, and these laws might astonish some present-day people with their continuing conferral of official powers. Many of these statutes and ordinances date back almost unchanged to the decades before the "Window Era" of the late 20th century, although there have been some more recent efforts to modernize and standardize their concepts, structure, and terms. (Notably, some scholars have advanced a model interstate quarantine act, which some jurisdictions have adopted. Also, recent concerns over possible emerging infectious diseases, bio-terror, and other public health emergencies have led to additional revision and expansion of some of the laws.)

A fairly standard type of traditional strict quarantine law is an Oklahoma statute, 63 Okl.St.Ann. § 1-504, which provides that

> [w]henever a local health officer determines or suspects that a person has been exposed to and may be incubating

> a communicable disease of public health concern, the local health officer may impose a quarantine upon such person and require such person to remain out of public contact and in the place or premises where such person usually stays. Notice thereof shall be given in accordance with the rules and regulations of the State Board of Health. It shall be unlawful for such person, or any other person, to violate the terms or conditions of the quarantine.
>
> Whenever a local health officer determines or suspects that a person has a communicable disease of public health concern, the local health officer may impose isolation upon such person and require such person to remain out of public contact and in an adequate treatment facility or in the place or premises where such person usually stays. Notice thereof shall be given in accordance with the rules and regulations of the State Board of Health. It shall be unlawful for such person, or any other person, to violate the terms or conditions of the isolation.

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2. "**Breadth" of Quarantines**

As was noted above, the "Quarantine Dimension" of "Breadth" addresses the varying sizes of quarantine-type contagion-controls in terms of horizontal space, or in terms of numbers of persons affected.

Quarantines and other social-distancing procedures have historically been thrown over a roughly concentric range of persons, population groups, polities, and geographic spaces--ranging from individuals to whole nations, and current laws in many jurisdictions continue, at least in principle, to confer such official PH powers. These will be discussed below, illustrating quarantines of each size by noting some historical examples, and by noting some present-day American laws that authorize the different types.

a. Individual Quarantines

The narrowest quarantines in population "Breadth" would be those thrown over individual persons. Because of their direct conflict between the collective interest in safety and individuals' interests in liberty, these sorts of quarantines have often illustrated in particularly graphic terms the potential medical, legal, and social issues involved.

Thus, although "wider" types of quarantines (*see* "area quarantines," *below*) can raise some of the same issues of science, law, and social behavior as individual quarantines, the latter type of quarantines will be discussed here at somewhat greater length.

For sharper illustrative purposes, too, this discussion of Dimensional type will focus on "strict" types of quarantines for individuals (*see* above discussion).

(1) The Writ of *Habeas Corpus* in Individual Quarantines

Do individuals have powers to contest their quarantining? In legal theory, they do have some possible remedies. In historic practice, however, these potential rights have only rarely been upheld in individual cases:

Since Mediaeval times, England—and countries that later generally followed its legal system, like the American republic and the Hawaiian kingdom—have accorded confined individuals the nominal right to seek a writ of *habeas corpus*. In legal Latin, this writ means literally "I-may-have-the-body," signifying that a judge who decides to grant such a petition will order a jailer or other confining official to present him with the prisoner's body (presumably still living and not-too-badly damaged by torture or privation). During the ensuing hearing, the inmate may adduce evidence and legal arguments to contest his detention. In other words, *habeas corpus* is only a procedural right, not a substantive one: Getting an adjudicator to grant this writ is only a first step for the confinee; he or she must still make a substantive case to convince the judge that the detention is illegal because it violates one of the jurisdiction's constitutional principles, statutes, ordinances, or regulations (for example, by claiming, under U.S. Constitutional law that it constitutes "cruel and unusual punishment" in contravention of the Eighth Amendment).

Over the centuries, confined persons of all sorts have sought the writ of *habeas corpus*—including, most often, criminal defendants--and sometimes they have gotten it, have received a judicial hearing, and have been eventually freed. Tellingly, though, one set of confinees has rarely received such writs in most jurisdictions following the Anglo-American-tradition—and this may be the most legally "innocent" confinee group of all: persons quarantined for the mere status of being infectious (*see discussion below*). Among these were HD quarantinees held in American, Canadian, and Hawaiian leprosaria. During the heydays of leprosy-segregation programs, few of these persons would get legal representation and try to challenge the justice of their detention (in part because many of them were sick, poor, powerless, and ill-informed about the laws of their respective countries). In the rare instances when they did seek the writ, they rarely won it. This may reflect the general attitude of the law towards quarantined persons (*salus populi suprema est lex*). However pitiable their situation, society wanted most of all to protect itself from their contagious disease.

(a) Historical Overview of Some Individual Quarantines—Responses to Particular Contagions

Over the centuries, many major contagions have provoked polities to impose individual quarantines, but several diseases have been particular prods for such contagion-controls (most sharply raising the PH, social, and ethical aspects of quarantining): leprosy, tuberculosis, syphilis, and gonorrhoea. Leprosy and TB were the quintessential contagions of loneliness—forcing their victims into solitude; the STDs were diseases of coupling, but they also induced some societies to segregate their carriers. The following account summarizes very briefly the long and complex role of these several contagions in shaping quarantine laws.

(i) Leprosy

Leprosy (now sometimes called "Hansen's Disease" ["HD"] in an effort to reduce stigma) is one of mankind's oldest diseases, dating back thousands of years in the Indus Valley on the Indian sub-continent, in Palestine, and in the Nile Valley of North Africa. Its pathogen, *Mycobacterium leprae,* has evolved primarily in humans. (North American armadillos may be the only other host or reservoir species in nature—which should, in principle, make HD an easier contagion to eradicate someday). Over the millennia, this bacterium has even lost the function of many of its genes, but this evolutionary process has not made it less harmful to man: HD clearly illustrates the process of heredity-environment interaction, since it tends to only cause symptoms in individuals with a genetic susceptibility to it.

While human immunological responses to *M. leprae* vary across a spectrum from most to least (generally, from "tuberculoid" to "lepromatous" in character), the most inadequate host responses to the pathogen are generally associated with severe symptomatic manifestations—which can include extensive nerve, skin, ocular, and skeletal damage, with consequential deformities and blindness. (While leprology is not widely discussed in the modern Western medical literature, some works in the last two decades may be noted for delineating these signs, symptoms, and sequelae of leprosy: *See, e.g.,* Boggild AK, Keystone JS, & Kain KC, "Leprosy: A primer for Canadian physicians," *CMAJ, 170*(1), 71-78 [1/6/04]; Jacobson RR & Krahenbuhl JL, "Leprosy," *Lancet*, *353*(9153) 655-660 [2/20/99]; Modlin RL & Rhea TH, "Immunopathology of leprosy." In RC Hastings (ed.), *Leprosy* (2d ed.) (Edinburgh: Churchill Livingstone, 1994, at 225-34); WHO Expert Committee on Leprosy, *Seventh Report* [Geneva: WHO Tech. Rep. Ser. No. 874, 1998].)

For centuries, revulsion at the sometime stigmata of leprosy became intermingled in a complex way with fears of contagion and with religious beliefs about the disease, prompting lepraphobia. In Biblical times, the Old Testament Book of Leviticus directed priests to denounce “lepers” as “unclean,” and to have them driven from the communal camp. Given the vagaries of diagnostic procedures in those early times, however, it seems likely that many dermatological disorders were mislabeled “leprosy”—lumped in with the specific set of syndromes that *M. leprae* actually caused. This was probably still often true in Medieval times, although modern paleopathology has indicated that there was indeed a vast but slow-moving pandemic of true HD in Europe during those centuries. It was addressed with a variety of responses by different individuals and polities--but the most common reactions were banishment, confinement, and even execution. Setting a theme that would recur in future centuries, the Roman Catholic Church developed a “Leper Mass,” which mixed in a curious way primitive medical diagnoses with priestly banishment to a living death; yet, the Church also motivated the construction of lazarettos and monastic leprosaria, where monks and nuns would nurse lepers out of charitable devotion. By the late Middle Ages, however, these institutions would become empty of their inmates (for unclear reasons, although the Black Death may have been one final factor).

During the ensuing centuries, Hansen's Disease persisted in only a few places in Europe (notably parts of Scandinavia) where there were special genetic susceptibilities to the pathogen, but the expansion of Western colonialism, international commerce, and immigration in the 1800s prompted a rising fear of imported leprosy. (Now, to some extent, ancient lepraphobia became intermingled with xenophobic views on Third World immigration.) Thus, by the end of that century, several North American and Pacific polities had begun to promulgate new laws and set up leprosaria as barricades against this ancient disease. Notable among them were Canada's provinces of New Brunswick and British Columbia, the U.S. states of Massachusetts, Louisiana, California, and Washington, and the new U.S. territories of the Philippines, Puerto Rico, the Virgin Islands, Guam, and Hawai'i. (Few people now realize that the progressive Commonwealth of Massachusetts ran a small, compulsory "leper colony" on remote Penikese Island in Buzzards Bay, southwest of Cape Cod, between 1905 and 1921. Early in the 20th century, too, British Columbia operated an even harsher colony on D'Arcy Island, where a handful of Chinese leprosy victims were essentially left to die.) Most famous (or infamous, depending on one's perspective) were the "leper settlements" established on the Kalaupapa Peninsula off the Hawaiian island of Moloka'i, and at Carville on a bend of the Mississippi River in Louisiana. (There is a fairly extensive literature on the latter two leprosaria. *See, e.g.,* the accounts in Tayman J, *The Colony: The Harrowing True Story of the Exiles of Molokai* [NY: Simon & Schuster, 2006], 432 pp.; Gussow Z, *Leprosy, Racism, and the Public Health* [Boulder, Co: Westview Press, 1989], 265 pp. On the other hand, very little has been written about the other little lazarettos. Note, though, Johnston P, "BC's 'Island of death' marked a sad chapter in Canada's history," *Can. Med. A. J., 152*(6):951-52 [Mar. 15, 1995]; Levison JH, "Beyond quarantine: A history of leprosy in Puerto Rico, 1898 to 1930s," *Hist. Cienc Saude Maguinhos, 10*(Suppl. 1):225-45 [2003]; Cyr P, "The exiles of Penikese Island: Politics, prejudice, and the public health," *Spinner, 3:120-131* [1984].)

((a)) A classic individual quarantine system: Hawai'i and the lazaretto at Kalaupapa

The evolution of the above-referenced lazarettos over time tended to follow some similar patterns (although there were, of course, some individual differences based on multiple variables, including local socio-economic-cultural differences between the polities involved). While the history of any of the foregoing leprosaria could be used to illustrate in sharper relief a program of individual quarantines for leprosy, one of them will be used as an exemplar here: the leprosy-segregation system established in the archipelago of Hawai'i on the eve of the modern era, with its particular locus on the Kalaupapa Peninsula. Its outlines are fairly well-known to many informed people, in part because of the heroic efforts of Father Joseph Damien de Veuster and Mother Marianne to care for the afflicted, but its specifics may not be so generally familiar. It is worth emphasizing that the goal here is not to present another biography of the celebrated people of Kalaupapa, but to provide a brief "biography" of the PH system that surrounded them.

To summarize Kalaupapa's long history:

By the mid-1800s, the kings of Hawai'i and their Western physician-advisors had become increasingly alarmed over what they perceived to be a rising incidence of leprosy in the Sandwich Islands (*i.e.,* Hawai'i); it was one of numerous diseases that had been introduced by European and American émigrés and by Asian contract laborers on the sugar plantations. (Ironically, TB was probably spreading much faster on the islands, but it elicited much less terror than leprosy.)

In response to this primordial fear of leprosy, the Kingdom passed a law in 1865 ("the Leprosy Act") that provided for the seizure, isolation, and seclusion of "all leprous persons, who shall be deemed by competent authority to be capable of spreading the disease." King Kamehameha V selected a site for a lazaretto on the small, bleak volcanic peninsula of Kalaupapa protruding off the north coast of Moloka'i Island. It was a dramatically-effective natural prison, with 1,600-foot green cliffs ("*pali*") on one side and the wild blue Pacific on the other.

On a cold, bleak January day in 1866, the first forlorn cohort of sickest "lepers" was herded onto the deck of a seedy schooner, and transported through the storm-tossed waters of the Kaiwa Channel to the rocky shore of Kalaupapa. Only minimal preparation had been made for their reception, and they were marooned with no medications, few provisions, and barely any access to water; their residences were merely decaying huts in the abandoned village of

Kalawao. Within the ensuing months, most of these first castaways would die from the combined effects of leprosy, malnutrition, and privation (their bodies often went unburied where they fell). However, the Kingdom kept rounding up more leprosy suspects and leaving them on the barren basaltic shores of Kalaupapa.

For almost a decade after its founding, the Kalawao lazaretto remained little more than a primitive dumping ground, where the Kingdom of Hawai'i tried to distance its infectious leprosy sufferers as far as possible from clean society. In that early environment, the essential absence of any internal institutions on the peninsula led to conditions of social chaos, where the strong often preyed on the weak. Since the inmates knew that they had been abandoned to die by the Kingdom, many felt free to run riot—what worse could the authorities do to them? (Leprosy was then thought to be violently communicable, and it terrified the uninfected, so some of the more aggressive confinees would intimidate the early managers of the settlement by threatening to embrace them or even bite them.) The infamous motto of Kalaupapa from about 1866 to 1873 was the native Hawaiian phrase "*a'ole kanawai ma keia wahi*!"— literally, "in this place, there is no law!"

(In accuracy, the exiles of Kalaupapa were not generally sinners or saints, gargoyles or greats, but a varying panoply of human beings who were mainly unified by their common immune deficiency to *M. leprae*. The behaviors of some of them under the extreme stress of this situation did range from extremes of exploitation to extremes of unsung devotion to others—but they more usually involved ordinary efforts at survival under the multiple handicaps of leprosy and abandonment.)

It is well known that Father Joseph Damien de Veuster volunteered to join the exiles on their grim volcanic peninsula in 1873, and, by force of will, he gradually brought a measure of common purpose and social order to the desperate coterie of people. Damien's story has become justly celebrated (it was famous even during his lifetime, and it was widely recalled in recent years when the priest was sanctified by his Church).

However, it is not so often recognized that after St. Damien's death from leprosy in 1889, the successive Hawaiian Kingdom, Republic of Hawai'i, U.S. Territory of Hawai'i, and U.S. State of Hawai'i maintained the leprosy-segregation policy for another 80 years—well into the modern era in medicine. It was a complex and autonomous system, which created a whole separate leprosy quarantine zone within the Hawaiian Islands—not geographically far from the rest of society, but virtually walled off from it.

The Hawaiian leprosy-segregation system had its own laws and enforcement machinery (e.g., Hawaii Terr. L., S. L. 1907, Act 122, amending R. L. Sec 1122): In its early years, to recount it very briefly, police officers would conduct episodic dragnets across the islands to hunt down suspected "lepers" (who were often hiding), and then haul them in chains to the Kaka'ako or Kalihi Receiving Stations in Honolulu for forced examination. Later, the detection procedures became more institutionalized, with a small coterie of inspectors (usually paid on a bounty basis) who would track down reputed HD victims in homes and workplaces, or regularly check schoolchildren for the anaesthetic lesions that might signify early lepromatous leprosy. (Alternatively, private physicians would be expected to report their own patients to the PH system.) At the Receiving Station itself, the diagnostic system eventually came to include bacteriological examinations of skin scrapings for the bacilli of leprosy, plus clinical examinations of naked male suspects or nearly-naked female suspects by a group of doctors. (Usually, the patient was placed on a revolving platform so that the doctors could examine him or her from all angles.) If the examiners agreed by a specified plurality that the individual was genuinely infected, he or she would be "declared a leper" under the law, assigned a Board of Health number, and then have a mug-shot taken for the files.

An adult leprosy patient would later remember this experience, saying:

> My father came to take me home from school. But instead of taking me to the Kalihi Receiving Station immediately like the principal said they should, my parents took me home.... The whole family cried, including my father. The next day my father took me downtown and brought me a new suit. It was my first suit of clothes—they were so nice. I never had clothes like that before because we were poor.... So I wore that suit of clothes to the Kalihi Receiving Station. Even though we were poor, my father said he wanted me to be dressed nicely when I was taken to Kalihi to be declared a leper. They took my picture for the official record of the Board of Health wearing that new set of clothes. When the picture was taken, my father broke down again and cried. So, I became a leper.

(Cahill E, *Yesterday at Kalaupapa* [Honolulu: Bess Press, 1994].)

Although leprosy patients and suspects might be retained for awhile in the Receiving Station, many would eventually be led through the streets of Honolulu to the harbor, where, in front of their wailing families (who would often be crying "*Auwe! Auwe!*" ["alas! alas!"]), they would be forced aboard a Board of Health contract ship for a one-way voyage to Kalaupapa. In the early years of the system, the leprosy victims were imprisoned in a cattle pen on the deck of the boat, surrounded by farm animals, but sharply segregated from the ship's crew and other passengers. During the journey, the infected persons would be washed over by waves and by each others' vomit, urine, foeces, and skin discharges. Sometimes, they would arrive on the far shore at night, where the earlier exiles would await them (with varying motives), their own deformities highlighted by wavering *kukui* nut torches in the darkness and wind. Initially, there would be no other reception committee; later, Father Damien or his associates would try to meet the landing craft, and eventually the settlement administrators would fulfill this function.

Among the transported persons would be leprosy-infected children, whom the Papa Ole (Board of Health) would often send to the far shore alone. (By the late 1880s, Kalawao-Kalaupapa would have simple boarding houses for youngsters, usually staffed by clerical or lay volunteers). Under the leprosy-quarantine system, families were generally separated for life, with most of the leprosy patients finally filling up the ample graveyards on the Kalaupapa Peninsula. In general, these procedures ran against the cultures of Native Hawaiians and Asians, who traditionally prized their family groups ("*'ohana*"). Among leprosy's multiple names in Hawaiian was the term "*ma'i-ho'oka'awale 'ohana"*—which meant "*the-sickness-that-tears-families-apart*…."

Only the wild and choppy Kaiwa Channel separated Kalaupapa from the island of 'Oahu and the burgeoning city of Honolulu, but it would always be a world apart. For several years after the death of St. Damien, the little settlement remained a harsh place--with very limited food and medical supplies, supplied only grudgingly by a small kingdom that could ill-afford to run such a capital-intensive lepraphobic program.

Gradually, however, living conditions at Kalaupapa did improve, as a succession of self-sacrificing priests, nuns, and laypersons provided nursing care in Damien's tradition. In later years, the U.S. Territory of Hawai'i itself built up the infrastructure of the lazaretto, adding better lodgings and introducing medical rehabilitation for the ravages of leprosy. By the mid-20th century, Kalaupapa had become culturally and physically like many other small rural Hawaiian communities—but it remained one controlled by the Territorial Board of

Health, and surrounded by oceanic moats, high cliff walls, and border fences.

Kalaupapa would also be continuingly marked by a set of distinctive quarantine laws, rules, and practices, some more wrenching than others: For example, territorial health law eventually required that all non-leprous children be taken away from their leprous parents at birth, and placed in special Honolulu facilities or adopting homes. (There were also some less painful, but still demeaning, indicia of infectiousness and "otherness," including the ancient practice of fumigating all outgoing mail, plus a system of internal boundary fences and barriers to separate the "clean" staff from the patients. For a long time, too, any cars brought to the Kalaupapa settlement would have to stay there, exiled like their owners, lest they somehow infect the rest of society upon return.)

Through a series of bureaucratic misadventures, the Hawaiian leprosy settlement never became a major center for HD research (as the National Leprosarium at Carville would become), but it eventually benefited from discoveries made at that distant institution. In the

1930s and 1940s, the sulfa drugs—notably dapsone—and later pharmacotherapies as well, finally and dramatically proved effective in killing *Mycobacterium leprae* in most patients, remedying their disease and rendering them virtually non-infectious. However, public attitudes and territorial laws did not catch up very quickly with those medical changes, and Hawai'i's leprosy-segregation program continued in a moderated form all the way until 1969—over a century after it had been started.

((b)) Analysis of the Hawai'i leprosy segregation program

The Hawaiian leprosy-segregation program raised in unusually stark relief some of the basic issues posed by all quarantines and other contagion-controls: Were the restrictions based on sound biomedical and scientific grounds? Was this system justified at an ethical, legal, and social level?

Fundamentally, it is submitted, the leprosy-segregation program's underlying scientific premises were flawed, and this will be explored a little further in the next chapter of this Dissertation.

Even if this were not the case, however, it could be argued that the system was still problematic at an ethical, legal, and social level. In general, lawmakers and administrators have a perennial duty to balance the equities at one equilibrium point or another on the policy scales between the collective good and the individual good (which may overlap to some extent, but are usually to a large degree in conflict). With regards to the control of communicable diseases, however, the collectivity has usually prevailed in such trade-offs historically (under an implicit or explicit utilitarian premise of "the greatest good for the greatest number"). This was certainly the case during most of the history of Hawai'i's leprosy-segregation program, as the following judicial ruling showed:

In 1884, the Royal Hawaiian Legislative Assembly asked the Kingdom's Supreme Court for an advisory opinion on the legitimacy of the Leprosy Act of 1865 and the PH system it had established. The justices replied:

> It has been truly said that self-preservation is the first law of nature. This is equally true of a State. "Salus populi suprema est lex."
> ....
> [T]he police power of the State is called "the law of

> overruling necessity." No State could exist without it. If it did not exist in this Kingdom, our population would be liable to be swept away by any and every contagious disease that might come to our shores, and no measures of quarantine or restriction could be taken against it.
>
> ……………………………………………………………………………………
>
> [W]e are of the opinion that the law authorizing the segregating and isolating of lepers is not only a wholesome law and constitutional, but that without such a law the result would eventually be that much of our useful population would leave these islands, ships would cease to touch here, our products would fail to find a market abroad, and these fair islands would become a pest-house to be avoided by the whole civilized world

"Segregation of Lepers," 5 Haw. 162, 164 (Hawai'i King.). The perspective and priorities expressed in this opinion would implicitly ground the whole Hawaiian leprosy-quarantine program for the next eighty-five years.

Since that time, however, this court's views may have been bypassed to some degree by evolving constitutional and ethical thinking about individual rights and liberties, which would weigh them more deeply on the scales of policy. The rarity of quarantines since the start of the "Window Era" in the 1960s has not widely tested this new approach to the equities involved, but it is proposed here that future quarantines will have to be approached from this new balancing. This will also be noted in the next chapter of this Dissertation.

Arguably, a future quarantine program—however solid its scientific foundations--would also need to give more consideration to the human social and cultural impacts of its actions than Hawai'i did during the 100+ years of its leprosy-segregation system.

(ii) Tuberculosis

The other major mycobacterial disease, tuberculosis, has been a scourge of mankind as long as leprosy has been. Like *M. leprae*, the acid-fast bacilli of *M. tuberculosis* co-evolved with their human hosts since antiquity. While these microorganisms did not turn into harmless symbionts like some other ancient parasites did, they developed the capacity to dwell quietly for years in many of their victims, asymptomatic and untroubling under most circumstances. For their part, many human immune systems acquired the ability to quickly destroy the pathogens—or at least to encapsulate them in fibrotic tubercles, where they would remain latent until some somatic disequilibrium favored pathogen growth (*e.g.,* immune dysfunction due to stress, increasing age, or HIV infection)**,** allowing them to become active-–and communicable--once again (with pulmonary caseation and other processes provoking tussis and other behaviors).

M. tuberculosis generally spreads from host to host via airborne droplet transmission (*see* Chapter II). Since the lungs are usually the first anatomical areas affected by TB, the classic form of symptomatic human TB involves respiratory and systemic symptomatology, with severe tussis, fevers, night-sweats, weight-loss, and eventually emaciation--plus the extreme sort of weakness and pallor that earned the malady its historic names of "consumption" and "the Great White Plague." (In the past, it was also called "phthisis," and its victims were labeled "consumptives" or "phthisics.") *M. tuberculosis* can also affect many other body systems, so there can be protean forms of the disease, including TB of the neck glands ("scrofula"),TB of the gastrointestinal tract, TB of the spine ("Pott's Disease"), and TB of the membranes covering the brain ("tuberculous meningitis")--although pre-bacteriological medicine did not always recognize these as being different manifestations of the same disease. When the microbial attack overwhelms the host's immune system, TB can take on the form of "miliary tuberculosis," in which hundreds of small infection foci are scattered across the body like grains of wheat.

By the time of the Industrial Revolution in the West, *M. tuberculosis* was widespread, even ubiquitous, in European and North American societies. Social conditions, including crowding and squalid housing, promoted host exposure to *M. tuberculosis,* while overwork, malnutrition, and lack of sunlight (especially among the laboring classes) increased host susceptibility. The "consumption" had become one of the major causes of death in those countries by the end of the 18th century.

However, while classic scourges, such as smallpox and cholera, were sweeping through Europe and North America, provoking mass terror, little public health attention was usually given to the Great White Plague. In those days, the consumption was just an extremely prevalent and slowly progressive "background" disease that caused symptoms in individuals, producing pallid coughers on sidewalks and horse-trams. Rather than a call to urgent public health action, it was simply considered a bleak part of urban life. This attitude, of course, made it no less destructive in reality. For instance, the Goncourt brothers, who wrote gritty naturalistic novels ("slice-of-life," or "*trenche-de-vie*") about lower-class Parisian life in the 1800s, recalled visiting a clinic in the city on one bitterly cold and windy night. As they were talking to the head physician there, an emaciated elderly man arrived at the door and pleaded for admission in a high quavering voice. Regretfully, the doctor turned him away into the icy night. As he subsequently explained to the *frères* Goncourt, "that man was a phthisic. If I admitted all phthisics to my clinic, I would have no room for any other patients" (*see, e.g.,* Dubos RJ & Dubos J, *The White Plague: Tuberculosis, Man, and Society* [New Brunswick, NJ: Rutgers U. Press, 1952], 277 pp.).

However, as social conditions, public health, and biomedicine began to reduce the incursions of feared epidemic diseases in the West during the late 19th and early 20th centuries, the less dramatic endemic "white plague" of tuberculosis began to emerge from the background into sharper relief. With the gradual abatement of the acute and dramatic pestilential diseases (through quarantines, modern sewage systems, vaccines, and sera), Western medicine and public health began to have the luxury to turn to the chronic background diseases like TB. Thus, a movement arose to create "sanatoria" for consumptives.

One goal of the sanatoria was therapeutic—the care of consumptives as individuals. There were no curative drugs in those days (although there was a continuing desperate search for one), but good nursing and salubrious conditions were thought to help (which, in fact, they probably sometimes did.) Gradually, this movement became *one* basic motivation for creating TB hospitals in airy country settings. The institutions would be located far away from the polluted cities, in rural mountains or alongside lakes where the air was thought to be best for challenged lungs—and, not coincidentally, where they would be far from other people to infect.

For, increasingly, there were also public calls for aggressive civic action to control the White Plague—especially after Robert Koch isolated its causative bacterium, conclusively establishing its communicable nature. One newspaper editor (among many others) denounced consumptives for moving freely about in society, spreading their deadly disease to new victims, and he demanded steps to confine them—against their will, if necessary. This objective of protecting society became another facet of the emerging "sanatorium" movement.

Thus, the new TB hospitals reflected an ambivalent goal—both therapeutic and coercive, which ran along a spectrum of emphasis from one objective to the other. To some extent, the individual sanatoria and their differing emphases reflected the differing wealth of their patrons:

Prosperous consumptives could go to comfortable private hospitals like Saranac Lake in northern New York State (founded by a consumptive doctor who believed that the setting had helped cure him). These facilities emphasized the goal of treatment (which included cold fresh air, rich diets, and—eventually, when those procedures did not work, the use of heroic measures, such as Quenu's thoracoplasty, artificial pneumothorax, and artificial pneumoperitoneum).

By contrast, poorer consumptives were often obliged to turn to their states for hospital care. In the *laissez-faire* American system of health care, the public sector entered the picture mainly to promote the collective safety (as was the case with mental institutions and prisons), and states would set up big hospitals to sequester their consumptive populations in not-always-salubrious settings. (An example was the Waverly Hills Sanatorium, which was located in Tennessee—an epicenter of TB in the early 20th century. It was a huge institution that tried to nurse its confinees and develop new treatments, but it was also grim and full of misery--with a tunnel in the basement for the quiet removal of the tuberculous dead. Waverly Hills Sanatorium still stands, abandoned, on its forested hillside today, vast, echo-filled, decaying, and empty).

The TB-containment emphasis of the states (and some counties and cities) became increasingly clear as they promulgated TB-control laws to compel patients to enter hospitals if they did not go there voluntarily. If tuberculous persons did not comply with the confinement orders of health officials, usually backed by courts, they could be hauled into sanatoria by police officers (who, in many cases, probably dreaded this assignment…). Once institutionalized, patients had to comply with the rules of the facilities, just as if they were convicts; otherwise, they could face even further restrictions of privileges, or isolation confinements *within* the walls of the sanatoria themselves. Sometimes, recalcitrant patients would even be placed in jails for non-compliance with health (which was not a good idea for either the patients or the prisons). (*See* the cases of Roger Draper, *below.)*

((a)) Some illustrative cases of Individual TB confinements:

Benton v. Reid and State v. Snow

In the 1956 case of *Benton v. Reid*, 231 F.2d 780, 98 U.S.App.D.C. 27, for example, the Washington, DC Director of Public Health consigned a chronic TB sufferer to the hospital section of the city jail to keep him off the streets. Upon receiving Francis A. Benton's writ of *habeas corpus*, however, the U.S. Court of Appeals for the District of Columbia wrote that "we cannot lightly infer that Congress intended that a person like appellant, neither indicted for nor convicted of any crime, is to be confined in a penal institution to suffer the social stigma and bad associations resulting therefrom," since such a confinement could be violating his Fifth and Sixth Amendment rights (*Id.*, at 783). Accordingly, the court granted Benton's writ.

It might be noted, however, that some TB patients and their families were even less cooperative than Benton. In a 1959 case (*State v. Snow,* 240 Ark. 746, 324 S.W.2d 532 (Ark. Sup. Ct.), for example, the court record recounts how a health department worker arrived at the cabin of a tuberculous Ozark mountaineer with directions to seek his commitment to a state institution. The patient himself was courteous enough—but his daughter ordered the employee to leave their home immediately, "and to attend to [her] … own business, and not to do any snooping around" afterwards, and the patient's son reinforced these requests by pointing a double-barreled shotgun at the worker's face until she left the premises….

During the "Window Era" of the late 20th century, as TB incidence declined, forcible TB quarantines became decreasingly common, though they were never fully discontinued at the state and local levels. The laws have remained on the books in virtually all U.S. states and territories. In recent years, moreover, the appearance of multi-drug-resistant TB ("MDR-TB") and even extremely-drug-resistant TB ("XDR-TB") has raised major concerns about an increasing public health threat from the old "white plague."

((b)) A modern-day TB quarantine--The Speaker episode

In 2007, a 31-year-old Atlanta man, Andrew Speaker, was diagnosed as having a strain of TB thought to be XDR. (It is unclear how Speaker contracted it, as he hardly seemed to be in a high-risk group: Ironically, he was an attorney, whose father-in-law was doing TB research for the CDC—though this was probably just a very odd coincidence.) Speaker was asked to stay close to home, but, for reasons best known to himself, he decided to follow through on a planned wedding trip to Europe. This act set off a mad scramble by the authorities in several countries to grab him and return him to the United States. Eventually, Speaker came back to the U.S. on his own and drove to New York City, where he was promptly seized and put into Federal quarantine in Denver. (Reportedly, it was the first use of a Federal quarantine for human beings since 1963.) Once Speaker was isolated, doctors concluded that he probably had MDR-TB, rather than XDR-TB. Thus, while his disorder was still worrisome, it was still amenable to some medications, and he was put on the relevant regimens.

At last report, the young lawyer was (perhaps not surprisingly) planning to sue the U.S. government for allegedly violating his civil rights.

(iii) Syphilis and gonorrhoea

There has been intense scholarly controversy over the historic and geographic origins of syphilis and gonorrhoea, including a debate over whether syphilis was present in the Old World disease during pre-Columbian times (*e.g.,* Morton RS & Rashid S, "'The syphilis enigma':

The riddle resolved?" *Sexually Transmitted Infections,* 77(5):322-324 [Oct. 2001]). For example, it has been noted that Mediaeval and post-Mediaeval England maintained some closed institutions--called "Lock Hospitals"—initially for the confinement of individuals who carried leprosy, and later for carriers of some form of STDs, but the specific nature of those diseases remains obscure. It seems likely that gonorrhoea, at least, was one of them; however, it is also likely that the inmate population of the Lock Hospitals was conflated through misdiagnosis, with numerous individuals among them having non-leprous and non-venereal disorders.

In any case, it can be posited that the major STDs date at least as far back as the late 15th century in the Old World. Whether or not syphilis was imported to Europe from the Americas at that time (as some historians contend), it certainly became violently pandemic during the 16th century. Only with the passage of time did *Treponema pallidum* ameliorate its impact on most human hosts, turning syphilis into a chronic disease with an extensive latency period between its primary and secondary infectious stages and its individually destructive tertiary stage.

It would be parenthetical here to discuss the complex biological and socio-cultural interplay of the venereal diseases. The primary concern in this Dissertation is how these diseases helped shape present American quarantine law.

To a major extent, the VDs were closely enmeshed with the complicated and ambivalent approach of governments to the control of prostitution. Generally, many jurisdictions maintained strict laws against this activity, but the enforcement of those laws tended to vary between places and times depending on multiple factors.

One major factor affecting enforcement was the presence of national conflict: During wartime, federal and state authorities would become concerned over the threat to the fighting forces posed by sexually transmitted infections (particularly during the First and Second World Wars). This led them to impose *cordons sanitaires* against prostitutes around many military bases and training camps (which were probably evaded by numerous enterprising servicemen). Furthermore, during the time periods around the two major wars of the 20th century, American health authorities established a number of special quarantine camps for the confinement of individuals who carried venereal diseases.

During World War I and the immediate post-war years, the main activity of some of the foregoing camps was simple confinement to keep the inmates from transmitting their contagion to others. In 1917, for example, the state of Kansas authorized its Board of Health to designate communicable diseases justifying "isolation and quarantine" (1917 Kan. Sess. Laws, ch. 205); subsequently, the Board became concerned about VD in military camps within its borders, so it declared that syphilis, gonorrhea, and chancroid were among the diseases that merited such controls, and it ordered county and local health officers to routinely examine VD suspects such as pimps and prostitutes (Kansas State Board of Health, Rule XXXVI, sec. 2(a)). Lacking other intrastate options, Kansas authorities set up detention facilities for infected men and women within the grounds of the state penitentiary at Lansing. Furthermore (as a reviewing court would remark), "[e]xperience demonstrated that the men sent to the quarantine camp were, generally speaking, a bad lot, and the [state] board of administration provided that they should be subject to such rules for the discipline and control of the institution as the warden, with the approval of the board, might adopt." *Ex parte McGee,* 105

Kan. 574, 185 P. 14 (1919). (*See also Ex parte Hardcastle,* 84 Tex.Crim. 463, 208 S.W. 531 [Cr.App. 1919].)

By the World War II years, venereology had advanced enough that the control function of quarantine centers was (as in TB) mixed with a major treatment motivation (although it should be noted that the longstanding attitudes towards sexual promiscuity carried an aspect of opprobrium that did not apply to TB controls). By this time, physicians had gained enough experience with the arsphenamine drugs against syphilis (including neosalvarsan), which Paul Ehrlich and his team had developed before World War I, that they had developed some standardized protocols for administering them to cure the disease. Of course, the fact that treatment regimens could be effective in many cases did not mean that they were either free of risks or pleasant to undergo. For a long time, neo-arsphenamine therapy often required weekly injections for a year or more, and these arsenical agents retained high toxicity for hosts that could produce serious side effects. This led many patients to discontinue treatment early, which could threaten their own health and the public's health. Consequently, scientists developed accelerated treatment protocols, which involved multiple injections or intravenous drip administration that could be completed in a period of weeks, albeit with some increased hazards.

In cooperation with some state and local governments, the US Public Health Service eventually set up a system of some 58 "Rapid Treatment Centers" ("RTCs") (in some 41 states and territories), with some 6,100 beds, where VD suspects would be detained and treated. In 1944, the confinement stays would average 22 days. Later, when the faster and safer penicillin family of drugs was developed, treatment regimens became even quicker. The patient/confinees of the RTCs were mostly female (often described in terms of the day as "women of easy virtue" or "promiscuous women"), though later some men were sent to the centers as well. (*See, e.g.,* Parascandola J, "Quarantining women: Venereal disease rapid treatment centers in World War II America," *Bulletin Hist. Med., 83*(3):1-15 [Fall 2009], www.muse.jhu.edu.ezproxy.lib.usf.edu/journals/bulletin_of_the_history_of medicine, accessed 10/25/11; Cates W, Rothenberg RB, & Blount JH, "Syphilis control: The Historic context and epidemiologic basis for interrupting sexual transmission of *Treponema pallidum,"* *Sexually Transmitted Diseases*, *23*(1):68-75 [Jan./Feb. 1996].)

During the years around the Second World War (like the First World War before it), various law courts would hear a number of *habeas corpus* motions from confinees alleging unlawful quarantines for VDs. As before, a number of the plaintiffs were supposedly "women of easy virtue" (and sometimes men from the "bad lot," to use the *McGee* court's wording, above); in a number of instances, they were contesting their continued confinement for mandatory VD treatment after their jail sentences for moral offenses were over. (The petitioners usually lost.) (*See, e.g., City of Little Rock v. Smith,* 204 Ark. 692, 163 S.W.2d 705 [1942]; *Varholy v. Sweat,* 153 Fla. 571, 15 So.2d 267 1943]).

(b) Some Present-day U.S. Individual Quarantine Laws for TB and VD

While most U.S. jurisdictions have repealed their old leprosy quarantine and social-restriction laws (some of them in relatively recent times), almost all American states and territories continue to make special provisions for the compulsory treatment and control of tuberculosis and the venereal diseases (usually distinct from their general quarantine provisions).

(i) Maryland

In typical provisions, the state of Maryland empowers its health officers to order the physical examination of TB suspects. If the officers conclude from the examinations that the examined individuals' condition may endanger the public health, they can require them to undergo outpatient care. Should the tuberculous persons fail to comply, the state authorizes its officers to quarantine them *in situ* at home or in public facilities (MD Code, Health - General, § 18-324; *see also, e.g.,* Ariz. Rev. St. s 36-714).

(ii) Tennessee

Also typically, the state of Tennessee still directs state, district, county, and municipal health officials to examine STD suspects and to compel infected examinees to submit to treatment until they become noninfectious. It also orders these officers to "isolate and quarantine the person[s] infected with an STD," if they determine that this is "necessary to protect the public health" (Tenn. Code Ann. § 68-10-104).

<u>**Area Quarantines**</u>

Beyond quarantines of individuals is the large set of quarantines that are thrown over wider population groups and geographic areas, ranging from households or individual structures, to neighborhoods or districts, to whole cities, to partial counties and counties, to states/provinces/territories, to entire countries or even groups of countries. It should be acknowledged here that this set of group and "*area quarantines*" constitute more of a *continuum* of sizes than a hierarchy of discrete entities—with some vast households/structures approaching neighborhoods in size, and some large cities being legally counties as well.

a. Household and Workplace Quarantines

(1) Household Quarantines

The next wider breadth of quarantines have been imposed over *households*, which consist of the immediate close contacts of overtly infected persons (usually, family members and/or fellow residents of a single building). In modern PH parlance (*see discussion above*), this procedure would generally involve a combination of "isolating" the clearly sick persons *in situ* and "quarantining" the probably-exposed persons who have been dwelling in close physical proximity to them.

(2) Workplace Quarantines

A variant of household quarantines, approximately equal in size, would be the quarantining of a single non-residential facility, such as a hospital or other workplace setting (*see* "institutional quarantines," below).

(a) Some Historical Examples of Household Quarantines

For centuries, polities have resorted to household quarantines in desperate response to dangerous contagions. During the years that *Yersinia pestis* plague swept through Europe (either in its 1340s-1350s pandemic strain or in its later epidemic strains), for example, officials might mark stricken homes with special insignia. (In the 1664 "Great Plague of London," for instance, the doorways might bear crosses, with the mournful statement "May God Have Mercy On Us.") Then, the authorities sometimes nailed those doors and windows shut, trapping the terrified sick and their relatives inside to die of disease or starvation.

In Colonial North America, infectious diseases made early appearances, and the governments of both towns and colonies soon began using various kinds of quarantines to try to stop them, with household quarantines being a major control tactic.

(i) Smallpox as a provocateur of Household Quarantines

Smallpox, or *variola*, was a particular scourge that provoked household quarantines. For example:

On Long Island, Easthampton Township ordered anti-smallpox quarantines as early as 1662 (*see, e.g.,* Neslund, Goodman, & Hadler, in Goodman et al., 2007, at 229).

In 1667, the Colonel and Commander of Virginia's Northampton County forbad any members of smallpox-stricken families from

> go[ing] forth their doors until their full cleansing, that
> is to say, thirtie days after their receiving the sd. smallpox,
> least the sd. disease shoulde spreade by infection like the
> plague of leprosy.... [Those persons] such as shall no-things
> [take] notice of this premonition and charge, but beast like
> shall p[re]sume to act and doe contrarily, may expect to be
> severely punished according to the Statute of King James
> in such case provided for their contempt herein;
> God save the King

(*Northampton County Records, 1655-1668*, *cited by* Duffy J, *Epidemics in Colonial America,* [Baton Rouge, La.: Louisiana St. Press, 1953]). Some nine years later, the Virginia House of Burgesses passed a statute imposing strict home isolation on smallpox victims throughout the Old Dominion (*Id.*).

As a major center of trade, the Massachusetts Bay Colony was hit by variola early and often, and it took some vigorous steps against the disease. In 1701, the colony's government empowered the selectmen of its towns to isolate and quarantine smallpox victims and suspects; thirty years later, it ordered the heads of households to report to local authorities when the disease had stricken their families, and it directed those householders to fly the dreaded banner of the quarantine from their homes (in this case, the flag was red—signifying that these families had been visited by "the red death") (Neslund, Goodman & Hadler 2007, at 227; Duffy 1954, at 102).

Well into modern times, in fact, Massachusetts still carried some of the strict household quarantine laws from those years on its codebooks. As of the date of this Dissertation, for example, the Commonwealth retains a statute in effect (Mass. Gen. Laws Ann. 111 s 95) that authorizes a town's board of health to confine a disease victim to his home if he can not be safely moved, in which circumstances "the house or place in which he remains shall be considered as a hospital, and all persons residing in or in any way connected therewith shall be subject to the regulations of the board…." In some form or another, this provision of law dates back over three hundred years (St. 1701-

02, ch. 9, ss 1, 2). Out of consideration for its quarantinees, the existing law does add that

> [w]hen the board of health of a town shall deem it necessary in the interest of the public health, to require a resident wage earner to remain within such house or place or otherwise to interfere with the following of his employment, he shall receive from such town during the period of his restraint compensation to the extent of three fourths of his regular wages;

Unfortunately, this clearly unrevisited law further specifies

> that the amount so received shall not exceed two dollars for each working day.

In the course of time, some features of household quarantines acquired a haunting sort of image that remains today as a dim recollection of past eras. These included the use of placards on doors and windows proclaiming in strident letters that the board of health had placed this residence under quarantine for a contagious disease, and forbidding entry to the premises or exit from it without the board's permission. Sometimes, the signs specified the penalties for noncompliance, and sometimes their message was underscored by armed guards posted around the dwellings—"*vi et armis,"* in the old legal language.

During most of American history, the inmates' fate was not usually one of starvation and abandonment, but it remained one of deadly risk from the disease itself, spartan living conditions, and estrangement from the community outside. (During the "Window Era" of the late 20th century, a pharmaceutical house ran an advertisement that invoked this scene. It depicted a small child staring in quiet despair from behind a blockaded door, next to the yellow placard of quarantine. The message of the ad was that the wonder drugs of the age had made this picture obsolete—but, arguably, some 21st century conditions could soon render this upbeat message itself out-of-date.)

(b) Some Present-Day U.S. Household Quarantine Laws

Explicitly or by implication, virtually all U.S. jurisdictions still direct or allow health officers to isolate the communicably-ill *in situ* and to quarantine their entire households when they determine that this is required by the public health. Several of these jurisdictions still explicitly describe the authority to place placards on quarantined homes. (For example, Pennsylvania states that "it shall be the duty of the health officer to … placard and quarantine all premises upon which cases of communicable disease exist..." [53 Pa. Stats. S 56605]. Guam adds that its health director "may place in a conspicuous position on the exterior of the premises where … [a] person is isolated or quarantined a placard having printed on it in large letters the name of the disease and warning all unauthorized persons to remain off the premises. Such placard shall be in both English and Chamorro…" (10 Guam Code An. S 3311. *See also* 16 Del. Code An. S 505; Iowa Code Ann. s 139A.2; Ohio Rev. Code Ann. s 3707.08; Tenn. Code Ann. s 68-5-104; 19 V.I. Code Ann. s 2). Vermont goes even further, allowing *private physicians* who suspect—even without reaching a definitive diagnosis--that they have attended an infectious patient to "quarantine the premises temporarily … and post thereon a card upon which the word 'quarantine' should be plainly written or printed."

b. Institutional Quarantines

A special type of area quarantine (usually somewhere in physical or population size between a household/building quarantine--as described above, and a neighborhood/district quarantine--as described below) is an institutional quarantine. This category would include infected worksites and other public places, which can have different management impacts depending on the purpose and characteristics of the institutions involved.

(1) Nosocomial quarantines

A notable type of workplace setting would be a *healthcare facility* in which an infectious disease has spread. These are distinctive in a number of ways: Among other things, there is clearly a higher risk of outbreaks in nosocomial settings; in addition, these events would be subject to special controls, such as barrier protection techniques. (During the SARS outbreak of 2003 in China, Canada, and elsewhere—which particularly struck hospitals, PH and institutional authorities sometimes imposed a variant of full-hospital quarantines: They closed off the institutions to all but limited entry, and they required the dedicated staff members--who were risking their health and lives to treat the sick and to manage the facilities--to remain in a sort of quarantine "cocoon." These employees would have to spend their off-hours in separate lodgings within the hospital grounds, or they would be allowed to go home at night—but required to limit their contact with outsiders.)

(2) Schools and colleges

Educational institutions comprise another important type of institution that has been historically subjected to quarantine-type controls. These gathering places for young people have been particular sites for the transmission of certain epidemic diseases, including forms of pandemic influenza that have particularly affected their age group. Moreover, schoolchildren have frequently brought home communicable diseases that have then threatened the health and lives of older or younger relatives. It has already been seen that PH officials have frequently tried to abate epidemics by closing down such public places and keeping students at home, in order to keep possibly infected persons from encountering susceptibles. (This was a frequent device during the Spanish Influenza pandemic of 1918-19.) In itself, this has not been a highly intrusive measure for persons affected. However, there is a "strict quarantine" variant of this procedure that has been adopted in various times and places.

(a) Some Historical Examples of Institutional Quarantines

In several instances historically, health authorities have responded to severe epidemic diseases—particularly pandemic influenza—by "locking down" college campuses, confining the students, faculty, and support staff inside in order to protect the larger outside communities from contracting the disease that has appeared in the schools. (Generally, this was *not* a tactic used for educational institutions below the collegiate level.)

(i) College quarantines against the Spanish Influenza—U.S., 1918-1919

Several American jurisdictions employed this relatively severe tactic during the Spanish Influenza pandemic, although the policy was implemented in a somewhat scattershot fashion rather than in a planned, inter-jurisdictional, or coordinated way.

In Hastings, Nebraska, for instance, the town's mayor placed the entire campus of Hastings College under quarantine—enforcing this intervention by posting armed soldiers around the perimeters of the school (US DHHS, "The great pandemic: The United States in 1918-1919," www.1918.pandemicflu.gov/your_state/nebraska.html). Curiously, though, the college itself moderated this stern lock-down to some degree by allowing students who lived locally to break quarantine by visiting their families; possibly, this compassionate "loophole" may have obviated the power of the quarantine, allowing flu virus to transit from college to community anyway.

At the University of Chicago, meanwhile, members of the student army training corps (the contemporary ROTC) living in two different dorms were handled in two divergent ways—one proactive and the other not--which created a small, unintended, and semi-controlled "natural experiment" on the potential value of institutional quarantines: The leaders of section "A" students closely monitored them and instructed them to report illness; if they thought that any of their young corpsmen had contracted the flu, they immediately sent those individuals home or isolated them in hospitals. By contrast, the supervisors of section "B" took a more *laissez-faire* approach to the situation, and allowed their young charges to continue their pre-pandemic activities, including mingling and attending lectures regardless of symptoms. In the end, although the two student groups were similar in most demographic respects, their influenza attack rates were not: Between October 17, 1918 and November 8, 1918, some 26 of the 685 section A cadets came down with flu (*i.e.,* their attack rate was 39/1,000)--but some 93 of the 234 section B cadets were stricken by the disease (*i.e.,* their respective attack rate was ten times higher, at 398/1,000) (Jordan EO, "Influenza in three Chicago groups. *J. Infect. Dis.,* 25*:*74-95 [1919], *cited by* Bell DM & WHO Writing Group, "Nonpharmaceutical interventions for pandemic influenza, national and community measures," *Emerg. Infect. Dis., 12*(1):88-94 [Jan. 2006], at 89, www.cdc.gov/eid, accessed 12/5/11).

(ii) College quarantines ("Fengxiao") against the H1N1 "Swine Flu"—Mainland China, 2009

A century later, the Peoples' Republic of China ("PRoC") employed an institutional lock-down procedure like that at Hastings College in 1918—though, this time, the disease at issue was the relatively mild pandemic strain of A/H1N1influenza that emerged from Mexico in 2009. During this particular pandemic, the centralized and authoritarian PRoC government closed colleges in a more widespread and systematic way: Called "*Fengxiao,*" the Chinese procedure also involved barricading campuses, confining the academic community inside, coupled with intensive monitoring of outbreak developments within the enclosed zones. In essence, this was a reverse of the traditional Western-style "school closure" procedures. A subsequent study of the outcome in Shaanxi Province yielded a somewhat mixed picture: The trapped university population appears to have suffered a more intense outbreak, but the community outside seemed to benefit from a delayed initial peak incidence of influenza, plus a reduced absolute peak incidence of morbidity. On the other hand, the authorities relaxed *Fengxiao* after a relatively short period of time for a holiday, and the general population became more mobile on this occasion; the retrospective researchers believed that this caused Shaanxi Province to experience a second, later wave of influenza. (They did acknowledge that other factors might have yielded this outcome.) Their inference was that the stern college *Fengxiao* would best protect an outside community--yielding a smaller, unimodal outbreak--if it was *even stricter,* with an earlier date of commencement and a longer duration. (*See, e.g.,* Tang S, *et al.,* "Campus quarantines (*Fengxiao*) for curbing emergent infectious diseases: Lessons from mitigating A/H1N1 in Xi'an, China," *J. Theoret. Biol.,* [in press], www.sciencedirect.com.ezproxy.lib.usf.edu/science/article/pii/S0022519311005583, accessed 11/29/11; Tang S, *et al.,* "Community based measures for mitigating the 2009 H1N1 pandemic in China," *PloS ONE, 5:*1-11 (e10911) (2010), doi:10.1371/journal.pone.0010911.)

c. Neighborhood/District Quarantines

Next wider in concentric size are quarantines placed over whole *neighborhoods or districts* within a municipality where a contagious disease has broken out. The precise definition of such quarantine zone can vary with the individual episodes, as can their sizes.

(1) Policy Concerns in Neighborhood/District Quarantines

All quarantines can potentially raise major epidemiological and socio-legal issues, but certain types of area quarantines may pose some distinctive concerns for policy-makers and administrators.

Some fundamental problems relate to the grounds for taking such broad scale measures, the definitions of the covered persons and areas, and the perimeters of the quarantine zones themselves. It is partly a matter of political geography: There is a distinction between area quarantines that track *formal jurisdictional boundaries* (*e.g.,* municipalities, counties, states/provinces/territories, and even countries)--and those that do not (*e.g.,* households, neighborhoods, city districts, and partial counties).

From an epidemiological perspective, there can be value to area quarantines that do not follow official boundary lines--*if* they can be set up on the basis of sensitive up-to-date information from the field about how widely an outbreak has spread. If they are thus tailored to the stages and dimensions of an epidemic, it is possible to justify them as a rational means of containing the contagion as tightly as possible, without roping in too many unaffected persons and areas. For example, an especially unsanitary neighborhood (which might have substandard tenement housing, deficient sewage systems, and/or major rodent infestations) might deserve particular PH attention to keep it from becoming the nidus of an exponentially expanding outbreak.

However, the above argument presupposes that there is ongoing quality surveillance information about an epidemic's pattern, as well as an official capacity to change the quarantine's dimensions in response to such developments. Epidemics are by nature fluid and dynamic events, and the reality one day may become obsolete the next day. There is a frequent danger that legal and procedural actions will be slow to reflect this dynamic epidemic reality "on the ground." Moreover, there can be serious problems with infected persons living and acting beyond the quarantine zone without showing external symptoms and signs (these asymptomatic people will be further discussed below). With such considerations in mind, would it be appropriate, for example, to set the boundaries of a quarantined neighborhood at certain streets—declaring that there is dangerous infection on one side of the line, and safety on the other?

Moreover, all area quarantines can also have special socio-legal implications, which again differ somewhat for *jurisdictional* and *non-jurisdictional* zones: All such quarantines are likely to provoke some intense protests and legal challenges by quarantinees and other interests (including merchants), with seemingly-well people objecting to being trapped in a zone with the overtly ill. The most vociferous protests are likely to involve the peripheries of the zones. However, it might be harder to demonstrate the "rational grounds" that many legal systems require for the dimensions of non-jurisdictional area quarantines. In these cases, the premises for the quarantine zones could sometimes be more questionable, and even, in a legal sense, more suspect of "arbitrariness."

In part, this may reflect the social milieus and attitudinal environments in which some historic neighborhood/district quarantines were implemented: Sometimes, as shall be shown below, public health authorities imposed them on neighborhoods where certain ethnic, religious, and/or socio-economic groups primarily resided—

groups that had long been socially-stigmatized by the majority societies. In such circumstances, the variegated set of official quarantiners themselves may have acted out of a wide range of attitudes, beliefs, and motives—which might have included promotion of the greater good, assumptions about minority propensities to carry disease, and sometimes actual antagonism towards the quarantined sub-populations. This would not be surprising, given that the socio-legal situations in such area quarantines were often highly complex. There were often multiple interplays of cause-and-effect in such circumstances (only some of which can be suggested here).

(2) Historic Issues in District Quarantines

In many countries, for example, socially rejected minorities (especially immigrants) might settle in special districts (ghettos, "*shtetls*," "*barrios,*" "Chinatowns," "Japantowns") because they were legally forced to do so, because they suffered social hostility from the larger populations, because poverty led them to seek low-rent areas, and/or because they sought out people sharing their kinship and cultures. In turn, these clusters would exacerbate the animadversions of the majority societies. Moreover, the neighborhoods in question were often squalid places—again, for a host of intertwined reasons: The inhabitants were often forced by their penury into accepting substandard dwellings, managed by exploitative landlords, and those insalubrious conditions would be exacerbated by crowding. Adverse and low-paying workplaces could also increase exposure to disease by crowding, and they often allowed families to suffer malnutrition, impairing their resistance to disease. In addition, immigrant groups sometimes did unintentionally import pathogens from their home countries, and sometimes they did have cultural practices (such as unsanitary poultry markets or methods of garbage disposal) that allowed rodent populations to flourish, promoting contagion. For their part, members of the wider societies would often respond to such situations with increasing antagonism, exaggerating the "otherness" of the minority groups and making questionable assumptions about their special biological propensity to catch and spread communicable diseases. In some New World instances, these fears of contagion were intricately mixed with xenophobia and economic opposition to immigrants. In contrapuntal response to the perceived hostility of the surrounding society (as well as in traditional response to oppressive authorities in old countries), residents of the affected districts would sometimes flee from health inspectors, hide their infected dead, or actively resist official actions. These reciprocal patterns of majority and minority behavior occurred in numerous instances in distant and recent centuries.

(a) Some Historical Examples of Neighborhood/District Quarantines

Historically, *Yersinia pestis* plague was often the provocation for neighborhood/district quarantines, but other contagions also prompted such civic actions. Although there were, of course, numerous case-by-case differences between these various area quarantines in the course of historic time, some of the general themes noted above tended to recur in these episodes:

(i) A district quarantine against plague in 17th century Italy

In 1656, for example, the rulers of Rome responded to a recrudescent outbreak of plague by blockading the city's historic Jewish ghetto. Clearly, the assumption here was that this district (where Jews were legally compelled to live) was a special hotbed of contagion, and the deadly outbreak could be scotched by trapping the denizens inside, thereby sparing the outside community. It did not work, however, and it is estimated that some 10,000 Romans—Jewish and non-Jewish—died of the plague during that epidemic (Tyson 2004).

(ii) District quarantines against typhus and cholera in 19th century New York City

In 1892, New York City PH authorities concluded that impoverished Jewish immigrants arriving on ships from Eastern Europe and settling in Manhattan's unsanitary and overcrowded Lower East Side were causing sequential epidemics of cholera and typhus. In response, they threw a set of district quarantines around the whole Jewish ghetto, and they forcibly transported diseased and allegedly-exposed émigrés to the city's quarantine islands. (These episodes were detailed by Markel H, *Quarantine! Eastern European Jewish Immigrants and the New York City Epidemics of 1892* [Baltimore: Johns Hopkins University Press, 1999], 262 pp.)

(iii) District quarantines against plague in Honolulu and San Francisco, 1900

In two classic episodes only eight years after the New York City district quarantines, *Yersinia pestis* plague itself appeared in the American cities of Honolulu and San Francisco. (Honolulu was the capital of the recently annexed U.S. dependency of Hawai'i.) These outbreaks were part of the third great pandemic of plague that emerged from Asia in the latter part of the 19th century, and threatened to follow the trade routes and shipping lanes into Western countries (just as the Plague of Justinian and the Black Death had probably done so long before). On these two occasions in 1899-1900, the neighborhood/districts at issue were the cities' respective Chinatowns rather than the Jewish ghetto of New York, but many of the epidemiological-socio-legal themes described above were replayed in these Pacific Ocean settings. (The series of San Francisco outbreaks between 1899-1908 have been recounted by a number of writers, including Chase M, *The Barbary Plague: The Black Death in Victorian San Francisco* [N.Y.: Random House, 2003], 277pp.; Shah N, *Contagious Divides: Epidemics and Race in San Francisco's Chinatown* [Berkeley: U. Calif. Press, 2001], 334 pp.; Kalisch P, "The Black Death in Chinatown: Plague and politics in San Francisco, 1900-1904," *Arizona and the West, 14*:113-136 [Summer 1972]. The Honolulu episode has been less well covered—though it was no less dramatic. One major historical book tells its story: Mohr JC, *Plague and Fire: Battling Black Death and the 1900 Burning of Honolulu's Chinatown* [Oxford, UK: Oxford U. Press, 2005], 235 pp.)

In each city, cases of plague began to appear among the ethnic Chinese inhabitants of the Chinatown districts. The universal terror of this lethal disease, which ran so long and so deep, soon set off alarms in many quarters. This understandable fear was associated with feelings that the districts themselves were deadly pestholes (which, for various complex reasons, they really were); it was less-defensibly intertwined with the majority groups' longstanding cultural suspicions and economic resentments of Chinese immigration. (In the lurid words of the *San Francisco Examiner,"*[t]he plague, black death, or bubonic fever seems to develop in long-accumulated filth in the densely populated Chinese districts. The Mongolians [*i.e.,* Chinese people] die of it by thousands" [*Examiner*, June 28, 1899, at 3, *cited by* Barde R, "Prelude to the plague: Public health and politics at America's Pacific gateway, 1899," *J. Hist. Med., 58*: 153-186 [Apr. 2003], at 160 & n. 4. Some nine years later, the rhetoric would be just as florid, as another epidemic began: W. C. Rucker would declare in the *Technical World Magazine* that the plague was an "Oriental dragon operating with the stolid cunning bred of aeon-old experience," and then that "[t]he forces of exotic disease had beached their galleys on our shores—the repulsion of the invader was the duty of the nation." *Tech. World Mag.,* 254-64 [1908], at 255, 265, *cited by* Risse GB, "'A long pull, a strong pull, and all together': San Francisco and bubonic plague, 1907-1908," *Bull. Hist. Med., 66*:260-286 [1992], at

262 & n. 10, 11. *See also* Mohr, 2005, at 13, 23 [attitudes to the Chinese immigrants to Hawai'i].)

To a certain extent, the stories of these two plague outbreaks were similar: The health authorities in both cities quickly decided that they had to stop the outbreaks at their sources, and they literally began stringing quarantine ropes ("*cordons*") and painting lines across the Honolulu and San Francisco streets that historically demarcated the respective Chinatowns. Armed guardsmen enforced the emergency ordinances against free passage in and out of the zones. (There are photos of the Asian populace of Honolulu standing grimly behind the line that separated them from the rest of the city. *See, e.g.,* State of HI Dept. of Land and Nat. Res., Historic Pres. Div., "100 years ago in Hawai'i: Honolulu responds to the plague," www.hawaii.gov/dlnr/hpd/centennial/cf_1.htm, accessed 9/16/11; *also,* Mohr 2005, at 75.)

Special focus will be given here to the Honolulu quarantine, whose special characteristics made it emblematic of how a relatively unrestrained district quarantine might operate—and what its various impacts might be.

((a)) The Hawaiian district quarantine—A close-up view

In Hawai'i, the quarantine authorities quickly acquired virtually absolutist powers beyond the reach of appeal: The transitional Hawaiian government (formerly, the Hawaiian Republic of Sanford Dole, Lorrin Thurston, and their allies; now, a U.S. territory-in-waiting) promptly authorized the three members of the Board of Health (Drs. Nathaniel B. Emerson, Clifford B. Wood, and Francis R. Day) to do whatever they felt was necessary to curb plague in the archipelago. (Their ally in this cause was Honolulu City Bacteriologist Walter Hoffman.) In the course of the district quarantine, there would certainly be opposition to the Board members' actions—particularly from the quarantined Asian émigré communities and from some older Honolulu doctors, but, for the most part, their freedom to act was extraordinarily unfettered. (As Mohr [2005] noted, "[t]hough they were nonelected public health officers, they were empowered—in the face of a world pandemic—to destroy private property; to incarcerate quarantined individuals in public camps; and ultimately to manage the affairs of the entire archipelago, public and private, in an absolute and essentially dictatorial fashion. To implement their decisions, they were deploying the militia, the police force, and the fire department" [p. 96].)

Ultimately, in the course of the four-month district quarantine (which lasted, with a brief interruption, from mid-December 1899 to the end of April 1900), the Board of Health (called the "Papa Ole" in Hawaiian) took such measures as temporarily stopping all shipping between the Hawaiian islands, closing down public places and modes of transportation for days at time, using teams of employees and volunteers to try to clean up and de-rat the very dirty quarantine district, confining at least 5,000 people to the barricaded area, examining those people for signs of plague on a daily basis, and transporting disease-suspects to a special isolation hospital at Kakaako…. And then there was the burning policy:

By early 1900, as grisly plague mortality continued to climb, the Papa Ole and its advisors concluded that they had to constrain the deadly outbreak by condemning and deliberately burning down any buildings where sick or dead persons had been found and removed. The now-homeless householders would be sent to special detention camps at the outskirts of Honolulu. Some members of the press and larger public urged the Board to incinerate the whole pestilential district, but its members apparently resisted this proposal, insisting on site-specific bacteriological proof of plague before undertaking controlled burns.

On January 20, however, an unusual (*kona*) wind took hold of a single-building fire, and whipped it into a conflagration that quickly swept beyond the control of the fire department. As the flames spread, the landmark Christian-Hawaiian church of Kaumakapili at the edge of Chinatown soon began to burn along with neighboring structures. In Mohr's (2005) description of the scene, "Kaumakapili's bells crashed through the church's burning roof to the sanctuary below, sounding 'their own dirge, like the harmonious death-wail of some many-voiced living creature,' according to an eyewitness (p. 123)." This had a visible effect on the watching crowd. Soon, huge clouds of multi-colored smoke rose high into the sky over the district, creating an apocalyptic scene. Through it, volunteers raced through the burning buildings, evacuating anyone they could find. In the florid account of one journalist,

> [t]he frenzy of the Chinese and Japanese residents was pitiful to observe. They fled to the streets, lugging away at bundles too heavy for a man to ordinarily carry, but the keen excitement of the moment gave them the strength of two men. Women with strained eyes and tears rolling down their cheeks clung to little children and babes, in wild excitement, searching everywhere to find a place of safety. Few carried more than a change of clothing for

> their babies…. Every one was making a supreme effort
> to flee from the fire-fiend that destroyed their homes and
> household goods

(Mohr 2005, at 131, *quoting Pacific Commercial Advertiser*, January 22, 1900, at 1). In the course of the day, armed guardsmen and paramilitary units marched masses of displaced people out of the fiery quarantine zone, and led them (before mostly-unsympathetic onlookers) to temporary detention quarters. In short order, the Papa Ole had volunteers erect barracks at the Kalihi quarantine camp, where more than 7,000 refugees would be lodged by the end of January. Astonishingly, no one was killed by the fire, but many of the homeless ex-residents would face three weeks in quarantine camp confinement.

There had been no planning for such an evacuation, so the Papa Ole had to work out *ad hoc* methods for safely feeding and clothing the dispossessed. To keep the resettlement camps from becoming plague incubators in themselves, inmates were publicly fumigated on entry and regularly inspected; also, overtly sick persons and their known close contacts were segregated from other confinees. These measures were culturally displeasing to some of the Asian and native Hawaiian confinees, but *Yersinia pestis* plague never did break out in the camps (Mohr 2005, at 161).

During the first four months of 1900, the epidemic went through multiple peaks, with sporadic cases appearing outside the burnt quarantine zone. (These cases were usually addressed with the same quarantining and burning policy used in Chinatown, but with somewhat less uniformity and vigor. In general, the Board imposed some plague-control restrictions on public behavior outside Chinatown--including building inspections, school and theater closures, and limitations on business hours and public travel; however, these rules were generally much less onerous, and they were much more lightly enforced [*see* Mohr 2005, at 169, 184, *et passim*].) A small outbreak of *Y. pestis* plague even appeared in the three-acre Chinatown in Kahului on the nearby island of Maui, and the Papa Ole ordered the quarantining--and then the razing--of this entire district; reportedly, the whole process in Kahului went much more smoothly and quickly than the one in Honolulu (Mohr 2005, at 171-72).

Finally, the incidence of Honolulu plague deaths began to decrease, and the Board lifted the state-of-emergency on April 27. However, there was a long aftermath, with a protracted, unsystematic, and often-painful reparations-claims process, which left many of the refugees with inadequate restitution. On the other hand, the governments of Hawai'i and Honolulu did promote better living conditions in Chinatown after the epidemic ended--promulgating new laws to reduce population density, and making various improvements in the district's sanitary infrastructure.

((b)) Analysis of the Hawaiian district quarantine against plague

Generally, the district/neighborhood quarantine of Honolulu's Chinatown was a complicated natural and human-behavioral event, which developed at many levels, and it seems fair to conclude that it presented a mixed picture of the effectiveness and impact of such quarantine-type procedures.

At the biomedical, epidemiological, and PH policy level, it appears that, at least to some extent, the Hawaiian Board of Health was acting in accordance with scientific thought at this time in scientific history.

Like many health authorities elsewhere, Hawai'i's PH leaders tended to follow the longstanding medical tradition of seeing epidemics (especially plague epidemics) in spatial terms. As Dr. Wood put this understanding, "plague is predominantly a disease of locality and place"—which grounded a spatial, area-quarantine approach to combatting it (*see* Sutphen MP, "Not what, but where: Bubonic plague and the reception of germ theories in Hong Kong and Calcutta, 1894-1897," *J. Hist. Med. & Allied Sci., 52*(1):81-113 [1997], *cited by* Mohr 2005, at 57, 197-98).

To some extent, contemporary scientific theories and discoveries and the turn-of-the-20th century seemed to lend some support to this spatial approach to plague-fighting: It was a transitional era in biomedical thought on contagions, when the bacterial aetiology of plague had just been elucidated, but the contagion's complex ecology was still being untangled (for example, the rodent-reservoir and flea-vector components of the pathogen's life-cycle were strongly suspected in many circles—but they not yet conclusively confirmed). The biomedical community was continuing to debate many aspects of plague dynamics. Some sanitarians maintained a longstanding view that human wastes and ordure contributed significantly to contagion. (From a PH policy perspective, this was actually a reasonable supposition—though it varied in specific degree of appropriateness with the specific type of contagion [*see* Chapter II]: Human excreta spread foecal-oral ["*Type II*"] contagions like cholera, but human garbage fed rats, so reducing the levels of such waste *could* in fact help control the spread of vector-borne ["*Type VI*"] bubonic plague.)

Whatever the limitations in the Papa Ole's scientific premises, it is very possible that some of its steps actually *did* abate the deadly contagion in its city. There was certainly a rough temporal coincidence between the Board's community interventions and the end of the epidemic. Moreover, Honolulu suffered no more notable plague outbreaks in later years. Of course, it cannot be flatly determined whether this was a causative connection, or merely an associational one; it will probably never be conclusively established that the quarantine-related actions *per se* attained the fundamental objective of stopping *Yersinia pestis* plague in Hawai'i. There were too many variables, and this episode was not studied in a modern scientific way while it was transpiring (or *ex post facto*, for that matter). Among other things, plague has its own dynamics in nature, which can fluctuate due to the interactions of pathogen, host, reservoirs, vectors, and environment. Nevertheless, it *is* plausible to posit that containment of the most-affected population prevented a greater transmission of the pestilence—particularly if there were any respiratory-droplet ["*Type I-B*"] pneumonic plague cases in Chinatown. At least as effective would have been the measures that killed rats and fleas—directly or indirectly—such as disinfection procedures, and, ultimately, the fire itself. (A similar historical anecdote was the Great Fire of London in 1666, which many medical historians assume largely ended the severe plague epidemic that had been raging in the British capital for several years—though, of course, this assumption is also conjectural.) In fact, some other jurisdictions across the world that would confront plague outbreaks in the next decade would adopt Honolulu's policy of burning down infected buildings; these included Kobe in Japan and Mazatlan in Mexico (Mohr 2005, at 199-200).

Thus, it could have been argued from one perspective that the Hawaiian Board of Health acted in a harsh but decisive way that was justifiable by the deadly disease danger that was menacing the archipelago.

It might also be said of the Papa Ole that it appears to have acted in accordance with the activist and civic-minded traditions of PH in those years. The Board members were using their vast powers in a resolute and focused way to address the deadly emergency that had befallen their city. Certainly, records indicate that they were not seeking any private gain from their labors. (On the contrary, the three Board physicians and Hoffman put their own lives at risk on a daily basis confronting plague in the city. Day and Wood also volunteered to be the first two persons to try a batch of the Haffkine Prophylactic, a supposed anti-plague serum, that the U.S. Marine Hospital Service had sent to Hawai'i--it would make them both very sick [Mohr 2005, at 177-78; *also,* 195-96]. Later, Day and Wood resumed their private medical practices without engaging in further public activities.)

On the other hand, there were other aspects to the Papa Ole's contagion-control actions during the epidemic that were more troubling: At another level of reality, its contagion-control procedures had major socio-cultural and legal impacts that were, on the whole, not very favorable. Arguably, the activist public health of the era—with its boldly interventionist approaches to contagion-control--was sometimes intermingled with attitudes and actions that would be considered highly questionable today in light of other social "goods." (In keeping with this general point, it might be noted that at least one member of the triumvirate of plague-fighters--Dr. Emerson--had also been a long-time principal architect and advocate of the Papa Ole's leprosy-segregation program [described in the section on individual quarantines, above.])

While it cannot be assumed that the Board of Health's members acted out of any overt antagonism towards the Asian community (their primary goal seems to have been a sincere effort to stop the plague as best they understood it), they did hold some implicit beliefs about the association between ethnicity and susceptibility to this disease (*see* Mohr 2005, at 201). Moreover, the Asian-Japanese-Hawaiian peoples' *assumptions* about the Board's motives were at least as important as its real motives.

In any case, regardless of the Board's beliefs, some of its specific contagion-control measures seem to have been rather roughshod and insensitive culturally: The district quarantine itself, the fire it unintentionally begat, the rough evacuation and detention actions, and the sub-optimal restitution process—all reportedly left a cloud of resentment and distrust in Honolulu's Asian communities towards the city's Occidental leadership, which lingered on long after the cloud of physical smoke itself had abated. This communal estrangement had been present to some degree before these PH actions, but it seems to have been sharply increased by the measures, and the Asian communities' quiet anger may have persisted for several generations (*see, e.g.*, Mohr 2005, at 191-93, 199, 203).

At the level of law, the operation of the 1899-1900 district quarantine on Honolulu's Chinatown could also have been challenged on various grounds. While the plague epidemic, quarantine, and fire took place during a historical interregnum when Hawai'i's international legal status was in something of a limbo, the constitution of the brief 1894 Hawaiian Republic had been loosely modeled on the U.S. Constitution, and in 1899 Hawai'i had just been annexed by the United States (and was awaiting the acquisition of territorial status), so it could also have been alleged that the U.S. Constitution already applied to the island chain. If such a legal argument could have been made, it might have been further averred that the selective quarantining of Chinatown violated its residents' Fourteenth Amendment (U.S.) rights to equal protection under the laws. (During the contemporary quarantine of San Francisco's Chinatown, some Chinese-American quarantinees did, in fact, successfully raise a similar argument in federal court—although there were differences in the legal statuses of the governmental entities involved in these two episodes, and the technical characteristics of the two district quarantines differed as well.) Moreover, the protracted and (for many people) ultimately unsatisfactory process of restitution for burnt and lost property might have been contested legally as an unjustified "taking" of that property without due compensation, which would also have contravened the Fourteenth Amendment to the U.S. Constitution. In general, the legal situation would have been murky in many respects, but a colorable case might have been made that the Honolulu district quarantine of 1899-1900 violated basic human rights in a number of ways.

By consequence, the possibility that this district quarantine *did* quell the city's lethal plague epidemic does not necessarily presuppose that it was the optimal way to accomplish this end. As with all quarantines, this Dissertation posits that PH contagion-control decision-making needs to consider both bio-scientific *and* socio-legal factors. The "least restrictive alternative" doctrine would urge that PH authorities pre-plan future actions that serve such ends with less adverse social sequelae.

(iv) A neighborhood-district quarantine against SARS in Hong Kong, 2003

Approximately a century later, the brief "Window Era" of epidemic peace in the West (ca. 1960-2000) may have ended with one of the first major "emerging" contagions of the new millennium—SARS. Of note here was the archetypal outbreak of SARS at the Amoy Gardens apartment complex in Hong Kong. Despite its bucolic name, this development was actually a rather grungy set of residential towers located in the relatively-poor Kowloon area of the Hong Kong Special Administrative Region ("SAR"); it was large enough in both spatial and population sizes as to constitute a small district in itself. Amoy Gardens quickly became one infamous epicenter for this new disease, with many scores of cases and fatalities occurring among its residents, particularly in Tower "E." It was one of the exceptional SARS outbreaks that was *not* nosocomial in nature. (Eventually, environmental studies undertaken in the complex suggested that SARS—ordinarily a "*Type I-B*" respiratory syndrome [*q.v.*]—had spread rapidly through the apartments from an index case by means of a sub-standard sewage-disposal system and an aerosolization of its coronavirus. [Several works have described the SARS epidemic, including the Amoy Garden episode and the epidemiological and sanitary engineering studies that attempted to trace its development.

See, e.g., Abraham T, *Twenty-First Century Plague: The Story of SARS* (Hong Kong SAR: Hong Kong U. Press, 2007), 176 pp.; *At the Epicentre: Hong Kong and the SARS Outbreak* (C Loh, *et al.* [eds.]) (Hong Kong, SAR: Civic Exchange, 2004), 176 pp.; Greenfeld, 2006. *Also see* Brookes TA & Khan OA, *Behind the Mask: How the World Survived SARS, the First Epidemic of the 21st Century* (Washington, DC: APHA Press, 2005), 262 pp.]; McLean AR, *SARS: A Case Study in Emerging Infections* [London: Royal Society, 2005], 133 pp.)

Significantly, the civic authorities of Hong Kong SAR responded belatedly to the outbreak at Amoy Gardens by blockading obvious access routes into the complex, barring entry, and trapping the remaining inhabitants inside. Several days later, a large number of these unfortunates were led out of the buildings under guard, and transported by sealed buses to quarantine camps in Hong Kong's small remaining countryside.

While the Amoy Gardens outbreak and neighborhood/district quarantine did not involve a disfavored ethnic minority group (as in the cases discussed above), so some historic issues were not involved here, it arguably did involve a relatively low-income group of people, who were somewhat distinguishable by their humble socio-economic status. In any event, they soon became stigmatized in the minds of the greater Hong Kong public, once they were openly trooped into buses before the flashing cameras and newsreels of the press. Many other citizens of the former Crown Colony tried to deal psychologically with the disease danger to themselves by emphasizing the special "otherness" of the denizens of Amoy Gardens.

(b) Some Present-Day U.S. Neighborhood/District Quarantine laws

While neighborhood/district quarantines were mainly employed in past eras (through the pre-modern period of the early 1900s), and they are not usually mentioned in the laws of present-day American states and territories, they are not gone as options for policy-makers.

The U.S. Department of Health and Human Service's Pandemic Influenza Plan of 2005 ("DHHS Flu Plan") appears to mention a form of neighborhood/district quarantines, albeit somewhat vaguely and reluctantly:

> In extreme circumstances, public health officials may consider the use of widespread or community-wide quarantine…. It may involve a legally enforceable action, and … it restricts travel into or out of an area circumscribed by a real or virtual "sanitary barrier" or "*cordon sanitaire*" except to authorized persons, such as public health or healthcare workers.
> ……………………………………………………………………………………
> Implementation of this measure during a pandemic is unlikely to prevent the introduction or spread of pandemic disease except in uncommon or unique circumstances (such as in a community able to be completely self-sufficient).

(DHHS Flu Plan--Supplement 8: Community Disease Control and Prevention, at 12, www.hhs.gov/pandemicflu/plan/sup.8.html, accessed 1/19/12). It should be noted that this Plan is mainly prescriptive rather than mandatory for states, territories, and communities; it recommends that communities not implement these types of area quarantines unless they have planned them in advance, in concordance with neighboring jurisdictions. (Another point to make here, however, is that the DHHS Flu Plan's somewhat imprecise wording on these quarantines seems to ignore an important distinction relating to their *purpose.* This will be further discussed below.)

(c) Summary Note on Neighborhood/District Quarantines

Arguably, neighborhood/district quarantines *should* remain as arrows- against-contagion in the PH quiver, at least for some exceptional situations where epidemic developments and other factors justify such action. As the DHHS Flu Plan notes, however, they would have to be planned and administered with much more care and balancing of factors than in 1900. (It has been seen here that the rough-and-ready area quarantines of the late 19th and early 20th centuries carried serious trade-offs and adverse social consequences.) There has to be adequate epidemiological evidentiary support for their use; there has to be flexibility in their implementation; and PH authorities have to foresee—and balance--the many potential ramifications of employing them.

d. Municipal, Partial County, and Countywide Quarantines

> [Dr. Rieux] knew what those jubilant crowds did not know but could have learned from books: that the plague bacillus never dies or disappears for good; that it can lie dormant for years and years in furniture and linen-chests; that it bides its time in bedrooms, cellars, trunks, and bookshelves, and that perhaps the day would come when, for the bane and the enlightening of men, it would rouse up its rats again and send them forth to die in a happy city.
>
> Albert Camus, *La Peste*

Generally, the next-larger area quarantines are those placed over whole municipalities and counties, as well as sections of counties.

(1) <u>Note on the Distinctions between Municipal, Partial-County, and Countywide Quarantines</u>

While, in the interests of brevity, these particular types of area quarantines will be discussed together in this Sub-section, they *can* raise some separate issues, as will be noted below.

(a) Historical (and Literary) Examples of Municipal and County Quarantines

Here again, the area quarantines of whole cities or American counties (or, in a few cases, portions of counties) primarily go back to past history.

(i) Camus and the plague in Oran (fiction)

Curiously, one of the most evocative pictures of a city-wide quarantine comes from modern fiction: Albert Camus' *La Peste,* which recounted the imaginary but graphic tale of a deadly bubonic plague outbreak in his hometown of Oran, Algeria. Camus' novel was freighted with allegorical and philosophical meaning, but of particular interest here was his account of how the national authorities locked down the afflicted city, leaving the residents—sick and not-yet sick--to face their collective fate.

(ii) Yellow fever in Philadelphia (reality)

A very loose area quarantine was implemented in 1793 when the City of Philadelphia was stricken by yellow fever. (This epidemic would cause a mortality of over 4000 cases—some 10% of the total city population [Gehlbach SH, *American Plagues: Lessons from Our Battles with Disease* (NY: McGraw-Hill, 2005), 273 pp.], at 20.) In those days, this dreaded hepatic disease was thought to be highly transmissible, so news of the outbreak frightened people living outside the city limits. Citizens of Baltimore manned roadblocks along the pikes between the City of Brotherly Love and their own metropolis, seeking to keep Philadelphian refugees from carrying yellow fever southward to them.

(b) Some Present Day U.S. Municipal, Part-County, and Countywide Quarantine Laws

Some present-day American jurisdictions still have laws on their books empowering health officials to impose area quarantines on whole infected cities and counties (as well as in some cases on parts of counties).

For example, the state of Alabama retains a law that allows the mayor or chief executive officer of an incorporated city or town to proclaim a municipal quarantine. It also authorizes a county's chief probate judge or the presiding officer of the county's commission to quarantine that whole county (as recommended by the county board of health, and subject to state health board approval) (Ala. Code 1975 s 22-12-12).

Alabama stands out for also authorizing *portions of* counties, or cities and towns therein, to declare *other portions of those counties* to be infected with a contagious disease, and to quarantine off those areas ("[w]hen a contagious or infectious disease of quarantinable nature exists in a part of a county, the remainder of the county, and any incorporated city or town therein, may establish quarantine against the infected portion or portions of the county…" [Code of Ala. s 22-12-14 (2011)]). The procedures for proclaiming such an area quarantine are quite complicated: *Ab initio*, a committee of public health, acting on behalf of the usual county board of health, could take this action *if* its majority comes from the supposedly *uninfected* part of the county. However, if the majority of that committee comes from the allegedly *diseased* county area, the process gets messier still: In this case, the general county can declare the partial quarantine *if* the county probate judge, or the presiding officer of the county commission, or any two members of the county commission (or at least one of the latter) live in the presumably uninfected area—so long as the county health officer recommends this action and *he* also lives in that uninfected part (although it can still be done without the officer's recommendation if he does live in the allegedly stricken area, or if he is currently absent from the county). Such action is subject to approval or modification by the Alabama State Board of Health. Assuming that the county's committee of public health *cannot* get its uninfected-area majority, there is another procedural alternative: The mayor or chief executive officer of an incorporated city or town in the supposedly uninfected zone can quarantine the unfortunate infected area of the county, so long as his own health officer recommends it (but he can so act even without such a recommendation if his municipality has no officer of this sort). This mayoral proclamation, too, would be subject to approval or modification by the Alabama State Health Board.

(i) Analysis of Alabama's partial-county quarantine statute

It can be readily seen that Alabama's partial-county quarantine process could be a recipe for operational chaos in an emergency--raising an abundance of substantive and procedural problems at a time when a clear line of command and speed of action would be vital. Just to cite a few such difficulties: As a matter of epidemiological substance, administrators would need to ask where they would draw the lines of infection/non-infection *within* the borders of the county. How confident could they feel about the accuracy of the incidence picture, and the consequential "thumbs-up/thumbs-down" for the allegedly uninfected/infected areas of the county? (If, for example, disease-carriers were often infectious without showing signs or symptoms, could the supposedly "clean" portion of the county necessarily be considered infection-free in a true sense for quarantining purposes)? Can a system this cumbersome respond to fast-moving epidemic events? Political realities would likely come in to the picture, too: While quarantines are usually controversial to some extent or another, the Alabama system seems to virtually guarantee intra-county donnybrooks over the epidemiological loci of an epidemic and the legal correctness of the quarantine-imposition process.

It would seem that this state has not recently revisited or rethought its quarantine laws. (This is further suggested by Section 22-3-8 of the Code of Alabama, which fixes the salaries of all county quarantine officers at no more than *$125.00* a month, to be paid in monthly installments…. This would hardly seem to be a great inducement for present-day physicians to take on the potentially stressful, controversial, and dangerous job of county quarantine officer in a time of coming epidemics.)

Ultimately, however, the fundamental point here is that the Alabama statutes on quarantines may arguably constitute the *reductio ad absurdum* of a disaggregated PH system. When looked at from a nation-scale aerial view, it seems to create a potential for a mass of fragmented polities imposing controls at different levels of authority and geographic breadth—with multiple quarantines that would sometimes overlap and contradict one another. In fairness, this decentralized approach might conceivably be useful for certain kinds of outbreaks of contagious diseases—particularly slower-moving ones that can be effectively scotched at a local level, at least at the beginning of their development; in such circumstances, laws that promote greater local autonomy might permit quicker and more flexible responses at an outbreak site. On the other hand, it seems hard to argue that such a system would respond well to a fast-moving national epidemic or pandemic, where broadscale coordination of contagion-control interventions would be crucial. The events of the 1918-19 Spanish Influenza pandemic showed this very starkly.

e. State, Provincial, and Territorial Quarantines

The next broadest set of area quarantines have been thrown over entire states, provinces, and territories in order to combat large scale epidemics and pandemics. Once again, imposing quarantines arguably becomes increasingly difficult as the targeted jurisdictions become ever larger in size and more autonomous in legal and cultural terms.

(1) <u>Centralism vs. Regionalism as Tensions in Contagion-Control</u>

In general, the states, provinces, and territories of sovereign countries are just one step below countries themselves in size, cultural self-identity, and power, although their autonomy can vary considerably across the spectrum of world governance systems:

In *highly centralized* nation-states, the powers of regional governments can be greatly diminished relative to those of national governments (as in historical France), or they might even be no more than administrative subdivisions of the central government (examples might include the small republican city-state of Singapore or the totalitarian state of North Korea).

However, in countries with *federalized* systems, the states or provinces often have distinctive histories, cultures, and jealously retained autonomies, and they can resist the centripetal flow of power towards the central authorities—as well as sometimes conflict with each other. (The classic examples would be Australia, Canada, and the United States, where the provinces, territories, and states developed originally as disarticulated entities, at most loosely confederated, only eventually joining into national unions that surrendered some powers to new central governments. The tensions and the tugs-of-war between the multiple regional entities, and between them and the center, have continued--albeit at fluctuating levels of intensity--from their times of origin to the present-day, as current U.S. politics show.)

Finally, some nations have *very weak central governments*, with multiple centers of decentralized power—often operating as rivals (such as Sun-Yat-Sen's Republic of China during the warlord period, or modern Afghanistan).

From the perspective of public health, the different forms of governance can either help or hinder efforts to control contagions, depending on numerous variables (which would include the rapidity, stages, and sizes of the disease outbreaks--as well as the degrees of effective cooperation and coordination between the participating regional and national loci of power). In general, centralized and decentralized systems can have their respective pathologies—and widespread outbreaks of disease can accentuate these pathologies.

(a) Some Historical Examples of State, Provincial, and Territorial Quarantines

At the dawn of the modern era, area quarantines of this spatial size were uncommon, but they did occur, or they were at least threatened--on a number of occasions:

(i) A threatened quarantine against California, 1900

During the San Francisco plague outbreaks at the turn of the 20th century—particularly the deadly episode in 1900 described above, the City by the Bay gained an unhappy national reputation as a plague port, and the state of California itself became increasingly viewed as unsafe. This image was heightened by the convoluted politics of the outbreak--the battling interest groups, the taint of paralyzing governmental corruption, and the jockeying of jurisdictions for supremacy all gave the national press and public a sense that no one had a good grip on the crisis. Other states and localities grew especially disturbed by the efforts of California's Governor Henry Gage and his local allies to deny that plague had arrived in the city and state. In response, they threatened to bar all interstate traffic between the Golden State and the rest of the country. Very reluctantly, the city of San Francisco and the State of California had to take some actions against the plague in order to stave off this commercial cataclysm.

(ii) Texas's state quarantine against Louisiana, 1899-1900

Just around the same time, the State of Texas quarantined off the entire neighboring State of Louisiana, supposedly to stop yellow fever from crossing their mutual border: On March 1, 1899, the Texan governor proclaimed a quarantine against all persons and conveyances coming from places where the disease had appeared, and a few months later his Health Officer determined that the existence of several cases in New Orleans justified an embargo of all interstate commerce between Louisiana and Texas. This meant the interdiction of all Louisianan trains entering Texas (later slightly modified to allow travelers to enter Texas if they spent ten days in quarantine camps located at the state lines, and had their baggage fumigated). Texas would even bar the entry of various industrial goods from Louisiana, including barrels of sulphuric acid—an admittedly very implausible type of yellow fever fomite. Reportedly, too, the health authorities of certain Texan counties and towns situated alongside the interstate railroad tracks planned to put their state's embargo into effect.

Aggrieved Louisiana went to the U.S. Supreme Court for an injunction against her sister state for impeding interstate commerce. In its decision, however, the Court refused to get involved, asserting that, on various technical grounds, it had no jurisdiction over the subject matter of this case (*inter alia*, because the situation did not involve a true controversy between the two states as entities). Chief Justice Fuller added piously that "[p]ublic policy forbids the imputation to authorized official action of any other than legitimate motives." *Louisiana v. Texas*, 176 U.S. 1, 20 S.Ct. 251, 44 L.Ed. 347 (1900). However, it is submitted here that the Court was being willfully obtuse.

Historically, as has been seen above, quarantines have sometimes been used to further a variety of goals—some of which were decidedly not public health-related. The Lone Star State's actions against the Pelican State in this case had a definite stench of commercial mischief, hidden below the flapping yellow flags of quarantine. In the U.S. Supreme Court's discussion of the background to *Louisiana v. Texas*, one can readily see the likely real underpinnings of Texas's actions: There was evidently an active commercial war going on between the fellow states, with Texas seeking to grab New Orleans' lucrative trade in cotton and other goods for its own up-and-coming Gulf ports, including Galveston. In all probability, the epidemiologically-dubious statewide quarantine was a pretext for this objective. Arguably, this case was another illustration of the potential pathologies of federalism in the public health sphere. (This is not to say that an interstate quarantine might not be justified in some circumstances to impede a major epidemic, but it is certainly a drastic move constitutionally and economically—it should be evidence-based, and it should not be attempted for ulterior motives, whether or not the state quarantiners can find a Court that will look the other way.)

(iii) New South Wales' quarantine against Victoria, 1919

In 1918-19, an Australian national maritime quarantine probably helped delay the arrival of the Spanish Influenza pandemic to the southern continent by several months. During 1919, however, scattered cases of the disease did begin to appear in various parts of the country. Now, the pathologies of federalism began to appear in Australian contagion-control as well: The deadly global event highlighted the weaknesses in the internal seams that held the Australian nation-state together. As the stress of the pandemic increased, it accentuated the fault lines in the national union, and individual states and localities began to act discordantly in efforts to protect their respective publics from the new scourge. This led to lateral conflicts between Australian sister states, and to hierarchic conflicts between the states and the federal government in Canberra.

Notably, the first-afflicted Australian state—Victoria—waited before reporting its cases of influenza; soon afterwards, however, a traveler from Victoria brought the disease to the coterminous state of New South Wales. In response, the latter essentially cordoned off Victoria by land and sea, stopping incoming traffic at the state lines, holding arrivals from Victoria in quarantine detention camps for days, and even detaining Victoria's sea vessels in Sydney Harbor. The Spanish flu soon saturated Sydney anyway (Bell DM & WHO Writing Group, "Nonpharmaceutical interventions for pandemic influenza, national and community measures," *Emerg. Infect. Dis., 12*(1): 88-94 [Jan. 2006], at 90, *citing* McQueen H, "'Spanish 'flu"—1919: Political, medical, and social aspects," *Med. J. Aust., 1*:565-570 [1975]).

f. International Quarantines

Historically, the broadest form of area quarantine has been thrown over entire countries or even groups of countries.

(1) The Issue of National Sovereignty vs. Globalism in International Quarantines

This level of public health action clearly enters a vast and separate socio-political arena that has its own dynamics and set of distinctive issues: Here is not a conflict between central governments and their component entities (with centripetal and centrifugal tendencies oscillating in strength over time), but a historically anarchic field of interaction between sovereign nation-players often acting out of self-interest (increasingly joined by international agencies, non-governmental organizations, and even sometimes individuals). Over the centuries, it may be submitted that the international arena has been particularly dominated by power politics, although it has been slightly ameliorated by a body of international law that has tried to tame them and impose some supervening principles of conduct. In the last one hundred-fifty years, there has been an increasing tension between nationalism and internationalism. Without a doubt, the first "ism" has usually prevailed (most extremely during the two world wars and their preludes), but the latter has become a rising counter-force since 1945. This has been true in many subject areas (including war-making and peace-making; trade, finance, and economics; human rights; and environmentalism, to name just a few). While this vastly complex international arena of human affairs is not central to the instant discussion, it is worth noting here to the extent that international public health and contagion-control have followed some of these "macro" trends over time. It would be a loss of information to ignore this vast context in which international contagion-control has developed in the past and is still developing.

(a) Some Historical Examples of Contagions that Helped Shape International Quarantine law

Several pandemic diseases helped to shape the somewhat haphazard and chaotic system of international quarantines over the centuries.

(i) Plague

Unquestionably, however, *Yersinia pestis* plague has been the dominant goad for such area quarantines. In its 14th century pandemic form, this devastating disease left a profound chill in Western thought and culture that lingered for hundreds of years, and this chill was repeatedly renewed by recurrences of plague in more regional settings: For almost half a millennium after the "Black Death" of the 1340s-50s, new strains of this pestilence would reappear in different parts of Europe, responding to the complex and dynamic ecology of its environment (including climatic variations), its pathogen, its rodent and flea reservoirs, and its human hosts. For example, *Y. pestis* levels would rise and fall in regional European rat populations, and it also remained highly endemic in areas such as Central Asia, the Levant, and North Africa. Trade would sometimes bring *Y. pestis* back into areas where it had been absent for decades, and it would once more strike (and usually kill) susceptible human hosts. This continuing, though variable, threat provoked many European polities to develop elaborate systems of quarantine to prevent reinfection by "foreign" plague.

In particular, the European city-states and nation-states that fronted the Mediterranean Sea, and used it as a watery highway for trade, were repeatedly stricken by ship-borne plague. Consequently, a number of them gradually built up defensive practices and structures to keep disease-ridden vessels from starting new epidemics in their populations. Among other measures, these included the development of a rudimentary epidemic intelligence system, in which consuls and agents would be stationed in Middle Eastern or North African trading ports with long histories of plague endemicity; they would report back to their superiors if the disease broke out there again in epidemic form. Eventually, some advanced European city-states would start cooperating with each other to a certain degree, trading information about new outbreaks—sometimes even when these were occurring in their own harbors. Over time, too, a hodgepodge system of maritime laws was also developed—with considerable variation between countries, which would compel ships to present "bills of health" asserting that they had departed from a port, and landed at ports of call, that were presently plague-free. (*See, e.g.,* the extensive historical account of maritime quarantines—mainly from the commercial perspective of England—in Booker, *Maritime Quarantine: The British Experience, ca. 1650 to 1900* [Aldershot, UK: Ashgate, 2007], 624 pp.; *see also* Schepin OP & Yermakov WV, *International Quarantine* [Madison, CT: International Universities Press, 1991], 344 pp.)

The most vigorous practitioners of this international maritime quarantine system—which included the Italian city-states of Venizia (Venice), Livorno (Leghorn), Genoa, and Messina, and the French port city of Marseilles—eventually built up a complex of lazarettos, often associated with coastal walls and watchtowers, plus anchorages for the detention of ships that could not present clean bills of health. Much attention was devoted to the alleged purification (*sciorino* or *depuration*) of cargoes that were traditionally believed to be frequent plague-fomites. Ships, passengers, and crews were also detained in the lazarettos and observed closely. (During most of those centuries, though, shipboard rats were generally not detained.) Only after meeting the elaborate rituals of marine quarantine would ships receive the coveted "*pratique*" (or clean bill of health) to dock and unload their passengers and cargo. (Descriptions of the Italian system of quarantine walls, watchtowers, and coastal guards can be found in Cliff AD, Smallman-Raynor MR, & Stevens PM, "Controlling the geographical spread of infectious disease: Plague in Italy, 1347-1851," *Acta. med-hist. Adriat., 7*(1):197-236 [2009].)

In some times and places, vessels that were notoriously infected would be driven away from the country's shores. Some stark examples of this panicky reaction occurred during Messina's plague outbreak of 1743 (*see* Booker 2007, at 157): First, polities along the boot of Italy quarantined off the whole plague-ridden island of Sicily, posting troops on the mainland Italian coast to keep Sicilian refugees from landing anywhere on shore. Ships carrying plague-stricken crews were left to drift all across the Tyrrhenian Sea, speckling its surface like pock marks on an infected face. For the most part, this flotilla of the damned remained at sea till the sailors died. In one episode, sixteen Sicilian plague victims got hold of a small boat, and somehow—despite their symptoms—managed to sail it to the famous lazaretto at Leghorn on the Italian mainland, hoping to get treatment or at least refuge there. --However, the lazaretto would not admit them, and instead towed their little craft to the island of Corsica, where it abandoned them. Furious at this official action, the Corsicans had no more wish to play Good Samaritan than did the authorities at Leghorn—and they promptly set the little plague ship ablaze with all on board….

(ii) Cholera

Like most of the pestilential diseases mentioned in this Dissertation, cholera as it is now defined has probably been a disease of man since ancient times—at least in certain parts of the world. However, its usual signs and symptoms in clinical cases make its specific historic points of origin and early extremity of spread somewhat debatable (*see, e.g.,* Barua D & Greenough WB, *Cholera* [Google e-Books, 1992], 372 pp.): To a certain extent, cholera is one of many enteric diseases that present a similar syndromic pattern, with variable degrees of diarrhea and vomiting often inducing adverse—and sometimes deadly—dehydration, electrolyte imbalances, acidosis, and other systemic effects (it is a classic "*type II"* contagion [*see* Chapter II]). Thus, it is hard to say whether "modern" cholera *per se* was actually present in various regions of the world historically—at least until the 19th century science of bacteriology enabled isolation of its causative agents (pathogenic serogroups of vibrio bacteria, which secrete enterotoxins [*e.g.,* CCDM, 2008]). Nevertheless, it is likely that one of the disease's prime early foci was the Indian sub-continent--where rising human populations and poor sanitation, as well as possible pathogen mutations, may have increased its epidemic propensities by the early 1800s (exacerbated by various environmental conditions such as seasonal monsoons, which would contaminate drinking water with human sewage).

Whatever cholera's origins, many social, economic, political, and technological features of the 19th century certainly helped make it into a pandemic disease: Notably, the European conquest of India (and other warfare) was accompanied by exponentially-expanded commercial shipping, which gave *Vibrio cholera* a global human enteric environment to infect. Clinical cholera appears to have emerged from India around 1817; in the course of the next two centuries, there were at least seven great cholera pandemics. While it was sometimes difficult to determine when one pandemic ended and another began (Barua & Greenough, 1992), there is little doubt about cholera's impacts on 19th century life and its fearsome psychological shadow.

One of cholera's few felicitous effects for mankind was its role as a prod to public health: For example, it is now well-known that English cholera epidemics in 1849 and 1855 led anaesthesiologist John Snow to investigate the water-borne spread of disease, and motivated him to develop pioneering epidemiological techniques--even before the pathogen itself was identified in the lab. Cholera was also a strong impetus for urban sanitation movements throughout the industrialized world, and it eventually spurred many polities to develop modern sewage systems. (During the pandemic of 1892, for example, the effectiveness of such a sand-filtration system proved itself in an unplanned "natural experiment": The Prussian city of Altona on the River Elbe had installed such a treatment system a short time before, while just kilometers away the autonomous city of Hamburg had resisted this innovation. In the course of the ensuing epidemic, Hamburg lost about 1% of its population to cholera--some 8,500 citizens, while Altona's mortality rate was 85% lower.)

((a)) Cholera as a spur for international public health law

Of special import here, however, the specter of cholera began to push historically-hostile nations into seeking a *modus vivendi* against the common disease enemy: From 1855 onwards, scientific and political representatives of Western nations started meeting to try to draft international covenants for the regulation of shipping, and for the control of contagions like cholera through quarantines and other measures. (Altogether, some fourteen such conventions would be held.)

As has often been the case in human affairs, though, the motives for the international conclaves were very mixed, and the conflicts between participants continued for decades. (For example, Britain and some of the other northern European commercial powers mainly wanted to "rationalize" the heterogeneous set of national maritime quarantine laws, which they considered a stranglehold on their burgeoning global commerce. However, they were opposed by European nations that faced the Mediterranean and had historically encountered the worst plague-threats from Africa, the Levant, and Asia [*see, e.g.,* Booker, 2007; Schepin & Yermakov, 1999].) Another problem was that the initial sanitary conferences were not well-informed by a modern scientific understanding of contagion—the first ones even preceded a wide acceptance of the Germ Theory. Thus, the early sanitary and quarantine conventions accomplished little.

(2) The Evolution of Public Health Internationalism (Globalism) and Its Continuing Conflict with Nationalism (Sovereignty Claims)

In the course of time, however, a certain degree of concordance did develop and the underlying science improved, so participant nations were able to generate a limited set of international disease-control concordats, treaties, and practices affecting land and maritime commerce (and, later, aeronautical commerce as well). During the late 1800s and early 1900s, too, signatory states ceded some very constrained powers to a successive set of international sanitary bodies. Mainly, these aimed to monitor disease outbreaks: In 1903, for example, the participant nations agreed to inform each other about new epidemics of cholera and other dangerous contagions arising within their territories. Four years later, the first official international sanitary agency—the Office Internationale d'Hygiene—was set up in Paris, and it was accorded the formal function of international disease surveillance (albeit in a relatively limited and passive way). After the intervening international war, the new League of Nations renewed this function in 1920--and twenty-eight storm-tossed and violent years later, its successor the World Health Organization did so as well (Schepin & Yermakov, 1997, *passim;* Barua & Greenough, 1992, at 11-12).

Like the United Nations itself, WHO was founded with a greater vision of promoting world health than had its predecessor agencies, and its Charter enunciated some high-minded ideals about world health that went far beyond those of the earlier bodies. Articulating this vision was surely an important first step in the pursuit of transcendent global health; nevertheless, it is clear that there long remained a considerable gap between these ideals and the reality on the ground. During the 19th and 20th centuries, internationalism and a global perspective on contagion-control (and in many other human matters) had been struggling for breathing space against the immense powers of nationalism, which had helped to motivate two world wars. (Arguably, the trench warfare of World War I and the ideologies of the Axis Powers in the following war were the *reductio ad absurdum* of national chauvinism.) While a global perspective on world health increased during the years of the Cold War and during the years that followed, it was surely heavily counter-balanced by the continuing proud sovereignty of nation-states. For example, long after international concordats had directed signatories to report to the world when they had suffered disease outbreaks within their frontiers, many countries still hid such events in the interest of national pride, tourism, and commerce. (As recently as the SARS outbreak of 2002-2003, Mainland China hid its exploding incidence of the contagion from the outside world for months, dissembling to its public and the foreign press, and blocking WHO investigators until the severe epidemic nearly became a pandemic. [This episode has been recounted by numerous authors. *E.g., see, generally,* Fidler DP, *SARS: Governance and the Globalization of Disease* (London: Palgrave MacMillan, 2004), 219 pp.]) State bio-warfare programs were other extreme manifestations of the continuing claims of national sovereignty as against the global public health. (The Soviet Union's Biopreparat was a major example; Iraq's pre-Gulf War program was a smaller-scale one. There are no doubt others currently in secret operation.)

(3) <u>The International Health Regulations Over Time</u>

During the 20th century, the League of Nations and later WHO periodically issued revised International Sanitary Regulations (later called "International Health Regulations," or "IHR"), which, *inter alia*, specified what contagions member states were to report, and what actions such as air/maritime quarantines were to be taken to prevent and control them. During WHO's early decades, though, the world health agency's powers remained relatively weak *vis-à-vis* its sovereign member states: WHO's mandatory regulations had a very limited purview in many respects. For example, the agency's authority extended only to the immediate environs of seaports and airports; the agency had no regulatory power to require the reporting of *intra*-national outbreaks. Moreover, the 1960s and 1970s would be the decades of the "Window Era" (*see* discussions above), when complacency about pestilence was widespread in the developed world. Consequently, the enumerated diseases were limited to the ancient bogeys of plague, yellow fever, cholera, and smallpox. Nations did not have to report the vast array of other deadly contagions that afflict man (and, indeed, there were many nationalistic reasons for them not to do so). (In fact, WHO actually *shrank* its list of reportable scourges when it dropped smallpox to reflect the triumphant eradication of the disease in the early 1970s; at that point in time, agency attention was not turned to the possibility of weaponized variola.)

However, by the last decade of the 20th century (as was noted previously), fears of pestilential disease were rising again in the West, and WHO began to respond with some tentative revisions to the IHR.

These were moving their tortuous way through executive drafting committees until HPAI H5N1 influenza appeared in Hong Kong in 1997 and then the SARS crisis struck the Far East and Canada in 2003. (Among other components to these events, as noted above, the PRoC hid its SARS morbidity and mortality rates from WHO until it was almost too late. To a considerable extent, WHO had to learn about SARS by informally monitoring international internet traffic.) These events galvanized WHO, and it completed the regulatory drafting process rapidly; it soon submitted the proposed IHR-2005 to its legislative body (the World Health Assembly), which approved the new rules.

(a) Some Present Day U.S. and International Quarantine Laws

Elements of the ancient system of international maritime quarantines remain in effect throughout much of the world today, including the United States. Many American federal and state laws still reflect the procedures once employed to control plague and cholera. The yellow flag of quarantine—*leit-motif* of this Dissertation—has remained the universal symbol of quarantine since that time in history.

(i) IHR-2005

Arguably, however, the most important new body of international quarantine laws is WHO's IHR-2005. To summarize its innovations briefly:

(a) Expansions of WHO's Authority

((i)) A new list of reportable diseases

Another vital step involved expanding the IHR to cover other potential communicable diseases besides the few traditional ones. Whereas IHR-1983's set of reportable diseases had dwindled to three (plague, cholera, and yellow fever)—in part reflecting the complacency of that era, WHO now recognized the potential emergence and re-emergence of many scourges. In addition (although it is not central to the present discussion), IHR-2005 went beyond the IHR's historic focus on contagions to include non-communicable threats to international health: Reportable threats to health were now defined widely enough to encompass non-pathogen hazards that could cross borders (such as airborne radioactive particles from a Chernobyl-style nuclear meltdown, or pollutants from a Hungarian bauxite storage facility entering the Danube River).

WHO's new health regulations focused on a "public health emergency of international concern" ("PHEIC"), which was loosely defined as "an extraordinary event which is determined … (i) to constitute a public health risk to other States through the international spread of disease and (ii) to potentially require a coordinated international response" (Article 1.1). IHR-2005 established a complex, three-track decisional mechanism for determining whether reported events were PHEICs (Article 8). It is essentially hierarchical—reflecting WHO's view of relative disease dangers:

In a special class of threat were diseases that would be intrinsically PHEICs if even one case appeared--requiring immediate reporting to WHO: smallpox, wild-virus poliomyelitis, SARS, and any new subtype of human influenza.

A second set of diseases included pneumonic plague, yellow fever, dengue fever, and cholera, West Nile virus, Lassa fever, Ebola fever, Marburg fever, plus various "diseases of special national or regional concern," such as meningococcal meningitis and Rift Valley Fever. –These were considered potential PHEICs, but they would first have to be evaluated under an algorithmic chart that applied various criteria to them. Notably, decision-makers would have to determine whether (1) they would likely have a "serious" public health impact, (2) they were "unusual or unexpected" events, (3) they carried "a significant risk of international spread," or (4) they raised "a significant risk for international travel or trade restrictions" (Annex 2). If the event in question met at least two of the foregoing criteria, it would be a reportable PHEIC.

Finally, WHO would encourage—but not require—state-parties to consult with it over a third class of events that did not constitute PHEICs but might still have international PH relevance.

In light of the need for speed in outbreak situations, IHR-2005 directed national authorities to complete their analyses using the decision-making instrument within two days, and to notify the WHO Contact Point by the following day (Annex 1, Part A, section 6[a]; Articles 6, 7).

((ii)) WHO's new purview

In addition, IHR-2005 basically changed WHO's purview: Now, the agency was empowered to inquire into *internal* epidemics in member states, not merely those occurring at borders or in seaports and airports. Signatory states were directed to develop active internal monitoring systems for diseases. They would have the duty to join a new outbreak-notification network, in which a "National Focal Point" in each country would report directly to a corresponding WHO "Contact Point" (which, in principle, would be operating around-the-clock) (Articles 4.2, 4.3, 4.4, 4.6).

(A problem here was that WHO did not establish a clear mechanism by which poorer countries could finance such new surveillance systems).

((iii)) A more proactive WHO inquiry role

At a procedural level, WHO also gained the international authority to independently seek out the existence of emergent diseases within member countries; it no longer had to passively wait till a state volunteered that information. As had actually happened *de facto* in the case of SARS, WHO now had the formally sanctioned power to consult non-governmental organizations or even private individuals about possible disease outbreaks. On an on-going basis, too, WHO's agents could now mine the "blogosphere" for extra-official reports about a disease outbreak—whether or not an affected state was willing to admit to the phenomenon. A state-member would now be held to a timetable for acknowledging that it was experiencing a PHEIC.

((iv)) International human rights in quarantining?

IHR-2005 also invoked quarantine powers over individuals—while noting virtually for the first time the need to respect the human rights of quarantinees/isolates. (The rules allude to the principle of imposing the "least restrictive alternative.")

(b) The Lingering Power of Sovereign States

It should be stressed, however, that state sovereignty remains a powerful force in many spheres of human affairs (from high finance to environmental protection to human rights law)—and international contagion-control law is no exception to this reality. On several points, the IHR-2005 seemed to buckle before the pressure of powerful WHO member states:

((i)) For WHO, a continuing paucity of clout?

Arguably, the new regulations had some profound procedural weakness that might deprive the new system of some of its clout: To placate State-Parties and their sovereignty demands, IHR-2005 did not confer on WHO any special punitive enforcement powers. Mainly, WHO gained the "power of the pulpit" to embarrass miscreant countries in the eyes of the world, the authority to recommend temporary and standing (but non-binding) contagion-control actions, and the right to issue travel advisories regarding afflicted areas (Articles 15-18). While these particular powers should not be gainsaid—they helped force open the Bamboo Curtain during the SARS epidemic, and they led to a major conflict and compromise with Canada during the same epidemic, they should not be overplayed either. Certainly, bad publicity can scare governments, but rulers may reckon that honestly admitting outbreaks can lead to trade embargoes and adverse travel advisories just as easily as being caught in the act of hiding those outbreaks.

Nor did IHR-2005 set up any mechanism for binding arbitration of disagreements between state-participants.

(ii) Confidentiality: For countries-- but not for persons?

Surprisingly, IHR-2005—with its new emphasis on human rights, on the privacy of medical records, and on the tapping of non-governmental sources for information—provided only vague and discretionary protections of confidentiality to such information sources (whether they be NGOs or simply "whistle-blowing" individuals) (*see, e.g.,* Fidler & Gostin, *J. Law, Medicine & Ethics* [2006], at 90). The 2003 SARS story showed how crucial such organizations and people could be in blowing open the Chinese government's efforts to cover-up the disease: Under the angry eyes of an authoritarian state, one brave Chinese doctor told the Western press, and thus the world, about the masses of SARS cases being hidden in military hospitals around Beijing. Yet, IHR-2005 requires WHO to tell all state-parties the identity of organizations or persons who had reported information to it. "[*O*]nly *where it is duly justified may WHO maintain the confidentiality of the source*" (Article 9.1; emphasis added).

Clearly here, WHO had yielded to State assertions of sovereignty. It offered whistle-blowers only the most grudging possibility of confidentiality—without articulating what criteria it would use in agreeing to hide their identities. Perhaps the agency could argue that this would be a check on "malicious gossip" at the global level, which might be aimed at harming a country's international standing and trade. But, by and large, the reality is that the power equation squarely favors the nation-state that wants to know who reported pestilence. This is particularly true of totalitarian regimes, of course, but all governments are well-positioned to punish whistle-blowers. Even well-heeled news organizations could suffer badly from subsequent denial of access—or even prosecution, or expulsion from a country. When WHO's informant is a lone individual—it is very easy to see how much harm could be done to him.

For less than the most courageous, the chill on reporting here is manifest.

((iii)) Willfully ignoring Taiwan

As happened during the SARS epidemic itself, WHO largely caved in to Mainland China's political demand that it not recognize the sovereignty of Taiwan, which the PRoC considers to be no more than a "renegade province." (During the 2003 epidemic, this effectively meant that WHO declined to deal directly with the Republic of China ("RoC") on Taiwan—and the little country suffered its own severe SARS epidemic without direct WHO information or input. If this exclusion of Taiwan from ordinary WHO communications recurs in the time of a faster-moving future epidemic --such as HPAI H5N1, the consequences could prove dire for both the RoC and the world.

((iv)) The Minefield of CBW

Another contentious area in the drafting of IHR-2005 was the deadly subject of international terrorism and biological-chemical-radiological warfare (*see, e.g.,* the discussion in Fidler & Gostin [2006], at 91-92; *also see* Pearson GS, *The UN Secretary-General's High Level Panel: Biological Weapons Related Issues* [Strengthening the Biological Weapons Convention, Review Conference Paper No. 14] [May 2005]). The claims of national sovereignty were high in this field, as were the treaties and military/police-level interactions between countries. Some member states did not want public health people intruding into their own responses to suspicious outbreaks within their borders. (More sinisterly, perhaps, other states did not want international observation of their own chem-bio-radio-warfare programs—and the possibility that they would be found in violation of arms treaties or UN resolutions.)

Thus, in this area (as in some others), the WHO drafters were walking in a land-mine field at night. Lest they wind up with an array of rejected and broken regulations at their feet, they had to craft generic language that would let WHO address such potential severe dangers to world health—while backing off from the hair-trigger issues of sovereignty. The final wording in the IHR was necessarily vague (as the language of legislative compromise often is): "If a State Party has evidence of an unexpected or unusual public health event within its territory, irrespective of origin or source, which may constitute a public health emergency of international concern, it shall provide WHO with all relevant public health information" (Article 7). These words *could* encompass bio-terror or bio-warfare events, but Article 1.1 of IHR-2005 defined the "health measures" that WHO could take as excluding any law enforcement or security-related actions.

In this way, the WHO draughtsmen tried to reassure a world of suspicious states that they were staying carefully within their own sphere of PH disease-control, and not presuming to intrude into areas so tensely guarded. … However, modern reality does not make such clear distinctions between the realms of PH, politics, and warfare—and, in an actual bio-warfare event, the shoe-leather epidemiologists will probably cross paths with the gumshoes and the combat boots.

g. Vehicle and Vessel Quarantines

(1) Quarantining Vessels Can Transcend Several Levels of Quarantine "Breadth"

Another quarantine variant relates in a general way to several of the foregoing types—it involves the quarantining of land vehicles, sea vessels, and aircraft. In a sense, this category of area quarantine cuts through several of the foregoing ones, since the issues it raises vary somewhat with the length of the vehicle or vessel's journey and with the jurisdiction(s) that impose it. For instance, if an American state stops and quarantines a train that is trying to pass through it on a voyage through multiple states, this could potentially raise U.S. Constitutional issues relating to interference with interstate commerce.

At a wider level of breadth, when whole countries or American states, counties, or towns interdict and quarantine land vehicles, ships, or aircraft arriving from foreign countries, as discussed above, this can run headlong into controversies of international law, with its concordats, treaties, and traditions.

(a) Some Historical Examples of Vehicle/Vessel Quarantines

This Dissertation has briefly discussed the history of vessel quarantines in the above section on international quarantines.

Ships consigned to quarantine could undergo considerable privation during the centuries when the system was being developed. During the long periods of delay, passengers would experience the continuing miseries of shipboard conditions on the rough vessels of the time, while the ships' cargoes would rot on decks nearby. In England, repeated petitions for release were often sent to the Royal Privy Council without receiving its response for long periods of time (since administrative and postal systems could be very slow and inefficient). In one early case, the master of a vessel forcibly anchored off Scotland beseeched the peers to release his ship and passengers, since they were slowly freezing in the cold offshore winds of November (it is not certain if their lordships ever responded to this entreaty). On another occasion—this one in the early 19th century, passengers on board a small quarantined boat had to share it for weeks with the corpse of a fellow-passenger who had died of cholera (Booker, 2007).

While lengthy detention in a quarantine dockage was the usual fate of vessels conceding "foul bills" (*i.e.,* acknowledging that they had left infected ports, were carrying traditionally-suspect cargoes, and/or had cases of illness aboard), they occasionally suffered worse outcomes. On several occasions during British history, for example, the Privy Council or Admiralty ordered ships that had violated quarantine laws to be burned at sea. Sometimes, British laws also ordered the execution of seamen or passengers who had tried to escape quarantine. (Although such sentences were not often imposed in England, southern European states that were far less ambivalent about the importance of quarantining often *did* execute quarantine-violators [Cliff, Smallman-Raynor & Stevens 2009, at 205; *also,* Booker 2007].)

(b) Some Present-Day U.S. Vehicle-Vessel Quarantine Laws

A number of American states retain laws that allow their authorities to impose quarantines on vehicles or vessels that are attempting to enter or cross their territories.

(i) Minnesota

At the interstate level, Minnesota law still includes an old provision that empowers its health commissioner to interdict conveyances that may be carrying communicable diseases into its territory. ("[T]he commissioner may establish and enforce a system of quarantine against the introduction into the state of any plague or other communicable disease by common carriers doing business across its borders" [Minn. Stats. Ann. s 144.14]. State health officers are authorized to board and inspect such conveyances, and if they find infection, they may detain the vehicle "and isolate and quarantine any or all persons found thereon, with their luggage, until all danger of communication of disease therefrom is removed" [*Id.*]. However, the statute does not make clear what grounds health inspectors would need to have in order to suspect contamination or carriage of disease in the first place.)

(ii) Rhode Island

Curiously, the New England state of Rhode Island retains some ship quarantine laws on its books that hark back to the 19th century (suggesting that these laws, too, are not often reviewed or re-examined (Gen. L. R.I. Ann. ss 23-9-1 to 23-9-20). The statutes' terms are redolent of a different age, when American states and even towns were autonomous entities protecting themselves from foreign epidemics (almost irrespective of the federal government):

These Rhode Island laws still authorize each of the little state's seaports, except Providence, to appoint a human sentinel, who must "hail all ships or vessels which may arrive in [its] … river, bay, or harbor…" (Gen. L. R.I. Ann. s 23-9-5).

If the ship is arriving from a port, place, or country that has been declared diseased, its master must go to a designated quarantine anchorage off the Rhode Island seaport, and "place a signal in the shrouds of the vessel in a manner as to be seen at a proper distance" (Gen. L. R.I. Ann. ss 23-9-5, 23-9-14).

Just as in post-Medieval Italy, no one aboard the boat that is trapped in the Rhode Island seaport's quarantine area may break that quarantine without facing a penalty (though, fortunately for any modern Rhode Island escapees, they would only be charged a fine of $20 or less—rather than being beheaded, as they would have been in 17th century Italy [Gen. L. R.I. Ann. ss 23-9-8, 23-9-9; *also*, Cliff, Smallman-Raynor & Stevens 2009, at 205; Booker 2007]).

In any case, the Rhode Island seaport's town council must hold the now-probably-desperate travelers aboard their shipboard prison, or in a land-based quarantine facility, until they have "passed a suitable quarantine" period (Gen. L. R.I. Ann. s 23-9-17). This last statutory provision particularly shows its age: The state of Rhode Island adds that they must be confined "until those of them that have, or are likely to have, the smallpox or other infectious or contagious distemper are perfectly recovered and cleansed from that distemper…" (*Id.*). Meanwhile, their ship's cargo must undergo the ancient process of "airing and cleansing" (Gen L. R.I. Ann. ss 23-9-1, 23-9-19).

(iii) Alabama

Despite having a relatively small seacoast (centered primarily on the Port of Mobile), Alabama also retains some maritime quarantine laws that include concepts and language from far back in history: Notably, Section 22-12-10 of the state's code (which descends from a law originally passed in 1896) charges a ship captain with a misdemeanor if he removes his vessel from quarantine before receiving *pratique*. Under Section 22-12-11, violators of county or municipal vessel regulations (as posted in a newspaper or in some public place, rather than on the Internet) would face the not-very-fearsome threat of paying at least $50 (which might have influenced captains' behavior more when the law's first version was passed in 1852). Here again, a state's maritime quarantine laws square curiously with the modern-day need for a unified national system of seaport laws.

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3. Duration of Quarantines

This "Dimension" of quarantines and other socio-behavioral contagion-controls addresses their *duration in Time*: At one end of this temporal spectrum, people and/or areas may be quarantined or isolated for a mere period of days. This would be an appropriate response to contagions that have a relatively brief period of infectiousness, such as measles, influenza, or even pneumonic plague. At the other end of this spectrum of time, however, quarantines could sometimes extend for the lifetime of infectious (or allegedly infectious) people; some major disease examples were cited earlier, *viz.,* historical leprosy, TB, syphilis, and asymptomatic typhoid--and the phenomenon of antibiotic-resistance may raise anew this possibility for some of these contagions. It is evident that the temporal duration of a quarantine (or other freedom-restricting contagion-control measures) is positively correlated with its burdensomeness, thus steadily raising the bar of justification that policy-makers must meet before they impose it.

4. <u>Purpose of Quarantines</u>

The next major "Dimension" of quarantines focuses on the *purpose* of those procedures: Whom do they propose to protect? Like the other major Dimensions proposed here, this Dimension may overlap some of the others—but it is fundamentally tangent to their plane. The issue here is not the severity of a quarantine, its geographic breadth, or its duration—it could be mild or severe, narrow or broad, brief or long; the question is whether that quarantine aims to protect society from infected quarantinees (as is usually the case), or to protect the presumably-uninfected quarantinees themselves from contracting a contagious disease.

The discussion of the prior Dimensions has mainly addressed the classic situation where an authority determines or believes that some persons or places *have been exposed to infection* and must thus be sequestered from the greater (presumably unexposed) society for its safety, rather than for theirs. Sometimes, however, contagion-control measures aim to isolate or even remove *a set of vulnerable people* from contact with pathogens. These will be considered here.

It should be noted here, of course, that the lines of distinction in PH purposes are not always clear: Complex contagion-control actions can have multiple goals and operate simultaneously in multi-pronged ways, both benefitting and imposing on individuals at once. The Dimension of quarantine "Purpose" remains an important one in policy-making, however. (It is submitted that there was a failure to highlight this "*Purpose*" distinction in the passage from the U.S. Department of Health and Human Services' Pandemic Influenza Plan discussed above, which was describing neighborhood/district quarantines. For numerous reasons, however, it *is* important to distinguish between quarantines that surround people or areas to protect the world from their alleged infection—as in the cases of Hawai'i's old leprosy quarantine and its 1900 plague quarantine—and quarantines that aim to *protect* the quarantinees inside a zone from infected outsiders. Among other things, the threshold of justifications for quarantines that aim to protect may not have to be as high as those that are arguably "adversarial" to the quarantinees.)

a. Some Types of Protective Quarantines

Ranging across the several spectra of depth and breadth, protective quarantines can include some of the following actions: removing allegedly uninfected--but susceptible--individuals from an area under epidemic threat; confining susceptibles to their homes to prevent them from encountering pathogens; throwing protective *cordons* around susceptibles and nominally untouched areas to keep possibly-infected outsiders from coming into contact with the immunologically-innocent inside the zone.

(1) Evacuations

The first type of contagion-control measure listed above might be more specifically labeled an "evacuation." It has some features in common with emergency evacuations of people from areas that are threatened by other hazardous conditions besides epidemics (such as earthquakes, fires, hurricanes, and floods), but a public health evacuation clearly raises its own operational considerations. (For example, it can legitimately be asked whether moving groups of people out of the path of an epidemic might actually spread the disease, unless some quick and effective diagnostic tests can identify asymptomatic pathogen-carriers in the set of potential evacuees.)

(a) Some Historical U.S. Evacuation Laws

Historically, some jurisdictions have employed evacuations in conjunction with classic household quarantines (*see* above), in order to keep neighbors from contracting the diseases that have stricken the houses next door. Massachusetts practiced such PH actions during outbreaks of smallpox in colonial and early republican times.

(b) Some Present-Day U.S. Evacuation Laws

(i) Massachusetts

*A curren*t Massachusetts statute (descended from the 1700s) still provides for such removals of neighbors (M.G.L.A. [Ann. Laws Mass., GL ch.] 111, s 95). Similarly, a North Dakota law (which originated in 1883) still allows local health boards to quarantine persons in their homes if their health does not permit removal to an isolation hospital--and in such circumstances the boards "*may cause persons in the neighborhood to be removed*, and may take such other measures as it deems necessary for the safety of the inhabitants within its jurisdiction" (No. Dak. Cent. Code Ann. s 23-07-06; emphasis added). Hawai'i has an analogous old law still in effect (Haw. Rev. Stats. s 325-9). (Incidentally, these old statutory provisions run somewhat counter to modern thinking in the way they approach strict quarantines: They favor the more invasive measure of quarantining/isolating infected persons in non-home facilities as a *first* option, reserving home isolation only for special cases where the individuals' health precludes removal. Nowadays, by contrast, many official policies often favor the less-intrusive "L.R.A." [least-restrictive-alternative] approach of leaving ill people *in situ* unless public safety considerations require their institutionalization.)

(ii) Other states

Some state public health emergency statutes that track the more modern model of disaster planning also provide for evacuating persons from disaster-stricken areas. For example, Section 24-32-2104 (7)(e) of Colorado's laws specifically empowers that state's governor to "[d]irect and compel the evacuation of all or part of the population from any stricken or threatened area within the state if the governor deems this action necessary for the preservation of life or other disaster mitigation, response, or recovery" (Colo. Rev. Stats. Ann. s 24-32-2104(7)(e)). Numerous other "state-of-emergency" laws also authorize such mass evacuations, particularly in response to place-contamination by bioterrorists. (See, e.g., Com. of No. Mariana Isl. Pub. L. No. 13-63; Colo. Rev. Stats. 24-32-2104(7)(e); 20 Del. Code Ann. 3142; Off. Code of Ga. Ann. 38-3-51(d), (6); 10 Guam Code Ann. 19501; Idaho Code 56-1003(7)(a); La. Rev. Stats. 29:766; Md. Pub. Safety Code Ann. 14-3A-03(d); N.C. Gen. Stats. 130A-2(7a), 130A-475(3); R.I. Gen. Laws 30-15-9(e)(5).)

Generally, these are not quarantines of people, but they are quarantines of places. They could sometimes be onerous to the evacuees and to persons barred from entering an area, especially if the evacuation requires people to travel on short notice with few possessions to safer areas, and one can readily expect that they would be very difficult to administer (especially with a people as individualistic as Americans). The 2005 evacuation of New Orleans in the face of Hurricane Katrina showed how disastrous such procedures can become when planning is inadequate and "a perfect storm" of situational factors are involved.

Nevertheless, these evacuation actions do not intensely restrict the freedom of the affected individuals and groups. The world remains essentially available to them except for the blockaded locale.

(2) <u>Confining or Limiting Susceptibles to Their Homes for Their Own Protection</u>

Some present-day public health emergency laws also allow governments to order their citizens to stay at home as much as possible during epidemics. For example, Maryland's Emergency Management statute code specifically accords the state's governor the power to order the public to remain indoors on such occasions (Md.

Code, Pub. Safety, s 14-3A-03(d)(2)). (Of course, this would be a mixed-motive measure—it mainly serves to protect the uninfected, but it would also, *ipso facto,* prevent the incipiently-infected from spreading their diseases to others.)

A less stringent variant of this kind of PH measure would include jobsite or travel restrictions: Health authorities might direct employees not to go to work in person to avoid the potential for encountering pathogens in the workplace; nowadays, telecommuting is an option for some kinds of occupations. Alternatively, PH officials may address the hazards of epidemic spread in public transportation, limiting occupancy in public transport or ordering a staggering of commuting times to limit contacts between the infected and the susceptible.

(3) "<u>Quarantines-Against-the-World</u>"

Finally, there is a classic type of protective quarantine that was used periodically in the past: Using it, health officials would try to protect still-unexposed persons by cordoning off their so-far-untouched community from a whole infected world. Essentially, this creates a "hedgehog defense" of a limited area and its citizens, keeping out commerce and visitations by potentially infected outsiders.

This dramatic maneuver might be termed a "quarantine-against-the-world."

(a) *Some Historical Examples of "Quarantines-Against-the-World"*

The desire for collective self-defense is almost as old as mankind itself, and in the course of time some communities have taken unilateral actions to protect themselves from the incursions of outside epidemics.

(i) European villages' self-protective quarantines against plague

In the Middle Ages, for example, some villages reportedly sealed themselves off from contact with outsiders in the hope that they could avoid contracting the plague that was killing the rest of Europe. (Bell DM & World Health Organization Writing Group, "Nonpharmaceutical interventions for pandemic influenza, national and community measures," *Emerg. Infect. Dis., 12*(1):88-94 [1/06], at 90, www.cdc.gov, accessed 11/15/11.)

(ii) North American villages' self-protective quarantines against Spanish Influenza

Following this atavistic path in the 20st century, many small and isolated towns in the Canadian and American West tried to save themselves from the rampant pandemic of Spanish Influenza by stopping highway traffic and interdicting arriving trains. In some of the U.S. towns, gun-wielding vigilantes allegedly forced passengers to remain aboard the trains, and then ordered the conveyances out of town (*Id*.; *also*, www.1918pandemicflu.gov/your state, accessed 2/1/12). (While these events were mostly conducted by townspeople on their own, a few official agencies did assist in some of the local efforts. For example, the provincial police of Alberta helped man roadblocks around three prairie hamlets.) Retrospectively, the outcomes of these interventions were said to have been mixed: Some historians maintained that several of the American "quarantines-against-the-world" *did* keep the pandemic out of some of these self-protective towns. (Barry JM, *The Great Epidemic: The Epic Story of the Deadliest Plague in History* [NY: Viking Penguin, 2004]; Jordan EO*, Epidemic Influenza: A Survey* [Chicago: Amer. Med. Assn., 1927].) However, another report later claimed that the Canadian actions were "'lamentably inefficient in checking the spread of the disease.' Quite simply, isolating individuals and families or quarantining entire communities did not work" (*Id., citing* Whitelaw TH, "The practical aspects of quarantine for influenza," *Can. Med. Assoc. J., 9*:1070-74 [1919]; McGinnis JP, "The impact of epidemic influenza, Canada, 1918-1919," *Hist. Pap. Can. Hist. Assoc., 19:*120-41 [1977]; *see also* Sattenspiel L & Herring DA, "Simulating the effect of quarantine on the spread of the 1918-19 flu in central Canada," *Bull. Math. Biol., 65*:1-26 [2003]).

(iii) Chinese villages' self-protective quarantines against SARS

Almost a century later, some rural Chinese communities also resorted to the ancient tactic of communal self-quarantining to protect their villages from the deadly SARS outbreak of 2003, erecting barricades and keeping out travelers from infected cities.

Of particular policy relevance here, however, are those historical cases where "quarantines-against-the-world" were not informal actions taken by citizens acting on their own behalf but official actions taken by government leaders:

(iv) New Caledonian protective quarantine against influenza

In 1921, an Australian outbreak of seasonal influenza was carried by ship to the French colony of Nouvelle Caledonie (New

Caledonia) in the Western Pacific. While the capital city of Noumea and the southern two-thirds of the island were quickly saturated with influenza cases, the French colonial administrators did manage to take some belated actions to prevent the disease from reaching its northern third. They used the paucity of roads into the region to this end, stopping overland passage to it, and they placed a two-day maritime quarantine on all ships in Noumea that were heading for the north (Bell DM & WHO Writing Group 2006, *citing* Peltier L, "L'epidemie d'influenzie qui a sevie a Nouvelle Caledonie en 1921," *Bulletin de l'Office International d'Hygiene Publique, 14*:676-685 [1921]).

(v) Spanish Influenza meets a "quarantine-against-the-world" in American Samoa

However, the most striking recent instance of a "quarantine-against-the-world" occurred during the Spanish Influenza pandemic of 1918-1919 itself in the Samoan archipelago in the South Pacific. This episode was particularly informative because its specific circumstances created a virtual natural experiment in the potential power of such quarantines. (It was vividly told by Crosby AW, *America's Forgotten Pandemic: The Influenza of 1918* [2d ed. 2003] [Cambridge, UK: Cambridge U. Press], 337 pp. *See also* http.en.wikipedia.org/wiki/SS Talune, accessed 3/7/12, *citing* Rice, G, "Black November – the 1918 influenza pandemic in New Zealand," [2nd ed.] [Christchurch, NZ: Canterbury University Press, 2005], ISBN 1-877257-35-4.)

The culturally and geographically homogeneous Samoan island chain had been artificially bisected in 1899 by two colonial powers—Germany (later replaced by New Zealand) and the United States. Both sets of colonial islands were run by autonomous and authoritarian military governments, and social and medical conditions were very similar on both sides of the artificial border (health infrastructures were rudimentary on both sides, and any healthcare came mainly from extended families). Nor were there any effective vaccines or treatments for flu anywhere on earth. The only fundamental difference in the flu preparation between Eastern (American) Samoa and Western (New Zealand) Samoa would prove to be a quarantine-against-the-world.

As World War I was drawing to a close, the vast movements of soldiers across the globe probably helped to spread a new mutation of the influenza-A H1N1 virus. A fundamental shift in the virus's primary antigens of neuraminidase and haemagluttinin had made it unrecognizable to the immune systems of large percentages of the world's population, and the virus began spreading exponentially among its human hosts. (Ironically, this new appearance of flu became popularly dubbed the "Spanish Influenza" mainly because neutral Spain was willing to report its morbidity and mortality rates, while the belligerent powers feared to do so, lest they give aid and comfort to their enemies.) Within the course of no more than six to nine months, there would be somewhere between 20 million and 100 million deaths from this manifestation of flu (even at this stage in biostatistical history, the death rate for such a pandemic event was only guesswork—but it almost certainly far exceeded the combat deaths in the world war, and its human impact was unmistakable).

While the U.S. government was not keeping its military governor of Samoa, Navy Commander John Martin Poyer, very closely advised about the movement of Spanish Influenza across the planet (the war was a major distraction, and distant dependencies were rarely high priorities), he followed events on the radio, and he made his own plans. Poyer began to seal off his set of islands from the entire flu-stricken planet, tightly quarantining all ships arriving in the main port of Pago Pago. He also utilized existing alliances with native chieftains (*matai*) to blockade any small-boat traffic traversing the international boundary channel from Western Samoa.

Meanwhile, a ship—the *SS. Talune*--had left Auckland, New Zealand in the last months of 1918, which soon proved to be carrying multiple cases of severe influenza aboard. In the ensuing weeks, this vessel seeded outbreaks in all its ports of call in the Southwest Pacific. In early November, it arrived at Western Samoa's capital city of Apia on the island of Upolu. The *Talune* was only subjected to a rudimentary marine quarantine in Apia Harbour (its captain may have downplayed the incidence of influenza aboard, and the harbour's quarantine officer only asked the passengers a few perfunctory health questions). In short order, the routine yellow banner of the quarantine was lowered from the ship's mast, and the steamer *Talune* received *pratique* to offload its crew, passengers, and cargo.

Within a short time, a violent epidemic of influenza had broken out across the port city of Apia, then quickly spread through Upolu and surrounding islands. Like many other Pacific Islanders, Samoan native people lacked a long historic experience with pathogens from the "world-island" (Asia-Africa-Europe) and the Americas, and they were singularly vulnerable to this strain of A/H1N1 influenza. Consequently, their death rate climbed to levels that were even extraordinary in that disastrous flu year: Within just a few months, some 8,500 people--22% of the entire population of Western Samoa—were dead, with profound and lasting impacts on their familial ("*fono*") and kinship-based culture. Many deceased young adults left behind orphans, and, with some 45% of the *matai* having died, many village societies broke down. The New Zealand administrator of Western Samoa, Lieutenant Colonel Robert Logan, took few effective steps to try to stop the spread of influenza across the islands under his command. He also took umbrage at the self-isolation of American Samoa--which he regarded as an unfriendly act by an allied power, and he cut off communications with Poyer's government across the channel (Munro D, "Logan, Robert--Biography." In *Dictionary of New Zealand Biography,* www.TeAra.govt.nz/en/biographies/3112/1, accessed 4/26/11).

Poyer's actions were indeed unrelenting. At one point, he personally stood in a small boat in Pago Pago Harbor with a megaphone, and ordered the regular mail packet from Apia not to land unless it first underwent a rigorous quarantine. The ship turned away without unloading its cargo or passengers. For their part, native *matai* on American Samoa were aware of the influenza threat to their islands, and they helped Poyer by even turning away small craft carrying their own kinfolk from stricken Western Samoa.

In the end, classic Spanish Influenza never did reach American Samoa. Although a strain of flu finally entered the islands in 1920 (after Poyer had retired), it may have only been a mutated form of the deadly 1918 strain, and it killed no one. In fact, American Samoa attained an outcome that was virtually unique on earth in those plague years: Not a single member of the small colony's population died of Spanish Influenza. Thus, the comparative flu deaths on the two Samoas in the relevant time period were approximately 8,500 to 0.

On June 10, 1919, John Martin Poyer left Samoa forever, honored with the Navy Cross and bidden farewell with a 21-gun salute. After a year of so many events--and so much misery--across the globe, world history soon forgot his name…. However, his highest tribute may have been a Samoan song overheard at the time of his departure (sung to the tune of the "Star-Spangled Banner"). It began "Oi ai le motu i le Pasifika sauté Tutuila ma Upolu/A o Tutuila oi ai fu'a Meleke, a o Upolu le o Niusilani….," and in translation:

> There are two islands in the South Pacific, Tutuila and Upolu,
> Tutuila under the American flag, Upolu that of New Zealand.
> God has sent down a sickness on the world,
> And all the lands are filled with suffering.
> The two Islands are forty miles apart,
> But in Upolu, the Island of New Zealand, many are dead,
> While in Tutuila, the American Island, not a one is dead.
> Why? In Tutuila they love the men of their villages;

In Upolu they are doomed to punishment and to death.
God in Heaven bless the American Governor and Flag.

((a)) Analysis of the American Samoan "quarantine-against-the-world"

A "natural experiment" such as occurred unplanned on the Samoan Islands cannot be conclusive in a causational sense on the value of a protective quarantine; in such a population, after all, there might have been confounder variables that could have explained at least some of the differences between the *de facto* "treatment" group and the *de facto* "control" group. Nevertheless, it seems reasonable to submit that this episode provided strong suggestive evidence for the postulate that quarantines-against-the-world *can* sometimes be highly effective containment tools against epidemic disease.

However, the generalizability of this conclusion must be hedged by some epidemiological and socio-political-legal realities. *Inter alia*, the Samoan episode involved an unusual combination of circumstances, which included exceptional geographic isolation, a benevolently autocratic naval authority, and a cooperative native public:

First, it should be remembered that these events occurred at the dawn of the modern world, when nations like Samoa were still connected to other peoples of their planet and their infectious commerce only by seacraft. Technologically, airplanes had appeared by that time, and they were certainly on the verge of bracketing vast global distances—but they had not yet made that leap to the south Pacific. This brought valuable time for an alert and aggressive contagion-fighter. Those simple technological circumstances are no longer present, of course, and modern aircraft can transport the carriers of numerous contagions (including flu itself) almost anywhere before they manifest any symptoms.

Moreover, the governance conditions and leadership circumstances of American Samoa in 1918-19 were hardly typical of American governments in general: They involved a benignant, well-informed, and proactive military ruler vested with autonomy from Washington and virtually despotic local powers, who was not beholden to respected local rulers but still consulted with them and had their support.

Finally, as has been seen elsewhere in this Dissertation, the press of competing goals in many modern places (including those of commerce and individual freedoms) usually starts cracking quarantines relatively early in their operational history. In this respect, the experience of American Samoa in 1918-18 was rather exceptional politically, to say the least.

In the end, the picture is, as always, complex, but it might be posited that quarantines-against-the-world will rarely carry the full impact they had in that time and place. Even in circumscribed form, however, they may *still* be valuable PH policy instruments for attaining some ends, such as gaining a limited amount of time for the development of anti-pathogen technologies. This potential biomedical value will need to be weighed in the balance with other social desirables arising in particular situations.

(b) Some Present-Day American Protective Quarantine Laws

Some state laws provide for some degree of *cordon sanitaire* around their states (e.g., R.I. Gen. Laws 23-8-18; So. Dak. Cod. Laws 34-22-1; W.Va. Code Ann. 16-3-2, 16-3-3).

(i)   Louisiana

In a curious twist, Louisiana extends the above practices on a wider scale, allowing the state health officer to prevent "persons acclimated, unacclimated or said to be immune" from entering "any infected portion of the state … when, in his judgment, the introduction of those persons would increase the prevalence of the disease" (La. Rev. Stats. 40:7). This statute appears to express the notion that new persons entering an infected area (whether or not they are immune) could increase the disease's prevalence for everybody. Thus, the individuals' own safety is only part of the goal here; overall disease control is the main purpose.

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5. Quarantines of Individuals for Society's Benefit—The Culpability Dimension

A final "Dimension" of quarantines (and some other socio-behavioral contagion-controls) addresses a different facet of these PH measures: It focuses on the issue of the "*culpability*" of quarantinee conduct from the perspective of the law of a legal jurisdiction. This Dimension asks the jurisprudential question—have the quarantined person(s) violated any statutes, ordinances, or regulations in connection with the carriage of pathogens? If so, how severely have they transgressed? As with the other Dimensions, the present one ranges along a spectrum from least to most (culpable, in this case): At one end of this continuum, quarantined persons are essentially innocent of misconduct in the eyes of a jurisdiction's criminal law; at the other end of the continuum, however, the disease carriers are intentional transgressors, who use pathogens as weapons in a deliberate way, as shall be illustrated in more detail below.

Often, it will be seen, some quarantinees might move over time down a sequential "path of misconduct" into ever-more legally culpable actions. In such circumstances, this Dimension might constitute a procedural hierarchy that occurs over time, with increasingly severe constraints imposed for violations occurring at successive stages of the legal process.

Here again, there may be a little overlap between this Dimension and the others, but they remain conceptually and operationally independent. While, in some ways, this Dimension might seem to parallel the Dimension of quarantine "Depth," or severity (discussed above), they are actually different in some very basic operational ways: Notably, in quarantine law, a lack of culpability does not necessarily betoken milder societal treatment, as shall be seen below.

a. Quarantines for the Mere "Status" of Carrying Pathogens

(1) Simple Quarantine Laws as Non-Criminal Statutes

As was just indicated, one end of the "culpability" Dimension involves no culpability whatever. Individuals are quarantined—sometimes strictly and harshly—because of the elemental fact that they have the "status" of "infectiousness" and are thus dangerous to others (even if they never wished this to happen--and may not even have not known that they were asymptomatic carriers). Quarantines of this kind reveal the fundamental character of this whole body of law in its starkest form: It is intrinsically a law of raw communal self-preservation, which does not require that any crime have been committed at all; in principle, it has no punitive, retributive, or deterrent goal.

(2) Background Analysis of Quarantining for Having the "Status" of Infectiousness: Doctrines of the State's "Police Power" and Parens Patriae

Under the Anglo-Saxon common law, the nation-state gradually developed two jurisprudential doctrines that empowered it to act in basic quarantine circumstances: The state was said to have a "police power" to preserve the public health, safety, and morals, and it also had the role of *parens patriae.*

Over the centuries, the reach of the English central government expanded ever more widely to encompass distant parts of the realm. This expansion of royal power was justified by various legal fictions (of which English jurisprudential culture was inordinately fond): One concept was the "king's peace"—in principle, interpersonal violence near the monarch disturbed his calm, so his agents could properly enforce civil peace in the area around him, and this area of law expanded more and more widely. With this doctrine came the widening concept of the state's "police power" to impose calm and order for the general good of society—also, in an ever-increasing scope. (Often, the criminal laws that enforced this calm and order would be considered highly draconian today.)

Separately, English law also developed the notion of the "*parens patriae*" (literally, "father of his country"), which maintained that the ruler would stand in as a sort of national parent over impaired people, taking care of their needs because they could not do so themselves. This provided doctrinal underpinnings for some civil laws—including laws for institutionalizing the “insane” or the infectious. (In harsh reality, of course, this doctrine claimed a governmental solicitude that did not really exist in the kingdom at that time: Pre-20^{th} century England was not a society that provided an excessive amount of tender care for its poor, “insane,” or ill--but the legal fiction asserted that it did do this, or at least that it *could* do it.)

When the American Revolution separated the thirteen colonies from their mother country, the new state governments acquired the legal authorities of police power and *parens patriae* over their respective publics that the English sovereign had once held. This included the power to protect American communities from communicable diseases, as well as the power to care for some sick residents of the states. (For a long time, though, most of the American states did not really expand very much on the English Crown’s minimal care for the afflicted.)

As was noted in the discussion above on the “Depth” Dimension (particularly in connection with HD and TB), there has been a longstanding tension in PH governance between the “pole” of protecting society from infectious persons and the “pole” of providing individual care to the infected. While these policy “poles” are not totally incompatible, they certainly differ in emphasis. In numerous polities across the world—including the United States, much priority was long given to preserving the public's health from infectious individuals (in the model of the Anglo-American common law, this was roughly like emphasizing the "police-power" aspects of a state's PH function). As bio-medicine became increasingly effective in the last century, however, the therapeutic purpose increased (in a rough sense, it was increasingly stressed the state's PH role as "parent of its people"). Thus, during the late 19th and early 20th centuries, leprosaria at Moloka'i on the kingdom/territory/state of Hawai'i and at Carville in Louisiana tried to "protect society" from the scourge of leprosy by keeping HD victims confined within deep natural and man-made moats and walls--but, over time, these institutions became more and more dedicated to nursing and then to medical research on cures for leprosy. During that same era, the TB sanatoria exemplified the complex intermingling of both goals (with private institutions for wealthy patients stressing the therapeutic goal above all, while state institutions for poorer patients often aimed to treat them—but also retained a strong element of coercive confinement).

(a) A Classic Example of Quarantines Without Implying Guilt: Hawaiian Leprosy-Segregation Laws

A classic example of quarantining without imputation of guilt would involve the citizens of Hawai'i who were suspected of having leprosy (*see* the above discussion in this Chapter): They could be dragged from their homes and schools, coldly examined, and then transported in a cattle pen on a decrepit ship to lifelong banishment in the Kalaupapa leprosarium. In the course of this whole harsh scenario, the subject individuals might never have committed a single act of disobedience or criminality. Even the implacable Hawaiian Supreme Court conceded this--while strongly supporting the leprosy segregation/quarantine system: "[L]eprosy is not a crime…. It is a disease. There may be instances where a person having the disease of leprosy willfully contaminates others, or transmits it to his offspring, or being free from it, recklessly exposes himself to infection, and these may be called wrong or criminal acts; but unless these acts are prohibited by law, they are not offenses, or punishable as such by law." *Segregation of Lepers*, 5 Haw. 162 [Hawai'i Kingdom 1884].)

In this most elemental form, quarantines are civil-type procedures, reminiscent of involuntary-confinement laws for those "mentally-ill" persons who are believed to be dangerous to themselves or others.

(b) Some Present-Day U.S. Quarantine laws for the "Status" of Infectiousness

Virtually every modern American state and territory (and numerous counties and municipalities) authorizes its health officers to quarantine infectious people without establishing any culpability or misconduct. To cite a typical example, Alabama's law states that "[w]henever the State Health Officer or his representative, or the county health officer or his representative, is notified of any … persons afflicted with any of the notifiable diseases or health conditions designated by the State Board of Health, he shall, at his discretion, isolate or quarantine such … persons as further provided in this article…" (Code of Ala. S 22-11A-3).

b. Quarantines for Non-Compliance with PH Officers

(1) A First "Criminal" Level of Culpability in the Quarantine Law's "Hierarchy of Culpability"

At the first level of culpability, an allegedly infectious person might face quarantining because he or she did not cooperate with instructions from health officers. A classic instance might be an active TB patient who was ordered to go to an outpatient clinic to undergo a multi-drug protocol, but failed to do so or only complied erratically (thereby putting his close contacts at risk of contracting the disease, and furthering the wider danger of promoting strains of multi-drug-resistant *M. tuberculosis*).

(a) A Historical Example of Quarantining for Non-Compliance with Initial PH Orders: Benton v. Reid

Francis A. Benton, the jailed TB patient described previously in this chapter, had reportedly gone AWOL from various hospitals before the District of Columbia finally incarcerated him. *Benton v. Reid*, 231 F.2d 780, at 782.

(b) Some Present-Day U.S. Quarantine Laws for Non-Compliance with Initial PH Orders

Most U.S. state and territories (and many smaller jurisdictions) will authorize the health authorities to quarantine such recalcitrants, with or without a court order.

((i)) *<u>Alaska</u>*

A typical statute that quarantines people who will not comply with outpatient care is Alaska's Section 18.15.380(c): It provides, *inter alia*, that "[t]he [state health] department shall notify an individual who refuses treatment under this subsection that the refusal may result in an indefinite period of quarantine or isolation and that the individual may be responsible for payment of the costs of the quarantine or isolation." Note that this provision does *not* necessarily criminalize the individual's non-compliance, since it also asserts that he or she has the nominal right to refuse treatment. From the individual's perspective, however, this non-criminal status may be rather less important than the fact that he or she may now face an indefinite confinement in a closed institution.

c. Quarantines for Defiance of a Court Order

A possibly "later" step in the path of non-compliance—which more commonly carries criminal law implications—might be an individual's defiance of a formal court order to get medically examined or treated. Usually, in such instances, PH officials will have gone to a magistrate or a court to seek judicial support for their health directions to a patient, but the patient still refuses to cooperate. Some jurisdictions may regard this behavior as a legal contempt of court.

(a) Some Present-Day U.S. Quarantine Laws for Non-Compliance with Court Orders

The power to criminalize and quarantine alleged contagion-carriers who defy court commands is also virtually universal in present-day American statutory law.

d. Quarantines for Non-Cooperation with Institutional Rules

(1) <u>Confinement Centers *Within* Confinement Facilities</u>

Next in a sequence of culpability would be a disease-carrier who is committed to a quarantine facility and then refuses to comply with the internal rules of that institution. At this point in a quarantining process, the individual will have already lost the right to move freely in the community—perhaps after a history of non-compliance on the outside--and he or she would now encounter further restrictions in degrees of freedom within the facility walls. The isolation hospital will have an interest in maintaining order among its confinees—particularly in light of their infectiousness, and it may be a public institution whose rules of conduct carry the force of law. Violation of those rules may place a quarantinee in the unenviable status of being confined within two layers of isolation.

(a) Some Historical Examples of Punitive Confinement Within Quarantine Zones

To cite two examples of confinement within zones of quarantine:

(i) Jailing within the Kalaupapa Leprosy Settlement

By the later phases of the Kalaupapa leprosarium's history (*see above*), the Kingdom and later the U.S. territory of Hawai'i had created a regular police force within the settlement, and they built a small jail on the peninsula where miscreants would be placed, thereby further ensuring order.

(ii) Confinement within the Carville Leprosarium

The Carville National Leprosarium in Louisiana (*see above*) also developed confinement facilities for recalcitrant residents. Notably, these included patients who had absconded through a popular "hole in the fence," and who then returned voluntarily or were brought back in shackles by policemen. Usually, the penalty consisted of temporary lodging in one of the detention buildings, with loss of some privileges. (*See, e.g.,* Gaudet M, 1988; Martin B, *None Must Ever Know,* 1959; Martin B, *Miracle at Carville*, 1950).

(iii) A historical example of the culpability continuum: The cases of Donald Moore

In a series of two Florida court cases from the last years before the "Window Era"—*Moore v. Draper*, 57 So.2d 648 (Fl. Sup. Ct. 1952) and *Moore v. Armstrong*, 149 So.2d 36 (Fl. Sup. Ct. 1963)--one can follow the downward path of an unlucky TB patient, who continually failed to comply with the directions of the health authorities—and who thus saw the circumference of his allotted spatial world and its privileges shrinking over time.

In *Draper,* the court stated generally in the first case that Florida had long been alarmed by TB, and the judges themselves agreed with this executive/legislative branch feeling, saying in stentorian terms that

> [r]ecent history of public health matters showed that tuberculosis was recognized as one of the most dreadful diseases and one of the greatest killers. The State has spent millions of dollars prior to 1949 in an attempt to minimize as far as possible the spread of this terrible disease. It had established a few hospitals and clinics and had carried on a program of detection, education and advice. It was recognized that those afflicted with this disease were a menace to society. They walked the streets; went to public places such as theatres, hotels and restaurants; they rode in common carriers; in their homes and other places they came in close contact with relatives and friends and the general public. They not only suffered themselves, but left disease, misery, sorrow and death in their wake

(*Id.*, at 2; emphasis supplied). Despite this view, Florida's health authorities did not, for a long time, yank the liberties of these people they perceived to be menaces to society, not out of any tender feelings for their rights, but because the state—then as now—was an under-capitalized, small-government jurisdiction that simply could not afford to build quarantine facilities for them. Eventually, however, a Cigarette Tax Law *was* passed, providing the needed revenue, and the Sunshine State started making up for lost time by quickly building a number of confinement sanatoria.

It was during this time that plaintiff Donald Moore fell afoul of the system, presumably because he was an active TB patient who was wandering around indifferently spreading his disease to others. On December 13, 1948, he wound up in one of the newly-built sanatoria, and he soon sued for a writ of *habeas corpus* to regain his freedom (claiming that his quarantine was unconstitutional in various ways). In its *Draper* decision, however, the court turned Moore down, asserting that the state did indeed have the legitimate "police power" to protect the public health, which the judiciary would not overturn, absent a showing that the rules were "arbitrary, oppressive and unreasonable." Since the plaintiff had not established that this was case, he would be staying at the sanatorium until he could prove that he was no longer dangerous to others.

Rarely in the law is it possible to find a denouement to a case; usually, the plaintiff disappears from the record after the court rules, and his fate becomes unknown to later readers of the case. Such was not the case with Moore, however. Almost a decade later, he was back before the same tribunal for a return engagement, seeking another writ of *habeas corpus* on the grounds that his civil liberties had been violated…. In *Moore v. Armstrong* (*supra*), the fact pattern clearly shows that this unhappy and uncompliant patient was *still* in state custody at its Southwest Tuberculosis Hospital ("Southwest Hospital") in Tampa after all almost 15 years. Moreover, he was now complaining that he was "being confined in a maximum security cell of the hospital for long periods of time" without receiving treatment for his TB. According to the court, however, the record showed that plaintiff Moore had gone AWOL from Southwest Hospital on at least six occasions, had abused drugs five times, and had become intoxicated nine times, leading to his isolation *within* the isolation facility. The record also reportedly showed that Moore had not been denied medication while in special isolation. –Thus, opined the judges, Southwest Hospital had complied with state statutes in the way it had treated him, and they once more dismissed his petition (without prejudice to his refilling again if he improved, and was no longer "dangerous to society").

After the *Armstrong* holding, Moore finally does drop out of the written record, and his ultimate fate is unknown.

((a)) Analysis of the Moore TB confinement cases

On balance, it is clear that Donald Moore was no model patient, and he was obviously an exasperation to officialdom—and *possibly* a genuine threat to the public health as well. On the other hand, the case seems unusual—and a bit troubling—in a number of ways: First, it is somewhat doubtful that the state of Florida locked up all its consumptives (even its recalcitrant ones)--which leads to the legal problem of inequitable enforcement of the laws. Moreover, the lengthy time periods involved in this case—and its time in history—are also puzzling: Moore was confined against his will for a longer time span than many murderers, which seems like a rather excessive response to his disease and disorderliness. In addition, it is most curious that all of this took place in the 1950s and 1960s—which was well into the modern era therapeutically. It is also surprising medically that Moore's TB did not seem to respond to anti-TB drugs, but maybe this was due to his uncooperativeness. (Surely, some alternative means of handling Moore could have been tried—nowadays, directly-observed outpatient therapy would clearly be the first choice [*q.v.*].)

In general, it should be added that Florida had belatedly set up a whole system of TB sanatoria that was headed for obsolescence within a few years. It had already become an outmoded concept by the time that Moore filed his second petition. The creaky state institutions that had arisen from the bounty of the Cigarette Tax would soon become therapeutic backwaters for a dwindling number of patients--and they would be shuttered and padlocked not that many years later.

e. The Knowing and Reckless Spread of Contagious Diseases

Next, there is another order of contagion-related criminal conduct, which would more closely resemble certain non-quarantine-related criminal acts: These would include cases wherein individuals who knowingly carry infectious pathogens engage in reckless behaviors that could transmit those harmful microorganisms to others. A classic example of this would be persons who know that they have STDs but continue to have unprotected sexual intercourse with susceptible partners--particularly if they have not forewarned the later of the risk they face.

Among other issues that criminal prosecutors would face in such situations would be establishing the requisite "*mens rea*" (knowing mental intent) as well as the "*actus reus*" (the actual act of unprotected intercourse). The state would have the burden of proof of establishing that the infected person acted with a full awareness of his or her infection when performing the act that could transmit the disease to the other party.

Arguably, "Typhoid Mary" Mallon was acting in this manner when she became aware of her own status as an asymptomatic carrier of typhoid, yet persisted in cooking for susceptible families and institutions. Probably, there could be some debate about her knowing recklessness before Soper confronted her in 1907, and before she underwent the confirmatory examination at Willard Packer Hospital (although even before those dates, Mallon's repeated flight from typhoid-stricken homes suggested that she already realized that she might be associated in some way with the outbreaks). In any event, Mallon could no longer claim ignorance of the connection after her first time in quarantine, and she broke her formal agreement to refrain from resuming her prior occupation, so her subsequent actions would clearly meet this standard of culpability.

These kinds of criminal acts are somewhat different from the quarantine-related behaviors discussed previously in connection with this "Dimension," so they are not central to this discussion. However, they do further illustrate the "continuum of culpability" that is involved in this Dimension. In jurisprudential terms, the laws of most jurisdictions would consider these acts to be more than *malum prohibitum* (a mere technical violation of procedural laws); they would arguably constitute *malum in se (i.e.,* fundamental wrongs against some concept of "universal or natural law," which most societies would condemn as violations of "natural" duties to other persons.) This would be even truer of the following category of offenses.

f. The Deliberate Transmission of Contagious Diseases

Finally, the "culpability spectrum" would culminate in conduct that most people—and most legal systems--would consider of maximum reprehensibility: a *deliberate* effort to transmit communicable disease to others. Evidently, such an act would come under the general rubric of "bio-terror," whether it is done out of a malign individual motive, in service of some remorseless creed, or on behalf of a hostile nation (examples of these acts--so far--would include the anthrax letter-mailings of 2001, the Rajneeshee cult's reported spreading of salmonellosis in Oregon in 1984, and the Japanese Empire's use of plague bacilli during its war with China in the 1940s [*see, e.g., Amerithrax Investigative Summary*, B. Leonard (ed.) (Google eBook, 2011), 92 pp.; Christopher GW, "Biological warfare: A historical perspective," *JAMA*, *278*(5):412-17 (Aug. 6, 1997)]). In the eyes of most systems of law, acts of this kind would clearly be major felonies using pathogens as the weapons.

E. Summary Statement for Chapter I

The foregoing chapter raised a number of themes. One salient theme has been that the broad range of socio-legal controls over contagion are distinguishable along a number of fundamental Dimensions. While these Dimensions are complex, and drawing generalizations from them must be done with care, several points are worth raising (albeit subject to major exceptions):

A priori, it is important to state again that all socio-legal contagion-controls, including quarantines, need to be grounded on a strong and up-to-date *bio-scientific evidentiary base*—much more than was historically the case (and, in some modern jurisdictions, much more than is *still* the case). Scientific validity of control-procedures is evidently vital for achieving the public-protection goals of contagion-control (as shall be discussed further in the next chapter of this Dissertation). It is also important on grounds of social justice, since scientifically-indefensible procedures could not meet even the threshold criterion of "rational official action" under American law. (In reality, however, it is usually not a matter of "all-or-nothing," since the science of contagion-control validation generally does not meet a Platonic standard of "perfection," and critical plans and actions will necessarily have to be made on the basis of sub-optimal science and information.)

At the *legal* level, there is also a need to recognize and address, as best as reasonably possible, the inherent tensions between the fundamental interests that come to the fore in PH and contagion-control: On the one hand, there is an eternal tug-of-war between the basic interests of collectivities and those of individuals—while this conflict appears in many areas of life and law (such as conscriptions and penology), contagion-control has long been a fundamental arena. To the best extent possible, lawmakers and PH authorities should ground all contagion-control interventions on modern jurisprudential views of *individual and group rights*. There is also a need to recognize the inherent power-conflicts between *politico-legal jurisdictions* (including central governments versus provincial/state governments, and the international community versus individual nation-states)—which also appear in the field of contagion-control, among many other arenas of human affairs; it is vital to develop and apply contagion-control procedures in accordance with international law and with a vaster vision of global health and safety.

There is nothing easy about balancing any of these equities. A sensitive and informed understanding of the *socio-behavioral* aspects of contagion-control can certainly help: To the extent that there *are* some commonalities of interest between entities (for example, all humans and their jurisdictions have *some* interest in not contracting or spreading infectious diseases), these can be stressed in making policies and laws and in administering them. For example, some degree of contagion-control can be accomplished at the individual level by social-marketing techniques, which utilize an exhortatory approach to impeding the inter-personal transmission of pathogens (*e.g.,* schools and employers can urge children and workers to stay home if they feel ill, and they can urge them to cover their sneezes in public places). In the end, however, some degree of conflict between human interests will be inevitable; it is incumbent on policy-makers, lawmakers, and administrators to recognize this, and to develop and implement contagion-control procedures that soften the grinding confrontation between them. Reality again intrudes here: Many PH policies—and especially PH actions—will have to be set up and implemented under epidemic conditions of intense social stress, confusion, and urgency, … which leaves only the reasonable requirement that governments undertake as much integrated policy-making, lawmaking, and practice in advance of crises as possible. Some chaos will happen anyway; mitigation of it is the goal.

All of the fundamental "Dimensions" discussed in this chapter have an impact on the foregoing policy considerations. To some extent, of course, considerations of scientific validity, ethical-legal justice, and social impact are *always* present in contagion-controls, even if those controls only affect a few people mildly and briefly. On the other hand, the "Deeper" the contagion-controls are (*i.e.*, the more intensive or strict their restrictions); the "Broader" the controls are (*i.e.,* the larger the groups or jurisdictions they cover); and the longer the controls operate "Temporally" (*i.e.,* the lengthier their durations), the more socially adverse are the impacts of unconsidered and unplanned programs. "Purpose" and "Culpability" considerations are crucial here, too. As has been seen, extreme injustice can come from quarantining leprosy patients on a barren lava-flow for life to protect a broader society from them, when the sufferers are guilty of no offense but that of illness. While area quarantines might be less intensive for affected individuals, quarantining a whole district, city, or state because of an outbreak within its borders can also wreak obvious havoc on a vast scale. Circumstances of these kinds would clearly lower the threshold for tolerable inadequacies in controls.

CHAPTER II: "ON CONTAGION":

A WORKING TAXONOMY OF CONTAGIONS

A. Note on Nomenclature—Definitions of "Contagions" and Other Terms

For purposes of this Dissertation, the terms "contagious disease" (or "contagion"), "communicable disease," and "infectious disease" will be used in a roughly synonymous way, although it is recognized that some classificatory systems define them to mean different specific phenomena. For example, some schemes regard "contagion" as an old term that only referred to tactile contact between primary and secondary cases (*i.e.,* "*Type III*" diseases--*see below; also see, e.g.,* Booker 2007, at 510-11); that is not the usage here. (Because the context of history is important in this work, older terms such as "plagues," "pestilences," and "scourges" will also be used here periodically to describe such infectious diseases—especially when they were ones that could cause severe symptoms, and could have widespread prevalence).

One classical medical dictionary (*Dorland's Illustrated Medical Dictionary* [Philadelphia: W. B. Saunders, 1994--, 28th-- ed., at 838]) defined an "infectious disease" as one that was "caused by or capable of being communicated by infection," and it defined "infection" to mean an

> invasion and multiplication of microorganisms in body tissues, which may be clinically inapparent or result in local cellular injury due to competitive metabolism, toxins, intracellular replication, or antigen-antibody response. The infection may remain localized, subclinical, and temporary, if the body's defense mechanisms are effective. A local infection may persist and spread by extension to become an acute, subacute, or chronic clinical infection or disease state. A local infection may also become systemic when the microorganisms gain access to the lymphatic or vascular system

(*Id.*, at 837-38). Elsewhere, this source defined "communicable diseases" and "contagious diseases" as those that were "capable of being transmitted from one individual to another" (*Id.,* at 359, 372). These definitions are close to the broadly inclusive one that will be used here--though not necessarily identical with the instant usage. (For example, the concept of invasion by "microorganisms" *per se* may be a bit limiting for present purposes. Some important pathogenic organisms are macro-parasites—far larger in size than microbes. For example, the historically-destructive guinea worm of Africa could become highly visible during the adult phase of its life-cycle—some victims would actually pull these worms out of their own skins by hand, twirling them around sticks. While such parasitic diseases were not usually the subject of quarantines, some of them could at least theoretically be grounds for some kinds of socio-behavioral controls.)

Another definition of a "communicable" or "infectious" disease is also partly relevant here:

> [a]n illness due to a specific infectious agent *or its toxic products* that arises through transmission of that agent *or its products* from an infected person, *animal or inanimate source* to a susceptible host; either directly or indirectly through an intermediate plant or animal host, through a vector, *or through contact with the inanimate environment*

(*Control of Communicable Diseases Manual,* Heymann D L [ed.], 19th ed. [Washington, D.C.: Amer. Pub. Hlth. Assn., 2008], at 704; emphases supplied; hereinafter, "CCDM"). In this instance, though, the definition is somewhat too expansive for this Dissertation's purposes, since—as shall be shown below—the instant schema will only encompass *some* transmissible diseases that involve animal sources or intermediate hosts, and it will generally *not* include the toxic products of pathogens, plant hosts or sources, or inanimate sources such as soil (although there are exceptions to this generalization, including hookworm disease, which uses soil as a vehicle). As will be seen, these limitations reflect the emphasis in this Dissertation on quarantines and other socio-behavioral measures that are used to impede human-to-human transmission of pathogens.

B. Caveats

Before proceeding further, however, it is important to stress some qualifying caveats to the proposed model:

1. The Present Taxonomy Is Functional Rather than Biologically-Specific

First, the present model is an operational model rather than a scientific taxonomy. Rather than taking cognizance of all complex biological (and societal) aspects of each disease, it aims primarily to provide a simple tool to guide legislators and administrators in drafting disease-control-statutes, ordinances, and regulations (and to guide the implementation of those laws). Hopefully, it would enable such policy-makers to stick closer to general scientific thinking in place at the time they draft or revise laws, rather than relying on antique lines of thinking in medicine and law. (In too many jurisdictions, as was shown in the last Chapter, numerous laws that are still in force—even if rarely implemented—enshrine archaic understandings of contagion.)

2. Controversy Is Almost Ubiquitous in Science

It is crucial to emphasize that much of science is not "revealed Truth," dogmatically accepted by everyone (or, at least, it should not be). To the extent that it is practiced correctly--and does not fall into the hands of authority figures (who can institutionalize dogma by force of their political or social status), science is an arena. In it, there are often many rival theories and interpretations of phenomena. To the degree possible (allowing realistically for human and group frailties), ideas should be made to compete and seek validation according to generally-accepted principles, such as the Scientific Method. Another consideration might be Karl Popper's proposal that scientific theories be intrinsically testable and possibly disprovable.

Thus, the Algorithm to be presented here will allow for uncertainty and controversy in many of its premises. (Historically, for example, there was intense disagreement in biomedical circles about whether tuberculosis was a communicable or a hereditary disease. It was not till the last decades of the 19th century that the discovery of *Mycobacterium tuberculosis* resolved the issue for the majority of scientists.) It will be accepted that assumptions made about the nature of individual diseases are not immutable, but should be routinely revised as scientific understanding changes.

3. **The Only Certain Generalization Is the Generalization to Be Wary of Rigid Generalizations**

Next, this Model will also acknowledge the complexity of nature: It is recognized here that diseases are not uniform in all circumstances. The interplay of pathogens, individual human hosts, and their environments can vary greatly from encounter to encounter, depending on such variables as host genetics and immunity, pathogen viability, and extent of exposure. Thus, any generalizations made about contagions will almost invariably be rife with exceptions. (For example, to say that "the common cold" is generally a mild disease is to still acknowledge that, on occasion, it might be a severe illness with lasting or even deadly sequelae—especially in immunocompromised persons.) Still, in making policy, generalizations must be made (preferably on proper statistical grounds), while allowance should be made to the extent reasonable for individual situational variations. Similarly, Absolute Dichotomies are rarer than Continua in science. For ease of handling, however, this Model will favor the use of discrete categories rather than continua, although it is recognized that they may cause a certain loss of information.

4. <u>**Nature Is in Continual Flux—and Science Is as Well (or at Least It Should Be)**</u>

Similarly, a good functional system will acknowledge that nature and bioscience are not just complex, they are also in constant flux: Circumstances will inevitably change with time in both. –For example, even if a particular disease (such as gonorrhoea) is readily treatable at present with antibiotics, the causative pathogens might increasingly develop resistance to them with the passage of time—till, at some unspecific point, those drugs are *largely* unable to cure it (*see, e.g.,* Bolan, Sparling, & Wasserheit, 2012). Separately, it may be correct at one point in time to state that there is no effective vaccine for a disease (such as Ebola Haemorrhagic Fever)—but one may (hopefully) be developed at a later date. In practical policy-making, it will be accepted that laws must react to a current state of affairs, which will change. Since, realistically, legislators and administrators do not revisit laws on a continuing basis, they should be drafted so that they will remain at least *reasonably* scientifically valid for some period of time.

5. **Differences between Law and Science—Present, but Hopefully Not Irreconcilable**

It is worth pointing out here that science and law have fundamentally different perspectives, concepts, methods, languages, and pace: In general (though not invariably), science moves rapidly, while law moves slowly. Science nominally--if not always in practice—should rely on "objective" evaluation processes for theories about natural phenomena. By contrast, law --or at least the part of law that is made by judges--follows the principle of *stare decisis* (*i.e.,* it seeks to conform as much as possible to the force of precedential authority from higher and prior courts). Nevertheless, science and law must often meet in modern complex societies, often under conditions of import and urgency. Hence, the goal here is to find ways to surmount the intrinsic differences between these fields, and enable them to work *reasonably* well together. Good science needs to inform good law-making. For example, current demonstrated evidence on the hazards of a chemical, or of a product, should inform the development of standards for acceptable levels of that chemical in the workplace, and should inform standards of safety for that product in the marketplace. There will probably always be frictions between the disciplines of law and science, and between their practitioners, but the goal is to find some *modus vivendi* that can bridge them—at least for the purposes of making effective and just social policies and laws.

C. An Evidentiary Basis for Contagion-Controls

As was stressed above, one of the fundamental objectives of this Dissertation is to urge that a system of integrated contagion-control be grounded on a solid scientific evidentiary base, at least to the best extent that this can be reasonably and practically done.

This general mission statement would (as noted previously) apply to the whole broad spectrum of biomedical and public health responses to contagion. Obviously, this would include such technological controls as immunizations and pharmacotherapies, which it is now well-recognized must have strong validation—but it should *also* apply to the panoply of socio-behavioral “defenses” against contagion, which extend across the “Dimension” of “Depth” (or “Severity”) from social education/exhortation to strict and classic quarantines. Arguably, the more intense and intrusive the PH intervention, the more crucial is a solid scientific justification.

In keeping with the "Caveats" presented above, it is acknowledged again that nature and science are generally not static, so policy-makers, law-makers, and administrators can only hope to "freeze a moment" in natural and scientific time, basing their contagion-control system on conditions and understandings that exist at that point in time. It is hoped that they would build some flexibility into their policies, statutes, regulations, and practices to allow for some degree of evolution in nature and knowledge, and it is further hoped that they would also establish some proactive procedures for periodically revisiting the laws—and revising them as needed. (Of course, the cold realities of politics and law come into play here, too, and it must be recognized that the multiple distractions of the legislative process may not always favor such optimal laws and procedures.)

It would be worthwhile here to briefly consider some of the current evidentiary grounds for quarantines and other socio-behavioral controls over contagion. This is not meant to be a totally comprehensive recitation of all evidence on the subject, but a sketch of some of the present knowledge base that can ground updated laws and practices.

In general, it is fair to say that the extant evidentiary basis for quarantines and other socio-behavioral contagion-controls is spotty, with some of their foundations being stronger than others. Realistically, researchers are always recommending a need for more research, and there could never be a true limit on the knowledge that could optimally be added. Nevertheless, it would arguably be desirable to use the remaining time before the next pandemic to expand the knowledge base for contagion-controls.

D. A Brief Review of Existing Contagion-Control Evidence

The body of evidence validating contagion controls (or not) could be generally categorized in three basic ways—in terms of major historical formative epidemic diseases, in terms of the contagion-control measures themselves, or in terms of the analytic methods used for describing and evaluating those measures. In a summary way, this Dissertation will review all three categories.

1. Anecdotal Evidence

Much of the historic evidence on the effectiveness of quarantines and other controls has been anecdotal in character. This is not surprising, given the very ancient nature of communicable diseases and the human responses to them, which long preceded the Western scientific method of validation: Epidemics threatened human life and welfare--and quarantine-type measures were marshaled against them--for many centuries before biostatistics and clinical trials were developed as the "gold standards" for evaluating such contagion-controls. Ironically, by the time that the scientific method had fully "come of age" in the mid-20th century, the "Window Era" of freedom-from-epidemics (*see* Chapter I*, above*) had opened in the West, and quarantines were increasingly viewed as outdated and not worthy of research attention. Thus, one needs to clearly recognize the limitations of this anecdotal body of historic evidence.

Notwithstanding the above, it still seems appropriate to draw from the imperfect-wisdom of mankind's long battle with pathogens, since it can sometimes provide insights that could still be useful in practice (at least pending more scientific evaluations).

2. <u>Independent Variables</u>

In assessing the effectiveness of public health interventions during an epidemic, the set of socio-behavioral controls (a.k.a., "non-pharmaceutical interventions," or "NPIs") themselves would, of course, constitute the independent variables.

3. <u>Dependent Variables</u>

Several fundamental aspects of epidemic dynamics could be considered as dependent variables. *Inter alia*, these would include the timing of the peaks of incidence and mortality (in the case of pandemic flu, the latter might be “excess death rate” over the population’s normative death rate), the mortality rate or excess death rate at the peak, and the cumulative mortality rate or excess death rate for the entire epidemic.

4. <u>Historical Analyses, Epidemic Modeling, Observational and Clinical Studies</u>

In recent years, however, the attention of researchers, policy-makers, members of the press, and the public has increasingly returned to the threat of infectious diseases.

As was noted previously, a web of circumstances in the 1990s--natural and human behavioral--combined to promote this re-emerging threat (among many other intertwined environmental, host, and pathogen variables, these probably included climate change, human intrusions into new micro-settings, the burgeoning human population, and the movements of human and animal vectors). As a result, some historic diseases returned to areas and populations where they had long been absent or limited in incidence (in the New World, these included dengue fever, pertussis, and cholera). Some of the pathogens involved had also acquired resistance to antimicrobial agents (among these were *Mycobacterium tuberculosis* and methicillin-resistant *Staphylococcus aureus*). Meanwhile, some new or previously unrecognized pathogens appeared, in some cases causing highly lethal syndromes (among others, there were the Ebola and Marburg flaviviruses, hantavirus, and Nipah virus). To worsen widespread public and professional fears, some governments, groups, and individuals acquired the motivation and the means to use pathogens as instruments of terror (examples included the USSR/Russia's Biopreparat at least into the 1990s, Japan's Aum Shinrikyo in 1995, and the American anthrax-letter mailer in 2001).

Towards the end of the decade, there was another major prospective danger: In 1997, a highly pathogenic mutation of A ("HPAI") H5N1 influenza virus appeared in the poultry markets of Hong Kong, killing many birds and a number of people associated with the trade. As is now widely known, this avian strain of flu proved to have an extraordinarily high case-fatality rate in humans (ranging around 60% in some outbreaks—which can be contrasted with the estimated

2.5% case-fatality rate of the deadly 1918-19 pandemic). The 1997 Hong Kong outbreak was abated by an aggressive campaign of fowl slaughtering, but the virus reappeared widely in wild and domestic birds during the early 21st century, and in some 600 human cases that presented the same high lethality. While this strain of influenza virus has not yet developed the capacity to spread efficiently between people, it has raised alarm bells in the public health world, and it has stimulated a degree of proactive thinking and planning against a future pandemic.

Amidst this high degree of scientific and popular attention and alarm, two notable epidemic events occurred during the first decade of the new millennium that seemed at first to confirm the fears: the outbreak of SARS in China during 2002-03, and the emergence of A/H1N1influenza in Mexico during 2009. As things turned out, the SARS epidemic proved to be highly lethal--with an approximately 14% general case-fatality rate, but it was relatively limited in geographic scope (although this was arguably a close-run thing); and the H1N1 influenza outbreak rapidly morphed into a WHO-Stage 6 pandemic, but it did not provoke mortality rates in most population groups that much exceeded those of seasonal influenza. Nevertheless, both episodes further stimulated efforts in some quarters to prepare controls for the anticipated "Big One" to come (probably mutated or reassorted HPAI A/H5N1). While popular and press interest—always transient—appeared to oscillate somewhat, a number of scientists, governments, international agencies, and NGOs continued efforts to draft laws and plans for the future. There continues to be much fragmentation and great variability in these plans, however.

Thus, there has been a rising interest in evaluating various counter-measures to contagion, including some socio-behavioral interventions. There is now a relatively limited--but growing—body of scientific literature that has sought to validate these procedures. So far, this research has mainly taken two forms: retrospective analyses of historical epidemic controls (particularly backward looks at the Spanish Influenza pandemic of 1918-19) and mathematical modelling of possible future outbreaks and their controls (especially pandemic flu). In addition, there have been some observational studies conducted in "real time" (principally relating to the SARS and A/H1N1-2009 epidemics), though these have been limited in numbers and methodology.

Even today, some hard realities make it hard to subject a number of quarantine-type procedures to rigid scientific testing. *A* *priori,* ethical considerations would certainly restrict the range of properly-controlled studies of quarantines that could be performed. Funding limitations would exert other hard constraints on such research. It has long been a human reality that most attention is paid to threats when they are imminent—and, at that point in epidemic developments, conditions may become too chaotic and unclear to allow for clear-sighted research assessments that are best done in times of quiet.

a. Retrospective Analyses of Spanish Influenza Control Measures

Several researchers have delved into existing records from the Spanish Influenza pandemic to try to learn whether any interventions were effective in 1918-19 and could be effective again against a future pandemic. In part, they have utilized some natural experiments that appeared in various places across the afflicted globe during the plague year, allowing a rough sort of comparability between intervention-groups and non-intervention-groups. It should be noted, though, that the different cases often varied considerably in the available data and in the comparability of the examined groups.

Hatcher, Mecher, and Lipsitch (2007) reviewed the data from some 17 American cities that suffered major outbreaks of Spanish Influenza in late 1918. They concluded that the ones that aggressively and quickly imposed some non-pharmaceutical interventions (from a set of 19 possible "NPIs," *i.e.,* socio-behavioral contagion-controls) wound up with peak death rates that were about 50% lower than the cities that did not act in this way. Also, the early-intervening cities experienced less-steep epidemic curves than the latter, and they had lower cumulative excess mortality than the latter. While early application of the NPIs that closed theaters, schools, and churches were correlated with reductions in peak death rates, no single NPI was associated with major reductions in epidemic impacts. Moreover, once the cities lifted their NPIs (generally within just two to eight weeks), they frequently experienced new epidemic waves of influenza.

Separately, Markel and his associates examined mortality data for 43 American cities (as published in the U.S. Census Bureau's *Weekly Health Index* during the 1918-19 period), and they reached some broadly similar conclusions. These researchers found that there was considerable variation between the cities in the anti-flu interventions that they used, in the way that the cities implemented those measures, and in the influenza-related outcomes that they suffered. All of the 43 municipalities imposed one or more NPIs--*viz.,* school closures, bans on social gatherings, and quarantine/isolation measures, with 33 of them ordering the first two of these types of interventions and 15 of them employing all of these intervention measures, for a median period of four weeks. While most of the city governments responded to the epidemic threat reactively rather than proactively, those that started their socio-behavioral controls at earlier phases of their outbreaks had later and lower epidemic mortality peaks and lower total numbers of deaths; also, those that intervened longer had fewer overall deaths. Moreover, some NPIs seemed to be associated with better outcomes than others, and cities that employed combined (or "layered") strategies appeared to fare the best (*e.g.,* Markel H, Stern AM, & Cetron MS, "Thomas E. Woodward Award: Non-pharmaceutical interventions employed by major American cities during the 1918-19 influenza pandemic," *Trans. Am. Climatol. Assoc., 119:*129-142 [2008]; Markel *et al.*, "Nonpharmaceutical interventions implemented by US cities during the 1918-1919 influenza pandemic," *JAMA*, *298*(6): 644-654 [8/8/07]).

b. A Tale of Two Cities in the Time of Flu: Philadelphia and St. Louis

The contrast in contagion-control actions and their possible impacts appeared most starkly when two particular cities were compared: The municipal governments of Philadelphia and St. Louis reacted very differently to the looming danger of Spanish Influenza, and the cities suffered relatively different impacts from the disease. (Of course, such *associations* between actions and outcomes do not necessarily imply a *causative* effect. Moreover, this tale of two cities was not a scientifically-controlled situation, and there were many potential confounding variables.) (*see, e.g.,* Markel *et al.*, 2007; Smith R, "Social measures may control pandemic flu," *Brit. Med. J., 334*[7608]:1341 [6/30/07]; Hatcher, Mecher, and Lipsitch (2007); Kalnins I, "The Spanish Influenza of 1918 in St. Louis, Missouri," *Public Health Nursing*, *23*(5): 479-483 [Sep./Oct. 2006], onlinelibrary.wiley.com.ezproxy.lib.usf.edu/doi, at 1-9, accessed 11/17/11).

As is typical of influenza pandemics, Spanish flu first broke out in scattered parts of the country during a relatively limited springtime prodromal wave. This abated without causing widespread mortality.

However, the next wave of the new pandemic would be different. Not surprisingly, perhaps, it first became highly manifest in military bases along the eastern seaboard, where sailors and soldiers were preparing to sail to the battlefronts, or disembarking after service there. A military doctor at Fort Devens, Massachusetts described the new disease's impact in phenomenological terms:

> This epidemic started about four weeks ago, and has developed so rapidly that the camp is demoralized and all ordinary work is held up till it has passed…. These men start with what appears to be an ordinary case of La Grippe or Influenza, and when brought to the Hosp. they very rapidly develop the most viscous [?] type of Pneumonia that has ever been seen. Two hours after admission they have the Mahogany spots over the cheek bones, and a few hours later you can begin to see the Cyanosis extending from their ears and spreading all over the face, until it is hard to distinguish the coloured men from the white. It is only a matter of a few hours then until death comes, and it is simply a struggle for air until they suffocate. It is horrible. One can stand it to see one, two or twenty men die, but to see these poor devils dropping like flies sort of gets on your nerves. We have been averaging about 100 deaths per day, and still keeping it up. There is no doubt in my mind that there is a new mixed infection here, but what I don't know…. We have lost an outrageous number of Nurses and Drs.… It takes special trains to carry away the dead. For several days there were no coffins and the bodies piled up something fierce, we used to go down to the morgue (which is just back of my ward) and look at the boys laid out in long rows. It beats any sight they ever had in France after a battle. An extra long barracks has been vacated for the use of the Morgue, and it would make any man sit up and take notice to walk down the long lines of dead soldiers all dressed and laid out in double rows…

(www.1918.pandemicflu.gov, accessed 6/2/11).

In mid-September, the initial reported cases of the deadly second wave of Spanish flu appeared in Philadelphia. A well-prepared city administration would have considered such index cases to be klaxons in the night, calling for prompt interventions, but Philadelphia's city fathers seem to have missed this opportunity. (They were hardly alone in this respect.) Instead of closing down public places and forbidding collective activities, the city held a patriotic parade on September 28. During the intervening period, influenza virus had the opportunity to double its spread almost three to five times. In any event, the pestilence had become barely controllable by the time the city's health authorities did shut down the schools and proscribed collective gatherings on October 3. Eventually, the second wave of flu and probably-associated pneumonias claimed, at its peak, the lives of some 257 out of every 100,000 Philadelphians (beyond expected levels), with a cumulative excess rate of pneumonia and influenza deaths of 719 per 100,000 by December 28 (Hatchett , Mecher, & Lipsitch, 2007, at 7582)

Philadelphia's response to Spanish flu can be contrasted with that of St. Louis's health administration: At least by his own account, Health Commissioner Max C. Starkloff took a number of vigorous steps to mitigate the impact of flu in the old Mississippi River port (*Annual*

Report of the Division of Health of the Department of Public Welfare, City of St. Louis for the Fiscal Year 1918-1919, cited by Kalnins 2007, at 3-7). These included mandating the reporting of Spanish flu by early September (using schoolteachers and others as volunteer data-tabulators), and incepting an Influenza Advisory Committee comprised of major civic and private stakeholders on October 7. This Committee affirmed Starkloff's authority to shut down schools, entertainment places, and even churches, and he promptly did so (although he initially allowed other businesses to continue their operations); he also limited crowding on elevators and trams. The St. Louis Health Division also imposed strict quarantine/isolations on individuals, generally *in situ*--with the placarding of afflicted homes as in other disease epidemics. City policemen were charged with enforcing these social-distancing and quarantining directives. In addition, Starkloff used less severe methods of contagion-containment, including public education, free vaccination (these early vaccines were actually medically ineffective), and intensive public health nursing (nurses conducted some 14,359 visits between October 21 and December 15 [Kalnins 2007, *citing* Starkloff 1919]). As a possible consequence of this coterie of active interventions, St. Louis wound up with a peak weekly excess pneumonia/influenza death rate of 31 per 100,000 and a cumulative excess pneumonia/influenza death rate of 347 per 100,000 (statistically lower than Philadelphia's rates, cited above).

It should be noted, however, that St. Louis's epidemic was a complex episode, with a second peak in mortality appearing in late November. This course of events could be interpreted in various alternative ways. One iconoclastic possibility is that the epidemic's dates of onset and full expression in St. Louis were simply delayed by the city's location, rather than reflecting its civic government's interventions in any way. According to this argument, St. Louis had a geographic advantage over Philadelphia (and some other badly-stricken cities of the east, such as Boston): Located deep in the American Midwest, St. Louis enjoyed a simple time lag before the second wave of the new plague arrived in its city limits (*see, e.g.,* Hatchett, Mecher, & Lipsitch 2007, at 7583, who found a correlation between cities' longitudes and their peak excess mortality rates). The first recorded St. Louis victims of Spanish flu did become symptomatic some time between September 20 and October 6—three days after Philadelphia belatedly implemented its own social-distancing measures (and after the Philadelphia epidemic was already almost beyond containment). There might be a degree of validity to this supposition—but the contribution of this epidemiological "grace period" should not be over-emphasized. It would seem unlikely that even in 1918 western American cities would be very long protected from the active rail and early motorized commerce of the day bringing travelers from the infected seaport cities of the east (this rapid interconnection between cities would be particularly true nowadays, when travel between American regions is much faster, and no war effort would demand priority of transport over civilian needs).

In any event, the main difference between the cities in the east with higher peak death rates, and the ones in the west with lower ones, appears to have been the ability of some western civic authorities (including St. Louis's) to actively monitor events in the east, learn from the calamities that were developing there, and take some proactive measures (*see, e.g.,* Hatchett, Mecher, & Lipsitch 2007).

Another interpretation of the St. Louis story might be that its governmental interventions *did* work—but they were not maintained with enough vigor. In reality, St. Louis's campaign against Spanish flu was not smooth and trouble-free (as such efforts rarely are). Among other things, the history of this city's intervention program may have illustrated the principle (discussed above) that contagion-controls cannot be safely ceased too soon: As often happens, social, political, and legal pressures began to mount, and the city government relented, allowing spontaneous mass gatherings to celebrate the Armistice on November 11, and reopening the public schools two days later. However, influenza virus was not yet vanquished like the Central Powers—it roared back among the city's remaining susceptibles two weeks later, creating a second peak in deaths, and forcing a hasty reclosure of the schools and a renewed ban on gatherings (Kalnins 2007).

The latter interpretation of St. Louis's epidemic seems likelier—the city's interventions *were* somewhat effective, but too brief. In keeping with some recent epidemic models, it appears that the city's active campaign against flu—which was discontinued too soon--helped create a bimodal epidemic, with a consequential pushing of the epidemic's peak to a later phase. There were still enough susceptible people in the river city who could be made ill by the virus after its worst depredations had abated elsewhere in the country.

c. The Impacts of Delaying the Onset and Peaks of Epidemics

In any event, it is possible that the *length of a delay* in an epidemic's first appearance and in its peak *could* have some important impacts due to pathogen and host variables.

At a pathobiological level, a short delay in the epidemic's onset might not have a major effect on its morbidity and mortality levels. However, this can vary with the nature of the pathogen. Influenza-A virus is highly mutable, and its various strains are prone to reassortment with other strains, so it is possible that it could evolve during a relatively brief period of time. It has been seen that a delay of about a year may have saved the populace of American Samoa from mass death due to Spanish Influenza: the islands' protective quarantine-against-the-world delayed the virus's arrival on their shores until 1920 when it had become highly attenuated and host-adapted. Of course, influenza-A virus's plastic capacity to evolve could cut both ways—over time, it could also become *more* transmissible and/or harmful rather than less so.

On the other hand, a number of flu-modelers have opined that—for reasons of human *bio-medical and social* response--NPIs *could* be vary valuable if they managed to delay an epidemic's arrival and peak in the world or in a community, even for a short time.

In part, this value has to do with mankind's biomedical gain from such a delay. This benefit would not have been so great in 1918-19, when biomedicine had only a faint understanding of influenza and no clear technological pathways for developing effective techniques to prevent and/or treat it. Thus, any time brought by a delay could not have gained mankind much technological advantage over the virus. Nowadays, by contrast, the time brought by NPIs could be invaluable to allow research science to identify the pathogen and to develop vaccines and/or drugs against it. The 2003 story of SARS clearly illustrated how fast modern science can sometimes work for identifying and isolating a pathogen—in that case, international research efforts elucidated the causative SARS-coronavirus within a mere matter of weeks. Of course, the international SARS outbreak ultimately abated without necessitating any high-tech responses, so no one made any major efforts to develop preventative agents or medications against this particular disease. On the other hand, present-day influenza vaccine science *would* clearly benefit from any time-delay in the spread of a new flu virus strain, since this would provide a crucial period of time to engineer a strain-specific vaccine, manufacture it, and distribute it widely.

Even in 1918, however, if NPIs had secured a delay or a protraction of an epidemic's peak morbidity and mortality, they could have rendered a valuable service in some localities. This relates to the *surge capacity* of social responses: Even with good planning (which was rarely practiced in 1918), emergencies will invariably produce a certain amount of chaos. A community can become quickly overwhelmed by a sudden mass increase in cases of severe disease. Such an event can disrupt the society in multiple ways, including impairing its capacity to treat the mass of new patients at once. Thus, effective NPIs at the onset of an outbreak could buy a country or a community valuable time to make social and medical responses that are more rational, efficient, and tailored to the situation.

It will be recalled (*above,* Chapter I) that Tang *et al.* (2010) similarly claimed that—during the 2009 A/H1N1 pandemic—the Mainland Chinese authorities ran the rather draconian *Fengxiao* university-wide quarantine "too mildly" by starting it late and not maintaining it long enough, which these researchers alleged allowed a bimodal epidemic to develop in the non-quarantined community outside the campuses.

E. A Model of Contagions (For Control Purposes)

Before any outbreaks of communicable disease, it is vital for policy-makers to have a prepared plan. Among its early components when a contagion emerges (especially if it appears to be new in character), will be to develop a standardized case-definition. Such a definition will collect all the known variables—including the apparent common *symptoms* (subjective reports of discomfort and illness behaviors) and *signs* (more objective overt indicators, such as skin lesions in measles, or laboratory test findings--if available, such as polymerase chain reaction testing in chlamydial infections [*e.g.,* CCDM 2008, at 117]).

Perhaps consideration of the following "**Dimensions**" will help:

Under this schema, the normative character of contagions in nature will first be assessed to determine if they meet certain enumerated criteria for the appropriate use of quarantine-type control measures ("**Quarantine-Deciding Dimensions"**). These factors would be:

(1) Degree of Clinical Severity (in the majority of cases)

(2) Modes of Transmission (usual);

(3) Intensivity of Contagiosity--and Other Characteristics in Epidemic Circumstances (normative);

(4) Duration of Infectiousness and Clinical Manifestation (in the majority of cases).

In addition, each contagion would be assessed in light of present bio-medical circumstances to determine whether these PH conditions would underscore a need for quarantining to control the disease. In other words, quarantines could always be used in the case of such contagions (legal and socio-cultural conditions permitting), at least as part of a multi-pronged control strategy—but some circumstances would make quarantines particularly crucial in helping to bring outbreaks under control ("**Quarantine-Supporting Factors**"). These factors would include the following six Dimensions:

(5) Virulence Factors—Pathogen Survival in the External and Internal Environments (in usual circumstances);

(6) Host Susceptibility Variables—notably, whether any Human Groups Are Exceptionally Susceptible to the Disease (and whether those susceptibilities—or even merely *perceived* susceptibilities--have socially stigmatizing impacts).

Biomedical Variables, including notably the following four Dimensions, which relate to the existing state of disease-control technology:

(7) Whether or Not the Causative Agent Has Been Identified (and with what degree of scientific assurance);

(8) Whether or Not There Is Currently an Effective Diagnostic Method or Methods (and how reliable and valid they may be);

(9) Whether or Not There Is Currently an Effective Prophylactic Method or Methods (and their degree of effectiveness);

(10) Whether or Not There Is Currently an Effective Treatment Method or Methods (and their degree of effectiveness);

Related to the above are questions of whether or not there are any animal reservoirs for the causative pathogen--and their known importance in human disease spread, and, particularly importantly, whether or not there has been an identified human asymptomatic carrier state--and its known importance in human disease spread.

(These factors will be considered in connection with the various above Dimensions.)

No doubt, other variables could be added to this model, but these will form its operational basis. (While some of the concepts to be presented in this model have some commonalities with categorizations of disease in standard use, this model will present taxonomies that differ from standard usages in their specifics, combinations, and applications.)

1. **"Severity" Dimension of Contagions**

First, communicable diseases can be generally distinguished along a Dimension of potential "*Severity*." This is a crucial threshold issue in deciding whether or not to impose quarantines, and—if so—what kinds: There would be little justification for imposing restrictive controls over behavior in order to curb diseases that do not generally have severe effects.

It should be stressed, however, that the terms "Severity of Contagions" need to be defined more specifically for operational purposes, since they could reflect many aspects of a disease. (In jurisprudence, the law favors specificity over vagueness, since it tends to give citizens clearer expectations of what official control behaviors to expect; judges will sometimes overturn laws as constitutionally "void for vagueness." Of course, there is a tension here, since leaving flexibility of options is in itself desirable in the area where science interfaces with law, allowing officials fighting epidemics some leeway to respond appropriately to events. Ultimately, legislative drafters will need to work within this perennial tension between desirables, and provide as much specificity of principles as is reasonable, while allowing for a measure of operational flexibility.)

a. Severity as Case-Fatality Rate

Simplicity might justify defining a disease's "Severity" by focusing mainly on its overall mortality rate in a population, or on its *case-fatality rate* among those stricken by the disease (*i.e.,* of all the individuals who demonstrably contract the illness within a specified period of time, how many will die from it within that period of time). For the most part, this criterion is readily quantifiable, and it is certainly an important aspect of a disease: From the perspective of a patient and his/her significant others, this variable will surely be of more than academic interest. If the first symptoms of this disease appear, what are his/her prospects of emerging alive from the ensuing bout of sickness?

There can be great variability in this spectrum of possible lethalities: For example, the case-fatality rate for simple viral rhinitis or coryza (*i.e.,* the so-called "common cold") is barely above [0%] for the general set of immunologically intact persons in most countries. Several other contagions are at the other end of this spectrum, however: The case-fatality rate for Ebola-Zaire Haemorrhagic Fever has risen to about 83% in some outbreaks. Untreated pneumonic or septicemic plague has a virtually 100% case-fatality rate. Under the current state of medicine, too, the first symptoms of unprevented clinical rabies guarantee death as much as any disease in nature. (In all of recorded medical history, the human survivors of this particular malady can be counted on the fingers of one or two hands.)

b. Severity as Morbidity Variables

Beyond mortality itself, of course, there can be numerous "Severity" variables that relate to the general *morbidity* of the disease in a population: For example, a disease of relatively low lethality could still cause high levels of disability in the set of symptomatic persons, with major consequences for the sick individuals and for their society. (For example, leprosy [*see* Chapter I] is not in general a rapidly deadly disease--but the amount of impairment that it has caused over the centuries is incalculable. Similarly, acute symptomatic poliomyelitis kills only about 5% of children who develop it, but it, too, can leave large numbers of lifelong impairments in its wake.) In general, the disabling features of a disease's "Severity" would also be reasonably quantifiable.

It might even be arguable that the term "*Severity*" should also take into account the sheer physical discomfort that a disease usually causes—irrespective of its lethality or its capacity to permanently impair. (For example, a bout of uncomplicated dengue fever rarely kills or leaves permanent physical damage, although it can make sufferers vulnerable to deadly complications if they encounter another strain of the causative virus. Most of all, though, dengue fever is just a thoroughly miserable disease for most people who contact it; it is called "*breakbone fever*" in the vernacular because of the arthralgias and myalgias it causes, and many convalescents curse the agonizing retro-orbital headaches that it gave them.) However, it would be hard to develop a quantifiable "misery" quotient for most diseases.

c. The Subjectivity, Subtlety, and Variability of Symptoms

Another problem in identifying the "Severity" of diseases involves the wide possible *variety of impacts* that they can have on different victims: A disease that is very harmful to one victim might go virtually unnoticed by another. (For instance, TB, yellow fever, meningitis, polio, and typhoid can be deadly or extremely impairing to some patients—but there are many asymptomatic cases for every overt one.)

A further qualification to note is that symptoms themselves can be subjective and subtle, as well as variable across hosts. Pathogens can affect a victim's bodily functioning to various degrees. There can be pathological disruption and even permanent damage at sub-clinical levels that individuals do not detect. Moreover, people will vary greatly in how aware they are of dysfunction in themselves or others—there can be a wide psychological spectrum from stoic and unaware to hypersensitive. For instance, "malaise" is often described as an early symptom of systemic illness—but the subjectivity and imprecision of such a sensation can be readily recognized. Alternatively, it can be asked whether a solitary sneeze represents an ordinary, non-pathological response to a transient irritant in the air—or the first manifestation of an infectious disease. Even "signs"—which are nominally more objective than "symptoms"—can be subtle and run a continuous gamut rather than being "either/or" dichotomous. (For example, a core body temperature of 99 degrees F. can be regarded as within the normal range, or as a low-grade fever, depending on the tested individual—and on the clinician who observes it.)

The foregoing Severity-variability problem might be addressed in different ways: One approach might be to have public health policy focus on the *worst potential impact* of a disease; out of an abundance of caution, it would stress vigorous policy prevention of a disease that *could* have a very harmful impact. However, this approach might not be reasonable from a socio-economic risk-benefit perspective: Arguably, given the variability of pathogens, human hosts, and their interactions, almost every disease can probably cause severe harm to *someone.* Strict quarantine-type measures would certainly have social and economic costs that might outweigh their benefits, so it may not be prudent to throw too wide a quarantine net to avoid occasional highly severe impacts. Perhaps, then, it would be preferable to assess the "*Severity"* of a contagion by referring to a rough normal curve of its impact on a population. Alternatively, legal policy-makers might rely on a scientific advisory committee to provide them with an opinion on the overall scientific community's consensus view of a disease's severity.

d. Severity Put on a Discrete Spectrum

Finally, it is recognized that, in addition to the above issues, "*Severity*" is probably a *continuum* rather than a *discrete* variable. For ease of management, however, it might be appropriate here to impose a somewhat arbitrary discrete schema on this variable, which would distinguish three levels of "*Severity*": "*Non-Severe*" (*e.g.,* the "common cold"); "*Moderately Severe*" (*e.g.,* Hepatitis A infection, measles); and "*Highly Severe*" (*e.g.,* the *Yersinia pestis* plague).

2. "Modes of Contagion Transmission" Dimension

Strictly for present purposes, it is next proposed that communicable diseases be characterized by their usual modes of transmission from one human host to another (the "*Contagion-Transmission*" Dimension).

In a very rough sense, this model is hierarchic, with the modes of transmission at the start of this scale being most efficient for pathogens, and the degree of efficiency decreasing downward on this scale (*i.e.,* inversely with the transmission typology).

It is fully recognized that many pathogens can propagate themselves in the human environment by a wide range of modalities, including some relatively uncommon ones. The critical modality for any one disease would be its most efficient common mode. Pathogens will have also greater efficiency when they can use multiple modalities to spread between hosts (and a number of the contagions at the top of this scale tend to have this capacity). The efficiency of pathogen propagation is clearly important for public health purposes, and will affect the selection of contagion controls.

(This discussion was informed in part by the *Control of Communicable Diseases Manual,* Heymann D L (ed.), 19th ed., [Washington, DC: Amer. Pub. Hlth. Assn., 2008], [hereinafter, "CCDM"], although it diverges from that manual on a number of points. Generally, the instant Model has some individual features that appear to be in common use, but it differs from the set of traditional usages in a variety of ways, including its applications.)

a. *"Type I-A"* Contagions: Respiratory Airborne Transmission— Small Droplet Aerosols

In the "*Type I-A*" modality, agents of disease transit from the respiratory tract of one host to that of another via aerosolized particles in the air. This is probably the most efficient means of spread in nature: The relatively small particles (one- to five-micrometers in size) that carry the pathogens can persist in an airspace for hours, and they can move through a relatively wide area—such as numerous rows of seats aboard an airplane. Moreover, contamination of fomites and surfaces—such as elevator knobs--can remain viable for days; this allows continued infection of new hosts even when the index case has left the area. Pathogens that have evolved this capability can move very quickly through host populations.

(A classic user of this mode of transmission is the measles virus. Its infectiousness is proverbial, with a reported attack rate of some 90% of secondary cases.)

b. "*Type I-B*" Contagions: Respiratory Airborne Transmission—Large Droplets

In "*Type I-B*" contagions, pathogens move from host to host via larger droplets (usually, they use the cough or sneeze of a symptomatic person). This means of spread is almost—but not quite—as efficient as the foregoing one: While this modality also allows the microbes to use air as a medium for transmission, the larger sizes of the drops does not allow them to travel as far within a particular spatial area, or to linger as long in the ambient air. Contamination of surfaces also lasts for a briefer time period.

The SARS coronavirus is one agent that uses the "*Type I-B*" pathway. Surprisingly, epidemiologists associated with the Campaign to Eradicate Smallpox in the 1960s and 1970s also found that the violent variola virus was a heavy-droplet-borne pathogen, requiring more intense close contact between hosts to spread than was previously thought. Separately, influenza virus certainly uses heavy droplets to move from host to host, although there is also a possibility that it can spread via small-droplet aerosols--*i.e.,* that it can cause a "*Type I-A*" contagion, as well as by manual/fomite transmission; this is still an empirical question.

There is a well-known story in public health that, in 1979, an airplane sat on a tarmac in Homer, Alaska for four hours with a defective air-circulation system, and one passenger with active influenza transmitted the disease to 72% of the other 53 passengers on the plane. (*See, e.g.,* Goldmann, DA, "Pediatric viral respiratory infections: Influenza," *Emerg. Infect. Dis., 7*(2): 2 (2001), www.medscape.com/view_article/414339_3, accessed 2/8/12, *citing* Moser MR, *et al.,* "An outbreak of influenza aboard a commercial airliner," *Am. J. Epidemiol.*, 110:1-6 (1979).) The circumstances of this case might have been somewhat exceptional, but it suggested the potential airborne nuclei droplet transmissibility of some strains of influenza under certain host and environmental conditions.

c. "*Type II*" Contagions: Foecal-Oral or Urinary Transmission

Pathogens using the "*Type II*" means of spread pass from the gastro-intestinal tract of an infected individual to secondary hosts via the foecal-oral pathway (or via the urinary tract-oral pathway): Basically, the first host expels contaminated foeces or urine, and the second host ingests them. This can happen in various ways: Foodstuffs, water, or other objects can be the physical media for transmission. For example, an infected cook can retain diarrhoeal fluids on her hands, and then apply them to meals that she prepares. Alternatively, an infected child in a daycare center might contaminate surfaces that a classmate will pick up and unwittingly swallow. Another classical means would be waterborne spread---for example, a plume of excreta travels from a leaking cesspool to a shallow well, infecting the persons who drink from that well. Sometimes, community swimming pools will be the environment of spread, when a child incubating enteric pathogens in his gut transmits them into the water, and another youngster swims in that medium with his mouth open.

(Archetypal "*Type II*" contagions would be typhoid, caused by the bacterium *Salmonella typhi*; cholera, caused by *Vibrio cholerae* bacteria; amoebic dysentery, caused by *Entamoeba histolytica;* and poliomyelitis—caused by the poliovirus.)

(1) Exclusion of "Food Intoxications" from the Schema

It should be noted that "food intoxications," in which individuals are harmed by the toxins generated by pathogens that are present or multiply in foodstuffs--but wherein humans do not transmit the pathogens themselves to one another--would not be covered by this schema. (These would include cases of botulism or *Bacillus cereus* "food poisoning," among many others.) While these diseases are certainly serious PH problems that call for legal controls in many cases, quarantines and other forms of social distancing would not be among the appropriate methods. (Of course, the use of food poisons in bio-warfare or bio-terror brings up a host of separate legal issues….)

d. "*Type III*" Contagions: Tactile Dermic Transmission

In "*Type III*" transmission, pathogens in a primary host's open skin sore or ulcer would be directly contracted by a second host through touch. Fluids from the lesion itself would carry the organisms. In addition, fomites such as contaminated towels might act as intermediate vehicles of spread. Usually (though not invariably), the pathogens' portal of entry into the secondary host would occur through breaks in the skin, since an intact integumentary system is ordinarily a good host-protective barrier against entry.)

(The bacterial disease impetigo neonatorum would be one "*Type III"* contagion; athlete's foot or *Tinea pedis*--caused by dermatophytic fungi such as *Trichophyton rubrum*—would be another; and the viral disorder molluscum contagiosum would be a third. *See, e.g.,* CCDM 2008, at 176-78, 426-27; *Handbook of Infectious Diseases* 2000, at 141-42.)

As in almost all natural phenomena, there is complexity here: some parasites such as hookworms (notably, *Necator americanus* and *Ancylostoma duodenalis*) are defecated in ovum form from the human anus, but they do not enter the next host through the mouth--in larval form, they burrow through the skin of his toes when he walks on that excreta. (Before outhouses were widely used in the U.S. South, hookworm infection used to be familiarly called "ground itch," or "the disease of the barefoot boy.") In a more complex pattern of transmission, the eggs of parasites that cause schistosomiasis (*a.k.a.* "bilharziasis") emerge in urine from the bladders of infected humans, and in foeces from other reservoir animal species, and they contaminate pools of water. There, they are consumed by certain species of snails; the snails then emit a larval stage of the parasite into that water, and those parasites enter a new human victim intra-dermally when he swims in it. Under the present schema, however, a pathogen's portal of exit from the primary human host is more important than its portal of entry into the secondary host. This is because legal interventions to compel actions that would decrease disease transmission—which is the primary concern in this model--would focus on the infected human carrier (in the instant situation, the excreting person). While public health would also try to protect the susceptible recipient of infection (in this case, the barefoot boy), it would most likely use educational and exhortatory means to accomplish this protective goal (*e.g.,* social marketing urging children to wear shoes or sandals in hookworm-endemic areas). Thus, the present model would operationally identify hookworm disease as a "*Type II*" (foecal-transmission) contagion.

e. “*Type IV*” Contagions: Blood-Borne or Tissue-Borne Transmission

“Type IV Contagions” are humorally transmitted infections; blood is a particularly important modality for transmission. A variegated set of pathogens exploit humans’ biomedical technologies--or their addictions—to move from victim to victim: They are present in human blood, which has historically enabled them to benefit from blood-banking before technological means are found to detect and eliminate them. For similar mechanical reasons, “*Type IV”* pathogens have been able to use contaminated needles from medical blood transfusions—and from intravenous drug addicts—to move from bloodstream to bloodstream.

(As is widely known, the classic exemplars of “*Type IV*” contagions include hepatitis B and C viruses and the human immunodeficiency virus that causes AIDS. Less widely-known, perhaps, are the cases of malaria that have also been transmitted by contaminated serological products—the plasmodium parasite that causes this disease emerges into the human bloodstream during the merozoite and other stages of its life-cycle, so malaria can occasionally operate as a "*Type IV*" [humoral] contagion, as well as spreading through its more common modes [*q.v.*].)

Although they are less common vehicles than blood, certain other biological fluids can also transmit pathogens. These include pericardial, pleural, and synovial fluids, for example.

A special variation of this "*Type IV*" modality has arisen in response to technical advances in biomedicine during recent decades: the process of tissue transplantation has sometimes transmitted pathogens as well as life-saving organs. (One curious example has been Creutzfeldt-Jacob Disease, which causes lethal spongiform damage to the brain; in several instances, its probable agent—the infectious protein called a "prion"—was passed from person to person via corneal transplants, or through the stereotaxic needles that hold the head immobile during neurosurgery. *See, e.g.,* CCDM 2008, at 219.)

f. "*Type V*" Contagions: Venereal Transmission

Classed together as "*Type V"* contagions are the many otherwise-heterogeneous diseases that spread by venereal means. They are worth considering together as much because of the social impact of their transmission method as because of any pathobiological similarities.

The sexual mechanism of transmission here can sometimes overlap "*Type III*" tactile transmission. For example, the strains of human papillomaviruses that can cause venereal warts—and, ultimately, cervical cancer in some women—can spread through skin-to-skin contact, although the more usual mode of spread is sexual in nature. (Hence, a claim of simple tactile contact is probably not a valid excuse for having contracted VDs in most cases.)

(Pathogens exploiting this particular set of human behaviors can be as varied as the spirochaetal treponeme of syphilis, the herpes simplex Type II virus, the AIDS virus, the trichomonas parasite, and the Chlamydia that are bacteria-like obligate intracellular parasites.)

Being this far down the "hierarchy" of efficient transmissibility, "*Type V*" VDs spread far more slowly than diseases that use "higher-efficiency" modalities, so they should be theoretically more manageable for public health. (Sexual interaction requires conscious and purposive actions by at least one participant; this contrasts with the almost reflexive actions of sneezing and coughing in "*Type I*" contagions.) On the other hand, the socio-behavioral complexities of human sexual activities and attitudes have long made the STDs particularly difficult for public health law. As was noted in the last chapter of this Dissertation, many American states and cities address STD-controls--with their social complexities--in separate sections of their health codes.

g. "*Type VI*" Contagions—Arthropod Vector Transmission

"*Type VI*" contagions are vector-borne: A major class of pathogenic organisms go through complex life-cycles that involve arthropods--with insects usually acting as flying syringes to spread them, and other arthropods (such as ticks) acting as jumping and biting intermediate transmitters. Although this would seem to be an inefficient and even chancy means of propagating a parasite species, it can clearly confer some advantages to them as well: The millions of cases of malaria across the globe, and the tremendous difficulty in fully eradicating the various species of plasmodia and their anopheline mosquito vectors, testify to this reality.

The widespread historic impact of epidemic typhus fever on mankind is another illustration of the sometime power of this modality:

The bacteria-like agent of typhus (*Rickettsia prowazekii*) requires the services of the human body louse (*Pediculus humanus corporis*) to spread from host to host—but collective human behavior over the centuries has abetted this method, often through social inequities: For example, *R. prowazekii* was a major beneficiary of unwashed slum-dwellers, jailhouse inmates, and armies of soldiers forced to stay in close contact under conditions of "lousy" sanitation. (There is an old account—perhaps apocryphal—of a group of closely-shackled, odoriferous prisoners being brought into an 18th century courtroom, suffering from what was then called "jailhouse fever." Whereupon, the storyteller claimed, their "miasma" conveyed the disease to almost all the high judicial officials in the room—including the judge--and all the court officers and jurists soon died. More modern interpretations of the situation have proposed, however, that the confinees had louse-borne typhus, which they transmitted to the court personnel—although one would have to assume here that there was rather close physical contact between captives and captors. Of course, even the sanitary practices of heavily peruked officials in those days left much to be desired.... More certain were the high rates of typhus among the trench-trapped armies of the First World War, and the famous 1944 outbreak of typhus in war-ruined and starving Naples, which was then under Allied control.)

A biological distinction is often made between those vectors that serve as crucial components of pathogen life-cycles—in which the microbes must go through various stages of their development and multiply (*e.g.,* mosquitoes carrying malaria)--and those vectors that only mechanically transport pathogens from host to host on their feet or probosces (*e.g.,* flies carrying the bacteria that cause typhoid, or carrying the chlamydia that cause the blinding eye disease trachoma).

Other well-known "*Type VI"* contagions would include the historic viral disease yellow fever.

More complex is the ancient pestilence of *Yersinia pestis* plague (*see* Chapter I, *above*) which can be both a "*Type I-B"* and a "*Type VI*" contagion, depending on its specific modality of transmission in individual cases and outbreaks: When the deadly pathogen is conveyed via the vectorship of fleas like *Xenopsylla cheopis* (which feed on rats and other mammalian reservoirs), the *bubonic* plague would be a "*Type VI*" disease. When, however, the microbe enters the mammalian lung and causes *pneumonic* plague, it would be a "*Type I-B"* disease. From a PH perspective, these are important distinctions, since the tactics of control for the two forms of plague could be very different: The slower first variant of plague might justify some degree of human quarantine, but it would emphasize vermin-control; however, the fast-moving latter variant of plague might require aggressive socio-behavioral interventions to impede direct person-to-person transmission. (Of course, there would be considerable tactical overlap; for example, both variants would also call for modern technological interventions, such as antibiotics.) Because of the major differences between these two forms of plague, this Dissertation has carefully refrained from using the casual term "bubonic plague" to describe historic epidemics of this scourge. One of the puzzles of human history, incidentally, is why *Yersinia pestis* plague could have crossed the world so quickly in pandemic form, when it was supposedly a "*Type VI*" contagion that relied on a relatively slow inter-human passage via intermediate mammalian and arthropod hosts. It is suggested here that the Plague of Justinian of the 450's, and the Black Death of the 1340-50's, might both have had major pneumonic plague components, at least in a number of their individual and regional manifestations. Alternatively, the two early pandemic strains of *Y. pestis* might have had some peculiar genetic mutations that promoted aggressive inter-human spread, or there may have been some distinctive host-susceptibility variables.

(1) The Model Excludes Strictly Animal and Plant Contagions--and Those Contagions in Which Humans Are Only "Dead-End Hosts"

It should be emphasized here, however, that the present taxonomy has been created to specifically address infectious diseases that can spread from human to human (either directly or indirectly). Thus, diseases that affect both animals and humans ("*zoonoses*") are only included here if infected persons can, in their turn, transmit pathogens to other people directly or via arthropod involvement. By contrast, this schema does *not* cover the plethora of disorders that *only* affect animals, or those zoonoses that only spread *one-way* from vertebrates to humans—where, in biological parlance, the infected individual humans are "*dead-end hosts,*" in whom the parasites will die without being passed on to others. This is because the issue here is the possible use of quarantine-type controls for humans (not animals or plants), and no human quarantines would make even theoretical sense when the victims are dead-end hosts.

Hence, SARS and H1N1 influenza *are* included here—while those diseases would initially be conveyed to humans by vertebrate reservoirs, such as palm civet cats and domestic pigs or chickens respectively, the infected humans *could*, in their turn, infect other humans or vertebrates. (However, the present taxonomy—and its prescriptions for human quarantines--would *only* become applicable to such a zoonotic pathogen when it had *already* made its initial leaps from animals into primary human hosts, and was now capable of spreading from person to person.)

On the other hand, Rocky Mountain spotted fever, anthrax, or rickettsialpox (a feverish illness caused by *Rickettsia akari,* and spread by mouse-borne mites) would *not* be included here-- since humans who get these diseases will not transmit them to other human beings.

Nor will this schema include diseases that are caused by *free-living organisms* in the environment that can infect humans and induce pathology. One example of such disorders would be *Aspergillosis*—a set of clinical syndromes, including pulmonary fibrosis, that *Aspergillus flavus* and some 180 species of other *Aspergillus* fungi can induce in susceptible humans (*e.g.* CCDM 2008, at 66-69). Another example of an excluded disease would be naegleriasis (a lethal meningoencephalitis caused by the free-living amoeba *Naegleria fowleri,* which can strike swimmers who nose-breathe under water in warm southern freshwater pools)--as this disease, too, does not spread beyond its few very unlucky human victims.

By way of further clarification, it might be added that the instant taxonomy would also not include pathogenic diseases such as tetanus, caused by the anaerobic bacterium *Clostridium tetani,* which horse manure, ordinary garden soil, or unsterilized birthing instruments can convey to humans, but which those hosts generally cannot pass on to others (*e.g.,* CCDM 2008, at 202-03). Diseases of this sort are serious PH threats that need attention—but they would not be controlled by quarantine-type procedures. (Of course, any use of tetanus or botulism toxins by bioterrorists *would* raise a host of other issues, and certainly bring on the full force of the criminal law.)

h. "*Type VII*" Contagions—Maternal-Child Transmission

In this schema, "*Type VII*" pathogenic diseases would be those transmitted downward from infected mothers to their offspring, during pregnancy, labor and parturition, or breast-feeding. (Examples of such a vertical infection pathway include syphilis and AIDS.)

i. "*Type VIII*" Contagions—Other Modes of Transmission

Finally, the "*Type VIII*" category of transmission-modality is a sort of generic category into which more uncommon pathways of transmission might be placed.

One example might be clinical rabies. Over centuries, its causative rhabdovirus has developed a grisly mechanism for self-propagation: As is well-known, it often causes a violent, frenetic response in its hosts, marked by blazing fever, hyperexcitability, agonizing spasms—and, in animals, it provokes an inclination to bite other mammals, thereby injecting the virus into them before the hosts themselves inevitably die. (It is a true contender for the worst-kind-of-death-in-nature). Human victims are usually dead-end hosts for this virus, since biting other people is a highly unlikely response. On the other hand, terminal rabies patients' saliva *does* contain the lethal pathogen, so it could theoretically pass the disease on to caregivers who are not careful.

Another exotic mode of transmission was manifested by *kuru*. This neuropathological disease--another spongiform encephalopathy that is apparently caused by infectious prions--became a peculiar malady of the Fore tribesmen of Papua-New Guinea. In the mid-20th century, women and children of the tribe would eat the brains of their dead relatives as a mark of respect—and, a number of years later, they would develop the deadly wasting disorder. However, the Fore have reportedly discontinued this ritual practice, and kuru appears to have largely disappeared as a result. In any case, cannibalism would seem to be a relatively uncommon method for pathogen propagation.

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3. "Intensiveness of Contagiousness" Dimension—and Other Epidemic Variables

Besides spreading from host to host by a variety of modalities, communicable diseases can differ on a number of other variables that can be quite important for the issues of contagion-control and the possible imposition of quarantines. (The following concepts and terms have now become widely known and discussed--although not always in a scientific way--but it is worthwhile to state them here because they are so relevant to the present subject.) These issues come up most starkly during incipient outbreaks and spreading epidemics (*infra*).

As discussed above, Modalities of Transmission can greatly influence a contagion's ease and probability of convection from host to host—but they are not always decisive on this point. Other Dimensions such as the Ro of a disease and the immunologic susceptibility of hosts can also heavily influence whether even a "*Type I*" disease spreads quickly, widely, and intensively, as shall be noted below.

a. Incidence and Prevalence of a Communicable Disease in a Defined Population

In taking evidence-based steps to control a communicable disease in a jurisdiction, planners, policy-makers, and implementers need to know, as best as possible, its "*absolute incidence rate*" (the number of new cases appearing within the population-at-issue within a specified period of time—such as a year) and its "*prevalence proportion*" (the total number of cases—both new and ongoing—that are present within that population at a specified point in time, or during a specified period of time).

b "Endemicity," "Epidemicity," and Related Concepts

Within a particular population, a contagion can be "*endemic*" (occurring commonly or continuously at some level in a given population or area), "*hyperendemic*" (generally high incidence in a population or area), or it can be "*epidemic*." (In common usage, the latter adjective means that the disease is spreading widely in a population within a relatively short time period. Curiously, though, "epidemicity" is also sometimes defined as any level of disease incidence that is above the "expected," "normal," or "baseline" incidence levels for the jurisdiction in question. Thus, even one case of smallpox—presumably eradicated everywhere on the planet—would, in that sense, be considered an "outbreak" of major concern, and two cases of it could be regarded as an "epidemic" event in every part of the globe--at least in terms of urgent needs for action by policy-makers and administrators.) The animal-disease equivalents of these concepts are "*enzootic*" and "*epizootic*." Specialists in the field either use the term "*outbreaks*" synonymously with the word "epidemic," or they use it to refer to an epidemic in a certain area—usually, one in its early stages of development. Finally, as is now generally all-too-well-known, the term "*pandemic*" refers to an epidemic than has taken on a global scope (or, alternatively, it denotes an increase in disease incidence at a global level). (*Cf., e.g.,* Green MS, *et al.*, "When Is an Epidemic an Epidemic," *Israel Med. Assn. J., 4* [Jan. 2004].)

c. Epidemics as Conceptual "Organisms"

At one level of perception, it may not be unreasonable to think of epidemics of communicable diseases as resembling organisms in themselves. In part, this is simply a metaphorical usage (and it is important to avoid anthropomorphism or teleology)—but it can have pragmatic control-value as well: In many ways, as has been noted here, epidemic developments are more than the simple expression of pathogen behavior *per se*—rather, they represent complex and multifactorial interactions between the pathogen, its host(s), and their environment. At their "macro" level, moreover, epidemics have their own internal dynamics--which are susceptible to various kinds of theoretical modeling and analyses that can be useful in developing appropriate controls. (One standard and very simple descriptive model for an epidemic is the "*epidemic curve*"—which tracks and depicts the incidence of cases in a disease outbreak. It can provide some clues for further investigation of such an episode—indicating, for example, whether it is spreading interpersonally into secondary human cases.)

d. Ro: The Infectivity Index

In assessing the epidemic threat posed by various contagions, many epidemiologists emphasize the "Ro" (the "reproduction" or "reproductive" number, sometimes also termed the "infectivity index") and similar characteristics of those diseases. Ro refers to the average number of secondary cases that can be inculcated by each primary case of infectious disease (it can range from R1 for some relatively slow-moving contagions to R15 for very transmissible "*Type I-A*" contagions like measles). A Ro of 1 indicates an endemic disease. Generally, however, if the contagion cannot reproduce itself at a fast enough pace in the target population (*i.e.,* over R1), an outbreak of one or two cases will not spread outward in epidemic form, and it will eventually burn itself out in the immediate population. However, diseases that have a Ro above one, can readily become epidemics. Moreover, the higher the Ro, the more difficult it will be to contain the contagion to a limited area (assuming no countervailing factors such as population herd resistance).

The Ro can be crucial in determining whether quarantine controls would be appropriate--at least from a strictly mechanistic PH level. Arguably, quarantine/isolations may be optimal contagion-control measures at a moderate range of Ro above 1. Quarantines/isolations might not be the containment tactic of choice for contagions with very low Ro's, since (as has been shown in this Dissertation) they can be disruptive devices in various social and economic ways--to the point that their benefits may not be sufficient to offset their disadvantages in some situations. Leprosy may be an example of this situation (*see* Chapter I): Notwithstanding its uncertain—and possibly respiratory—mode of transmission, leprosy's characteristics under the Ro "Dimension," and under other "Dimensions" such as Duration, may make it a less appropriate biomedical/PH candidate for quarantine/isolation.) At the other end of the Ro spectrum, however, the rubeola virus that causes measles is so readily transmitted (with its reproductive number of 15) that it can virtually saturate a population of susceptibles in a short time period. Thus, quarantine/isolations may be helpful adjuncts in a multi-pronged program of measles prevention and containment—but with such a rapidity of spread, vaccination would have to be the dominant counter-strategy.

To a certain extent, reproduction numbers of diseases can vary over time as pathogens evolve, environmental conditions change, and epidemics progress, so lawmakers and policymakers developing contagion-control systems that incorporate this variable (and related ones) need to build in a certain flexibility to reflect such potential developments.

e. Other Relevant Epidemic-Related Variables

Related factors that can also affect an epidemic's viability and impact, including its serial interval (which refers to the time from inception of infectivity in the index or primary cases to the time of infectivity in secondary cases).

4. "*Temporal" Dimension of Contagions*

The fourth important "Dimension of Contagion" in the present schema focuses on the *general* length of time that a communicable disease will last in a human host. Here, it is important to distinguish between the length of time that the pathogen *infects its victims*, the length of time that it causes *clinical illness in its victim,* and the length of time that it makes its victims *infectious to others*. --While these three time periods *may* closely approximate each other, and they *will* often overlap, they are by no means isomorphic. In different ways, all of these variables are important in planning public health legal controls over contagion—but the third one is more important than the other two.

The length of time that individuals are *infected with the pathogens* and the length of time that they cause them *actual clinical illness* can differ in themselves: In chronic untreated syphilis, for example, there is usually a long latency period (which can start between one and four years after infection and can sometimes even last for decades) when syphilitics remains quite infected with spirochetes and at personal risk of developing impairing pathology, but they often feel no symptoms at all, and they may be unaware of their infected condition; most of the time, they are also not infectious to their sexual partners during this latent period of time (*see, e.g.,* CCDM 2008, at 593).

a. Temporal Duration of Symptomatic Illness

Generally, symptomatic diseases are said to be either (1) *"acute,"* (2) "*sub-acute*," or (3) "*chronic*." This is a somewhat arbitrary breakdown, which makes an apparent trichotomy out of what is really a continuum. However, it is functionally useful for some purposes, including contagion-management and control. It is particularly helpful at the extremes of the spectrum:

(1) Acute Diseases

An "acute" disease is usually described as one that, in the majority of cases, lasts a month or less (*whether at a symptomatic level, or as an infectious entity*) (www.medical-dictionary.thefreedictionary.com, *citing McGraw-Hill Concise Dictionary of Modern Medicine* [St. Louis: McGraw-Hill Co, 2002]). Examples of ordinarily acute diseases (varying across the spectrum of severity) include plague, smallpox, yellow fever, influenza, mumps, and SARS.

(2) Sub-Acute Diseases

A "sub-acute" disease is said, in most manifestations, to last between one and three months (U.S. National Center for Health Statistics, *cited by* www.medicine.academic.ru/7840/Subacute, accessed 2/6/12). Examples of such diseases include subacute bacterial endocarditis. (It should be noted that some usages define "subacute" in a somewhat vague way to refer to the overtness of symptoms—but that is not the usage here, and it is submitted that it is important not to blur the Dimensional distinctions between Severity and Duration.)

(3) Chronic Diseases

A "chronic" disease is one that normatively persists for over three months (*e.g.,* www.medterms.com/script/main/art.asp?art, accessed 2/6/12). Chronic infectious diseases include leprosy, TB, and syphilis.

b. Some Generic Stages in an Individual Host Encounter with Pathogens

In a very over-simplified way, one can distinguish several generic stages in the possible encounters between pathogens and individual hosts. (This account resembles—but differs in some respects from—the one presented in *Handbook of Infectious Diseases*, Holmes HN [ed.], [Springhouse, PA: Springhouse Corp., 2000], 598 pp., at 2-30A. *See also* Chapter I, *above.*) These stages need not happen sequentially—but they sometimes do:

First, it is possible for pathogens to *contaminate* the individual—as when a lab worker spills a beaker of *V. cholerae* on her arm. However, this event in itself does not constitute an infection, and—with some luck and appropriate responses—it does not have to lead to one.

At a next "stage" of involvement, microorganisms might *colonize* a human being—again without technically infecting him (such as *Staphylococcus aureus* living on the surface of his skin, or under his eyelashes--normally unsymptomatic and unnoticed). Some even co-exist with the host in a symbiotic way that is termed *mutualism*—beneficial to both (such as those bacteria that dwell in the human intestines, enabling their hosts to digest certain foods, and occupying a niche that pathogens might otherwise occupy).

In some cases, however, microbes will cross a subtle but crucial threshold into *infection* (in which they will multiply inside the host's tissues). In one sense, they have taken on another role in nature—functionally changing from mutualistic symbionts or *commensals* (who co-exist with the host physically, but do not harm him or take his nutrients) … into *parasites* (which do exploit their host in those ways). This transformed role can occur when the micro-environment changes in some way or ways—such as a new deficiency in the host's immunity, which had formerly held the microbes back in a sort of microscopic *détente*. Organisms that coexist with an immunocompetent host without causing harm can exploit an immunocompromised state to become pathogenic.

However, this is not the end of the Temporal continuum of encounters between pathogens and their hosts, as the following discussion will indicate:

c. Duration Periods of Infectiousness *Per Se*

In general, from the disease-control policy perspective, the two durational variables mentioned above of *time of being infected* and *time of being clinically ill* are mainly important since they pertain to the "*Severity"* of the disease in general. However, the foremost concern to public health policy-makers would be the victim's *period of infectiousness to others*—which may be different from the period of clinical illness. This may not always be known, and communicable diseases can vary considerably in the mean and variability of their periods of communicability (*see, e.g.,* CCDM 2008, at 711); there can even be changes in this factor in different places and phases of the same epidemic. To the extent that it can be identified (perhaps in a normalized form), however, the duration of infectiousness is a critical variable for contagion-control and its impacts. Among other things, it may have an impact on whether a disease carrier is merely quarantined for a few weeks during an acute illness—or whether she will be legally confined for the rest of her life, which might last for decades.

A specific sub-issue here is the length of time—if any—when an individual is *asymptomatically* infectious to others.

d. Presence or Absence of a Prolonged Asymptomatic Carrier State

In deciding whether a disease merits a quarantine-type control response, an associated "Dimension" to consider is whether or not it can generally produce an *asymptomatic carrier state*, particularly one that is prolonged. This is important to contagion-fighters because ambulatory carriers of infectious disease (whether or not they recognize their own infection) are particularly capable of spreading it widely to other people.

Some communicable diseases tend *not* to generate any prolonged asymptomatic carriage in most cases. Their victims are only (or mainly) infectious when they have obvious symptoms, such as violent coughing or rashes, and then they can be stopped from circulating by their own symptoms or by outside intervention. Oddly enough, even smallpox, for all its ferocity in "*Severity*" terms, does not tend to create a prolonged state of asymptomatic carriage; victims do not usually start shedding viruses into their environment until they are suddenly stricken with the overt—and prostrating—symptoms of exanthems in the throat that trigger intense coughing spells. The sufferers are not usually ambulatory at that point. Similarly, SARS does not ordinarily become infectious until individual hosts have already been infected and then become symptomatic for a number of days (although it should be noted that there can apparently be exceptional "super-spreaders" of this disease, who had disproportionate impacts on the spread of SARS in 2003; however, the mechanisms for the "super-spreading" phenomenon have not been not thoroughly investigated, and they remain unclear).

In general, there are several types of asymptomatic carriage of infections: *incubatory*, *convalescent,* and *generally asymptomatic*: The first two types occur before--and after--an individual suffers clinical illness, respectively. From a control point of view, they can certainly be problematic, since the carrier may be quietly shedding unseen pathogens into his environment for days before (or after) his illness become manifest symptomatically. This is true of influenza, for example. On the other hand, these particular infectious states are not *usually* prolonged in time. Moreover, the carrier in such cases may have incipient—or lingering—symptoms that can impede his capacity to travel and transmit his infection to others.

More worrisome for public health are those individuals who *never* seem to develop any overt disease symptoms at all—or who have no more than subtle signs and symptoms that they can innocently or indifferently ignore. Examples include *Neisseria meningitides*, which many people can quietly carry around in their nasal passages, exposing their more vulnerable contacts to the potentially fatal CNS infection meningococcal meningitis. Another example would be methicillin-resistant *Staphylococcus aureus* ("MRSA"). Even better known is typhoid, which (as recounted in Chapter I) "Typhoid Mary" Mallon spread to kitchens all around southern New York State in the 1900s before she was finally caught and thrown into life-long quarantine on an island off New York City.

While it may be somewhat oversimplified, the instant model will treat a disease's possibility or unlikelihood of generating an asymptomatic carrier state as a tri-partite discrete variable: (1) "*no notable asymptomatic carriage";* (2) *"brief asymptomatic carriage";* and (3) "*prolonged asymptomatic carriage.*" (The distinction between the latter two states can be somewhat arbitrarily set as the difference between carriage that lasts for days around an illness—and carriage that lasts for longer periods of time….)

By consequence of the above scenario, PH contagion-control policies may focus special attention on the quiescent (or *latency*) period—"quarantining" symptom-free persons who were alleged "contacts" of the demonstrably ill (who would themselves be isolated).

e. Some Policy Implications of the Temporal Dimension of Contagion

The standard Duration of a contagious disease can have profound implications for the running of contagion-control programs—particularly segregation-and-strict-quarantine systems. To some extent, of course, some of the same issues arise in all strict-quarantine confinements, whatever their temporal length. In practice, however, it is one thing to confine and isolate an allegedly infectious individual during the month-long span of an acute epidemic contagion—such as pneumonic plague or SARS; it is quite another to segregate, banish, and quarantine the victim of a five-to-twenty-year chronic contagion, such as TB or HD (and, in a few times and places, syphilis or AIDS).

When a jurisdiction adopts the goal of quarantining the *chronically* ill, it can run head-long into a plethora of financial, legal, social, and ethical problems that arise from incarcerating a community of people for months, years, or decades. The closest analogues would be correctional facilities or mental institutions, but these analogies are relatively poor. Among other things, the standards for hold or release would be vastly different among these various kinds of institutions—rather than criminal guilt, or psychiatric "harmfulness to self or others," the criteria for retaining people in long-term quarantines would be judgments of infectiousness (with perhaps a punitive overlay for disobedient or "absconding" inmates [*see* Chapter I, *above*]).

Here, policy-makers would have to confront issues of ethics, law, and social desirables—and weigh them against the collective interest in avoiding contagion. At a jurisprudential level, it might well be argued that the State's and Community's showings of necessity would increase commensurate with the length of isolation that they propose to impose. It might be arguable that public health law should seek the briefest quarantining period that would be consistent with the goal of stopping disease spread. (*See the discussions below.*)

Other Dimensions of Contagion—Including Technological Contagion Controls: "Quarantine Supporting or Intensifying Factors"

To some extent, the following five "Dimensions of Contagion" are less crucial to the quarantine decision-making process than the preceding ones. In addition, the final three of these Dimensions relate to the technological responses of biomedical science to communicable diseases, and they are thus more subject to change with scientific developments. Often, in fact, these particular Dimensions can change with the sometimes-frantic pace of science in the face of a desperate PH emergency. Hence, they can be entirely fluid—altering on an almost day-to-day basis during some crises and some hotly competitive scientific races-to-discovery. As a result, those Dimensional criteria might, in a sense, wind up being simple "snap-shots" of a kinetic process. Nevertheless, they are factors to be considered in making general and specific decisions about quarantines, including the degree of quarantine urgency or intensity. They would properly go into an algorithm for action that might inform the "front-line" forces of public health. (Accordingly, they will be identified as "Quarantine Supporting or Intensifying Factors.")

In applying these "Dimensions" to planning, a policy-maker, legislator, or administrator would have to ensure that he or she had particularly good, up-to-date information about the state of biomedicine relating to each contagion of policy concern. Once again, an expert advisory panel would be a valuable adjunct to policy-making here.

It must be repeated here, too, that these "Dimensions" are scientifically complex, and they can only be sketched briefly here in the interest of space constraints. The primary focus of this Dissertation is the set of socio-behavioral controls over contagion, so technological controls will be discussed mainly in connection with the latter types of controls.

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5. Dimension of Virulence Factors—Pathogen Survival in the External and Internal Environments

While not a crucial factor in decisions whether or not to quarantine, it may be worthwhile for planners to consider, among other variables, the *pathogen-virulence factors* relating to their durability in external and internal human environments. For example, how long would a bacillus or virus remain active and virulent in some expectorated sputum? Another consideration might be how much of a dosage of a pathogen would generally be necessary to inculcate illness in a secondary host. For example, it takes infection with a high number of cholera bacilli for some to survive gastric acid and colonize the human intestine. --By contrast, only 100 *Shigella* bacteria would be theoretically needed to inculcate the severe dysenteric disease shigellosis, only one bacterium could cause a case of plague, and only one variola virion could provoke the lethal symptoms of smallpox.

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6. Dimension of Host Susceptibility--Special Sub-Population Groups

In addition to the foregoing "Dimensions of Contagious Diseases," public health policy-makers need to ask whether a communicable disease poses distinctive dangers for certain *population sub-groups* (and, conversely, whether the disease is unlikely to be a major danger for other sub-groups). This applies to the variables of *probability of contracting infection, probability of developing clinical disease, and probability of suffering severe impacts if disease is contracted.* A related consideration applies to the differential propensity of demographic subgroups to *transmit* pathogens to others. There are many examples of such variable host group susceptibilities (across different age groups, genders, pregnancy statuses, and other host sub-populations), but the present context only permits discussion of a few examples here:

With regard to the probable severity of illness itself, for example, rubella is generally a mild illness for children and adults; however, it has a major teratogenic propensity for human fetuses during the first trimester of pregnancy, so pregnant women and their unborn offspring would be considered an exceptionally vulnerable population sub-group to this disease.

Also, *most seasonal* influenza epidemics (which reflect a limited and incremental *drift* in the influenza virus's genome) tend to have the severest impacts on the youngest and oldest persons in a population, with a consequential "V"-shaped mortality curve by age group. However, *pandemic* flu can follow some different patterns on these variables: First, these global manifestations of the disease (which reflect a fundamental genetic *shift*) may be unrecognized by the immune systems of young adults, since they have never before encountered the reassorted or mutated forms of the virus's haemagluttinin and neuraminidase surface proteins. Moreover, the robust immune systems of many young adults may mount a pathologically-intense response to the viral challenge, potentially exacerbating the disease-induced pulmonary and systemic symptoms. Thus, some flu pandemics may generate a "W"-shaped mortality curve by age—with a prominent "spike" in the middle range of ages, as well as at the extremes of age.

Another phenomenon that relates to seasonal influenza incidence by age group involves schoolchildren: Not infrequently, this demographic group is least affected by flu in terms of numbers and severity. However, the settings of schools and the behavior of children often leads to the relative rapid transmission of viruses between them and with associated adults; they then frequently carry the pathogens back to their homes, putting older and more vulnerable members of their families at risk of severe sickness with complications. (This phenomenon is also true of some less-common contagions, such as hepatitis-A.)

These special sub-population susceptibility and vulnerability considerations can often shape *vaccination* policies—since there is a need to triage limited stocks of available vaccine to the most vulnerable groups first. But they might *also* conceivably affect *quarantining* policy to some extent. Among other considerations, it might be necessary to impose certain "Modified Quarantine" restrictions on infected persons to prevent their coming into contact with particularly vulnerable sub-populations. For instance, it might be necessary to prevent persons with active TB from teaching or working in daycare centers for the duration of their demonstrable infectiousness. As a separate matter, the frequent role of schools as incubators of fast outbreaks was early recognized, and it helped motivate the early school closures mentioned in the last chapter.)

The Last Four Dimensions of Contagion—The Presence or Absence of Technological Methods of Control

The following four Dimensions of Contagion pertain to the current *biomedical* understanding of particular contagions, and to the *biomedical and technological* control methods that are currently available against those diseases. As has been repeatedly stressed in this Dissertation, the broad set of contagion-controls is not disjunctive or alternative in most cases—usually, various controls should be employed together in a *multi-pronged* response to infectious diseases. The main issues relate to the development of optimal strategies that incorporate and coordinate those responses, assigning specific roles and timing to the different methods, both technological and socio-behavioral.

Also, as shall be noted further below, the following Dimensions are particularly subject to change over time, which calls again for the building of some degree of programmatic flexibility into laws and plans for contagion-control. In pragmatic reality, moreover, there may also be variability across places and jurisdictions in the actual availability of some technological responses to contagions. For example, poorer developing countries in sub-Saharan Africa might lack access to some “high-tech” contra-contagion methodologies--such as drug protocols against HIV/AIDS--that are more readily available in richer countries. Even different American states, intra-state regions, and socio-economic groups can vary in their access to technological preventatives and therapies. However, these realistic differences in availability of technologies across jurisdictions do not necessarily call for a response when anti-contagion statutes are being drafted; they may be a more appropriate target for attention at the level of operational contingency planning.)

7. <u>Dimension of Aetiology -- Has the Causative Agent Been Identified for the Contagion?</u>

This "Dimension" asks whether the *causative pathogen of a particular disease* (1) is currently known to science with relative certainty, (2) is subject to major controversy, or (3) is flatly unknown.

As always in this schema, there is a great potential for variability in terms here: As was noted earlier, much of science is an arena of conflict, and some disagreement can exist over many basic premises and concepts (even within a Kuhnian paradigm).

Nevertheless, it seems reasonable to state that, for some diseases, "facts" relating to their aetiology are largely settled, and they can be relied upon in making policy. (For example, hardly anyone doubts at this point in medical history that the *lyssavirus* causes rabies or that variola virus was the historic agent of smallpox.)

By contrast, *other* alleged disease aetiologies are merely theories that are sharply contested by alternative explanations. To cite instances of this, as early as 1873, G. Armauer Hansen isolated a bacterium that he termed *"M. leprae,"* which he claimed was the cause of leprosy; however, it proved to be very hard to grow *in vitro* or *in vivo*, so it could not meet Koch's Postulates for establishing causality, and its role in leprosy remained controversial for decades.___ Hansen ultimately turned out to be right in that case, but other pioneering ideas of contagion-aetiology have not always been correct: During the last years of the 19th century, for example, there was intense debate about the causative agent of hepatic yellow fever, with one dogged theory pushing a putative bacterial contender that it presumptuously called "*Bacillus icteroides*" (alluding to the jaundice that it supposedly called). It would take decades before the incipient science of virology had advanced far enough to identify the real flaviviral agent of the deadly liver disease. Early in the next century, too, microbiologists argued strenuously about the cause of the terrible Spanish Influenza that was killing people outside their lab windows. One major proposal was "Pfeiffer's bacillus," and another was the bacterium that is still inaccurately named *"Haemophilus influenzae"*; these theories of causation—and others—would long have their staunch advocates. Here, too, the real agent--the A/H1N1 influenza virus, in this case--

would not be identified for years. (*See, e.g.,* Barry JM, *The Great Epidemic: The Epic Story of the Deadliest Plague in History* [NY: Viking Penguin, 2004].) As recently as the SARS epidemic of 2003, competing teams of investigators suggested various possible causative agents for the mysterious new scourge—including Chlamydia and a paramyxovirus—before a Hong Kong research group finally isolated the actual coronavirus agent, although in this case the aetiological period-of-uncertainty was compressed into mere weeks.)

Finally, the causes of some presumed contagions are flatly unknown at certain points in time, and there are few or no reasonable suppositions about them. Of course, this state of knowledge is always changing, as inquiry and confirmation push back the margins of ignorance. Sometimes the period of obscurity is brief: In the case of SARS, it was only a matter of *weeks* from the start of the epidemic to the moment that the causative "SARS-coronavirus" was conclusively identified. In other circumstances, the biomedical uncertainty may last for decades. For instance, the causation of some seemingly non-infectious diseases might ultimately turn out to have microbial origins, contributions, or at least triggers (for example, certain chronic brain pathologies like Alzheimer's Disease, multiple sclerosis, or amyotrophic lateral sclerosis), but, so far, no one knows whether this is true or not.

a. Some Theoretical Problems in Identifying Causation

Next, it might be noted that--as a theoretical matter in epidemiology--it is not a simple process to establish the etiology of a disease. As was long the case with leprosy, it is sometimes not technically possible for a long time to comply with basic scientific criteria (such as Koch's Postulates) for establishing pathogenic causation. The mere repeated observation of a microorganism in association with a syndrome may be suggestive—but it is not considered determinative. Moreover, nature being as complex as it is, "causation" itself can be more than simple, linear, or unifactorial: Often, multiple factors can be involved in the production of disease; some might be necessary, but not sufficient, others might be causative but unnecessary … and so forth. To use leprosy as an example again, both the "environmental" factor of exposure to the pathogen, and the "genetic" factor of variable susceptibility to it, are apparently required to produce the syndrome—a reality that long confused the way that science, society, and law interpreted the disease's contagiosity and then handled its victims.

Thus, in many instances, biomedicine and PH will have only discovered a potential contender for a causative pathogen--with experimental confirmation still unachieved. Often, several competing researchers will be proposing different pathogen candidates for the title--and this state of affairs can persist for some time.

b. Causative Pathogens May Not Need to Be Identified to Take Action Against a Putative Contagion

To be sure, the early step of finding a causative agent is not invariably necessary for developing diagnostic, preventative, or therapeutic agents against a disease: Many great biomedical and PH procedures and medications that have controlled deadly contagions were made empirically, in the absence of a discovered pathogen. (A few famous examples included the following: Prophylaxes such as Jenner's vaccine against smallpox and Pasteur's vaccine against rabies long antedated isolation and observation of the causative viruses. Snow and Budd in England showed how cholera and typhoid, respectively, could be controlled by PH actions to clean contaminated water supplies—years before the causative bacteria of those diseases were identified. Use and refinement of the drug quinine long preceded the discovery of the plasmodia that cause malaria.) Even today, some generic contagion-control steps can be taken early in an outbreak of a possibly “new” disease--days, weeks, or months before its infectious agent has been identified: For example, it is always appropriate to practice universal infection-control precautions and barrier nursing techniques on a routine basis in a clinical setting—and it is all the more necessary when there are suggestive indicia that an unknown disease may be infectious in character.

c. The General Importance of Determining Aetiology

While knowledge of aetiology is not always necessary for disease-control, however, modern evidence-based PH tries to determine it as quickly as possible, since it can guide so much subsequent research, planning, and action. Identification of the pathogen can narrow the myriad set of possible pathways to pursue in response. (Identification of the agent of SARS in March 2003 enabled researchers to develop more targeted disease-control mechanisms.)

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8. Dimension of Diagnostics--Has an Effective Diagnostic Test Been Developed for the Contagion?

The next and related Dimension of a contagious disease that will have an impact on its control relates to *diagnostic procedures:* Once the responsible agent of disease has been firmly identified, the next step is generally to try to develop a diagnostic test or tests that will detect its presence in biological samples, such as sputum or blood. Thus, the present Dimensional issue for lawmakers and rule-makers preparing quarantine statutes and regulations would be whether there is currently (1) a well-established, reliable, and valid diagnostic test (or tests) for the contagion in question, (2) a controversial, inadequate, and/or impractical test (or tests) for it, or (3) no present diagnostic method for it at all. (Again, this is really a continuum that will be treated as a discrete threesome for present purposes.)

Here again, though, it is not necessarily an "either/or" situation. Diagnostic tests may indeed become available that are sub-optimal in various ways. Generally, assessment tools can be evaluated by a number of standards, including their *"reliability," "validity," "sensitivity," "specificity," "positive predictive value," and "negative predictive value."* The science here is extensive and complex, and it will be referenced here only briefly to the extent that it has an impact on the present concerns.

a. Test Reliability

A test's "*reliability*" asks how similarly it records the same phenomena each time that it is administered (when, for example, different examiners apply it on different days). How much error enters into its results?

b. Test Validity

A test's "*validity*" is the central concern, asking whether the instrument is "actually" measuring in nature what it purports to measure. Associated concepts include the following: How "*sensitive*" is the test? (In other words, to what extent does it successfully detect a disease-state that is actually present in the tested individuals?) How "*specific*" is it? (*i.e.*, to what extent does it correctly identify the absence of infection in truly- uninfected individuals?) Related concepts are the instrument's "*positive and negative predictive values*" (Otherwise put: If the test announces that a tested person is infected—or not infected, how often are these "findings" true in fact?) The higher a test rates on these criteria, the more valid it is.

c. Error

In reality, virtually all tests devised by man will have some degree of error in them, whether random or non-random in character.

Various biases of design and implementation can reduce the reliability and validity of the diagnostic instruments—and these can occur at many stages of the testing, analysis, and response process. (To cite an example from the last Chapter, leprosy "suspects" were subjected for thousands of years to observational "examinations" by clerics, doctors, and laymen that were often impressionistic, and that often falsely labeled uninfected persons "lepers." When the apparent leprosy bacillus was discovered in the late 19th century, it led to a bacteriological protocol of skin scrapings and microscopic examinations for diagnoses. While this new procedure—used in conformity with continuing clinical examinations--was a more objective criterion for leprosy pronouncements, it also introduced another chance for subjectivity and error at a later stage in the process: Inter-observer reliability now came up again at the point when bacteriologists reviewed the slide under a microscope to search for and count M. leprae. Thus, while legal regulations in some places now mandated these new steps, and they thereby made the whole assessment procedure somewhat more reliable, there could still be false-positives—with terrible life-long consequences for the misdiagnosed.)

d. "Positive" and "Negative" Test Results—And Different Points of View on Them

Clearly, the general goal is to have tests that yield as many "*true positives*" and "*true negatives*" as possible, and as few "*false positives*" and "*false negatives*" as possible, relative to the number of tested persons—but few tests can be high in all these standards, and, in practice, there must often be "trade-offs." The prime desirables can vary somewhat depending on the situation and the perspective of the individuals involved:

From the viewpoint of a *zealous PH administrator*, for example, an initial screening test should, above all, be highly "*sensitive*"—that way, it will reduce the risk that a truly infected individual goes unnoticed, and will continue transmitting his disease to others. For instance, the administrator may seek a device that effectively and accurately measures the body temperature of persons moving through an airport or other public place, in order to take aside any would-be travelers who are truly feverish--and who may thus be carrying a pestilence of concern (such as SARS or avian influenza). If this screening actually generates some "false positives" for the disease, the health officer may think, additional testing (slower, more cumbersome, and perhaps more invasive--but a more accurate indicator of this disease) can then be administered to the febrile individuals, and it will free the ones who are not really infected. Alternatively, if there is no such "gold-standard" test, the PH officer might detain the luckless travelers and isolate them to see if they start showing the telltale symptoms and signs of the contagion. (Another example of this approach occurs in many HIV-testing protocols: The initial screening test is often a method that will "finger" a relatively high number of potential HIV+ cases—but will also "rope in" some uninfected persons with them. A negative first test ends the inquiry--but a positive test will lead to a second assay, which can then confirm or disconfirm the initial "finding.")

It can be readily seen that *travelers* may have a different outlook on these various prospects: If they do not want to be found infectious (because it can lead to dire legal and social consequences—such as confinement in an isolation hospital), knowledgeable ones would prefer that the diagnostic test be highly "*specific*" (in other words, they would want a test that can readily pronounce them "disease-free" if they are in fact disease-free). However, if a would-be airplane passenger *does* evince a sign (such as a high-grade fever) on testing, she might hope that the test that found this had a *low "positive predictive value"* (i.e., it may have pronounced her to be "sick"—but it is often wrong on this point, and a second test may refute that finding). On the other hand, if there is an effective treatment for the disease in question, the individual might have some mixed feelings: While she would dread the isolation that will now be imposed on her, she might also share some of the PH officer's goals of effectively detecting and treating her malady.

e. The Legal Need for Diagnostic Tests That Are Not "Over-Broad"

Procedurally and legally, the presence or absence of diagnostic tests can be important for the fair, and evidence-based, imposition of contagion-controls: If, in a crisis, PH authorities assess the public health situation, duly weigh the socio-legal considerations, and determine that "social-distancing" measures are required, they will need to make them fit the "conditions-on-the-ground" as closely as is reasonably possible. As much as science permits, their control procedures will have to be informed by high-quality diagnostic instruments. If quarantine and isolation are premised on unreliable or questionably valid screening tests for the contagion, they might be considered "over-broad" and "arbitrary," and thus constitutionally unacceptable.

The presence or absence of a valid, workable test for a communicable disease would clearly affect the policy preparation for an outbreak, as well as the responses to it. When there is a "great, buzzing confusion," and no workable test for field personnel, the control options are fewer from the start. Early in the SARS epidemic of 2003, for example, Chinese clinicians had to stumble around in the dark for several weeks as the disease started felling them in their wards; they had to make up an operational case-definition "on the fly" for the seeming new syndrome, and they certainly had no confirmatory lab tests for it at that point. Under those circumstances, they prudently had to depend on empirical observations, generic barrier nursing practices, and intra-hospital isolation units--pending laboratory identification of the causative agent. At this stage of the epidemic, in other words, responses had to be broad—even rough—in character, necessarily erring on the side of caution and over-inclusiveness.

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9. <u>Dimension of Prophylaxis -- Has an Effective Preventive Method Been Developed for the Contagion?</u>

The "*Dimension of Prophylaxis*" raises some of the same issues as the previous one. Regarding any one contagion, policy-makers need to ask: Is there (1) a *highly safe and effective prophylaxis (or prophylaxes)* for it, (2) only an inadequate, outdated, or controversial preventative agent (or agents) for it, or (3) no technical specific prevention method at all?

a. Vaccines as Preventives

As is well known, the classic examples of prophylactic measures are vaccines. These have sometimes been the most powerful agents of disease-control available—especially in the case of viral diseases, which still can only be met by a limited array of anti-viral therapies. Smallpox vaccination eradicated variola in the 1970s (unless some bioterrorists revive the scourge in the future). If current efforts and natural and social circumstances permit, polio and measles vaccination might attain the same PH goals in coming years. There are also well-validated vaccines for such diseases as tetanus, yellow fever, mumps, rubella, pneumococcal pneumonia, Haemophilus influenzae –b, meningococcal meningitis, rotavirus, and Herpes zoster.

Numerous community-vaccination strategies can be used in efforts to contain outbreaks. During the 1960s and 1970s, for example, the Smallpox Eradication Campaign employed strategies of *ring prophylaxis* in many localities—conducting intense surveillance for cases, providing incentives for reports of cases, isolating the confirmed cases, and vaccinating contacts to surround the variola virus with concentric walls of immunized human hosts. Frequently, this strategy proved more cost-effective than using mass vaccination programs (*e.g.*, Bishai J & Nelson K, "Measles and polio eradication: Striving towards a post-infectious disease era," *Stanford J. Pub. Health*, www.stanford.edu/group/sjph/cgi-bin/sjphs, posted 6/1/11, assessed 2/9/12).

Of course, as with diagnostic and therapeutic instruments against infectious diseases (see the prior and ensuing discussions), it is not by any means always a disjunctive, "either-or" situation in prevention—"there is a prophylaxis or there is none." Not infrequently, a vaccine is available as a weapon in an outbreak—but it is poorly validated, or it is demonstrably deficient in generating adequate immune responses in a population of vaccinees. Given the inadequacies of past technology, for example, this was clearly the case for a long time with certain vaccines against bacterial diseases, including early-20th century immunizations for typhoid and cholera. Even today, there is only an outdated and questionable vaccine against plague, and only an old immunization (the Bacille Calmette-Guerin) against TB (which has yielded efficacy findings for adults that have ranged from *0-80%* in different research studies) (*e.g.,* CCDM 2008, at 467-68). As for such diseases as SARS and Bolivian Haemorrhagic Fever, there are no specific prevention (or treatment) options at the present time, and individuals' survival from these diseases may depend on such factors as host susceptibility, effective nursing, and luck.

b. Other Preventive Technologies, Including Chemoprophylaxis

In lieu of vaccination, sometimes chemoprophylaxis can be utilized as part of a preventative strategy. (This involves using therapeutic drugs to prevent at-risk individuals and communities from becoming infected, to prevent infected individuals from developing clinical disease, or to prevent such individuals from spreading the disease to others [see, e.g., CCDM 2008, at 703].)

In 2009, for example, the anti-viral drug oseltamivir was used as part of a ring-containment stategy against A/H1N1 pandemic influenza in closed military bases on the island of Singapore (Barclay L, "Oseltamivir ring prophylaxis may help contain influenza outbreaks in Asia," *Medscape Medical News*, posted 6/9/10, www.medscape.com/viewarticle/723271, accessed 2/9/12; Lee VJ *N.*

Engl. J. Med. 362:2166-2174 [6/10/10].) It has also been proposed as an early intervention against localized outbreaks of the feared HPAI A/H5N1 influenza.

However, chemoprophylaxis carries some hazards, and it has a limited scope. For example, there is an individual danger of side-effects—and there is a mass danger of promoting pathogen-resistance. (*see, e.g.,* Barclay L 2010). Thus, this use of anti-microbials is often limited to individuals at relatively high-risk of infection, such as travelers to areas where malaria is highly endemic, or to persons who have been in close contact with known cases of diseases like influenza and TB.

Some preventative measures are relatively "low-technology" in nature, but they have proven to be effective in a number of contexts. These include insecticide-impregnated bed-nets against the anopheline mosquitoes that carry malaria, and condoms to reduce the risk of contracting AIDS and other VDs.

c. Some Socio-Legal Controversies Regarding Prevention

When highly effective preventive measures are available in an epidemic crisis, they may displant quarantines and isolation as the preferred "front-line" methods of control. However, this does not necessarily reduce the prospect of social and legal controversy; in some circumstances, the presence of such prophylaxes simply moves the conflict to another arena: Vaccination itself has been a major battleground since its inception. For example, there were riots in Colonial America during early campaigns to implement immunization procedures against smallpox (first variolation and later vaccination). After creation of the American republic, legal battles over the right to refuse vaccination recurred in various parts of the country for decades. Eventually, the U.S. Supreme Court faced the issue in the 1905 case of *Jacobson v. Massachusett*s, 197 U.S. 11, 25 S.Ct. 358, 49 L.Ed. 643. In its ruling, the Court declared once again that "*salus populi est suprema lex!*," and it upheld laws that compelled vaccination over most individual objections. But that seemingly final ruling has hardly quelled the vaccination debate: As is well-known, a new imbroglio has arisen in recent years over the claim that some vaccines can cause autism. (Whether or not the allegation has merit—and most scientific research refutes it, it has lead to a reduced public use of such prophylaxes as the pertussis vaccine—with a resultant rise in diseases like whooping cough.) The recent vaccine against strains of the human papillomavirus has raised issues of its own—relating to the wisdom and morality of immunizing young teen-aged girls, among other concerns. Thus, immunization is a whole field of conflict in itself, overlapping some of the issues of quarantines—and raising some of its own.

Sometimes, the issues of quarantine and vaccination converge in practice. For example, when PH officials threw their strict neighborhood quarantine over Chinatown during the 1900 outbreak of plague in San Francisco (*see above*, Chapter I), they conditioned individual residents' escape from the quarantine zone on their accepting a plague-preventative called the "Haffkine Prophylaxis." However, this vaccine was actually of rather dubious medical value, and it could have serious side-effects, as the members of Hawai'i's Papa Ole found out personally that same year (*see above,* Chapter I); for these reasons and cultural reasons, many of the quarantined individuals objected to undergoing it. Thus, the PH, socio-political, and legal issues raised by the quarantine itself were accompanied by related issues pertaining to vaccination.

Even if demonstrably effective vaccines are available in principle against contagions, this does not guarantee that they will necessarily be available in the "front lines" against an oncoming epidemic. Technical problems can arise elsewhere in the chain of production and distribution of prophylaxes, which can have an impact on their usage. For example, production against influenza has long been hampered by the slow method of growing the virus in eggs. This has made every year another race to produce enough vaccine in time to overcome the new strains of influenza virus that usually come in the fall. It is to be hoped that innovations in concepts and techniques will come to address this impediment (especially before the imminent arrival of the H5N1 "avian influenza").

Of course, even when there *are* modern specific preventative agents against a disease (such as immunizations—or sometimes chemoprophylaxes), quarantine-type procedures are *not* precluded from being part of a multi-pronged response to the threat. They can be used as adjuncts to the more modern methodologies in a multi-pronged social defense strategy. (For example, it might take some time before a wide-scale vaccination campaign can be mounted, and before the vaccines generate adequate antibody titers in the recipients; pending that time, social distancing measures would be important.) However, in situations where there are *no* specific, validated prophylaxes against a deadly disease (*i.e.,* no modern missiles against it), it may be necessary to dust off the old harquebuses (*i.e.,* the quarantines), and bring them to the front lines of defense.

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10. <u>Dimension of Therapy – Has an Effective Therapeutic Method Been Developed for the Contagion?</u>

Finally, another major variable--or Dimension--to consider in preparing controls against a contagion is whether there are any existing *therapies* for it. Rather than focusing on preventing the inculcation of infection, this response strategy would seek to terminate infection in individuals who have already developed it. Therapy for illness, of course, is an ancient goal of medicine in itself--but the main collective, PH purpose of therapeutics would be to kill pathogens to keep them from spreading to susceptibles in the patients' contact environment.

Again, some of the same scientific issues arise regarding the "Dimension of Disease Preventability" pertain to the "Dimension of Disease Treatability," *viz.:* Is there (1) a *generally-safe and effective treatment (or treatment)* for the disease, (2) only an outdated, beleaguered, risky, or controversial therapy or therapies for it, or (3) no specific therapies at all for it? (This criterion does not regard generic treatments, palliatives, or nursing care--important as they often are--as being equivalent to targeted and validated therapeutics for particular diseases.)

Again, the thematic purpose of the instant work necessitates that the following discussion be summary in character, but it does deserve brief mention here to give proper context to the present model and algorithm.

a. The "Golden Age" of Therapeutics in Contagion-Control

It is well-known that the "Antibiotic Revolution" of the mid-20th century introduced a variety of new responses to pathogenic attacks—including some of the most effective agents in the age-old history of microbe-human interaction and conflict: Within a short time, pharmaceutical science developed the sulfa drugs, penicillin and its derivatives, streptomycin, the cephalosporins, the tetracyclines, and many other products of this robust new paradigm. During those heady years, drug companies would enlist people from around the world to send them samples of potential microbe-killing substances, and they would doggedly analyze those materials in the hopes of finding successors to penicillin. (Indeed, one professor went to the end of a sewer pipe in Sardinia, and he found the first raw material for the new class of cephalosporin antibiotics.) For awhile, at least, this energetic effort changed the "balance of power" in the micro-environment, and it helped give Western societies a new sense of freedom from epidemics that would have been unimaginable a generation earlier.

The new therapeutics had impacts on quarantine settings: Once introduced into closed institutions for various diseases, the anti-microbials helped change their mission from mainly social containment and asylum--to one of mixed containment … and cure. In the special world of leprology (*see* Chapter I), the sulfones, rifampicin, and other therapeutic drugs of the 1930s and following "Window Era" decades appeared to be "miracles" that would bring down the fences around the old leprosaria, enabling their inmates to return to the wider societies outside—although, in practice, laws and social attitudes proved slow to tear down those walls. Streptomycin, para-amino salicylic acid, isoniazid, rifampin, and other agents had a similar impact on the TB sanatoria of the 1940s to 1960s.

Eventually, in this brave new world, the old lock-downs, placards, and closed institutions of quarantine did come to seem like the ancient forces of cavalry in an age of rocketry. --Thus, by the 1960s, the warhorses of quarantine and isolation were largely put to pasture for several decades.

b. A Rebound in Contagion

Unfortunately, as has been noted throughout this Dissertation, many pathogens have developed a resistance to the antibiotic drugs of the 1930s to 1960s (and an analogous process has also developed in response to the more recent anti-viral agents). As is well known, these processes reflect a complex web of inter-connected natural and socio-behavioral phenomena: Microbes' rapid capacity to mutate gives them an innate advantage over slower-moving human immune systems and human sciences in the eternal zone of inter-species combat. Often, when anti-microbials kill off the weakest microorganisms in a human micro-environment, this removes natural competitive controls over pathogens. In addition, strains of pathogens can appear that have developed genetic capacities to resist the drugs; with this selective advantage, they can rapidly proliferate in the altered micro-environment. (In addition, some microbes can actually transfer their newly-acquired abilities to others.) These biological developments are abetted by human weaknesses, complacency, and market economics: For example, some patients demand antibiotics to treat viral illnesses such as common colds—which can enable bacteria present in their environments to acquire resistance to those drugs. Other patients—especially in the Developing World—who can not obtain adequate medical care, self-medicate with erratic doses of antimicrobial drugs sold over-the-counter, furthering this same natural process. Moreover, in many countries there is a "black market" in diluted and adulterated antibiotics, which can also accelerate the natural selection process for pathogens in human micro-environments. As a separate phenomenon, the American cattle industry has long put antibiotics in feed to stave off infection and promote livestock growth. Meanwhile, the paucity of profit for resuming the search for antibiotics slowed the stream of new products to the tiniest of trickles. There are many other components to this complex emergence of microbial resistance, but these are some of the clearest causes.

It is to be hoped that mankind can resume its hunt for pharmacological agents against pathogens. Alternatively, it is hoped that another paradigm of treatment prove successful—such as developing antimicrobial drugs that can resist resistance, using viral phages as "allies," or pushing immunotherapy forward.

In any case, pending the arrival of a new paradigm, it becomes necessary to consider once more whether a contagion at issue is treatable with current methods. The algorithm needs to address this issue in deciding whether the old warhorses of quarantine are actually necessary again.

c. Sub-Optimal Therapeutics for Contagion-Control

It should be added that, in the therapeutics area as in the other Dimensions discussed above, the situation is not always a disjunctive one, marked by the simple presence or absence of an effective and curative treatment. In numerous cases, the reality is more complex, with an existing remedy (or remedies) that is hobbled by various deficiencies that make it rather sub-optimal for treatment and contagion-control. (In principle, of course, perfection is an unattainable goal, and therapies—like all other medical modalities—can always be improved. But at some point various standards of practice will hold that the drug or procedure is generally effective for the purpose for which it has been made. Due to individual human variation, any agent will fail to cure—or even harm--some patients, but these preset standards will judge whether or not they are considered effective across their target populations.)

Ebolavirus and *Marburgvirus* Haemorrhagic Fevers are neither preventable by immunization, nor specifically treatable by standardized medications. At the milder end of the "Severity" spectrum, there are also no vaccines or specific therapeutic agents for *Herpes simplex* (Type I) cold sores.

Here again, when the longstanding armaments of science start failing, it may become increasingly necessary for policy-makers to leave *some* place in their plans for the ancient techniques of quarantine. Arguably, those methodologies almost *always* have at least an ancillary role to play as part of a multi-pronged response to an epidemic—even when the therapeutic situation is reasonably good. But when the therapeutic situation becomes desperately deficient, they could become vital once more for preserving the public's health. (For example, this was illustrated by the recent case of Andrew Speaker [described in Chapter I, *above*], who had to be quarantined by the Federal government in Denver when he was found to have severe Multi-Drug-Resistant tuberculosis. Even worse are the cases of "*Extremely-* Drug-Resistant" TB that have started appearing—where *Mycobacterium tuberculosis* has started to defy even some of the less-optimal, second-line-of defense drugs.)

d. Contagion-Controls as "Balancing Acts"

In conclusion, it can be readily seen that a technically appropriate PH response to a burgeoning outbreak is not a simple matter of choosing one response tool or another. Depending on the stage of the epidemic in a given area and population, on the immediate availability—and adequacy—of the defensive weapons themselves, on the manageability of various kinds of social-distancing, and on a host of other factors, it will often be necessary to use a combination of responses, either successively or conjunctively. These might include quarantines and isolation in early stages of a mysterious outbreak on a hospital ward, and—once the agent is identified, appropriate vaccination and/or therapies may be used preferentially in other locations and stages of epidemic development…. To a major extent, an effective epidemic response may be a skilled balancing act.

F. <u>The Independence of the "Dimensions of Contagion</u>"

Finally, it is important to stress here again how different the above Dimensions of Contagion can be from one another—and how this divergence can have major impacts on public attitudes, policy, and PH law: While there are sometimes overlaps between them, these

Dimensions are generally independent variables—height on one of these spectra does not necessarily signify height on another.

One extreme example of the independence of these "Dimensions of Contagion" involves "the common cold" and pneumonic plague. In reality, both of these diseases are very similar on the spectrum of "Transmissibility": As "*Type I*" contagions, they are both communicated very easily and rapidly via the respiratory modality, with the respective pathogens (various rhinoviruses, coronaviruses, and other viruses for colds; *Yersinia pestis* for the pneumonic plague) moving with extreme efficiency in respiratory droplets from primary to secondary human cases. Being in the same airplane compartment as a victim of either the common cold or pneumonic plague presents a high probability of becoming infected by those pathogens (with various obscure susceptibility and exposure factors playing some role in whether or not one gets the clinical diseases). Yet, the two diseases obviously vary dramatically in terms of their "Severity": Under ordinary circumstances, a cold is one of the mildest of diseases, causing little more than nuisance symptoms like coryza (stuffy head), tussis (coughing), and sneezing. By contrast, pneumonic plague is arguably one of the worst diseases that can befall a human, with violent symptoms such as burning fever, expectoration of frothy, bloody sputum, and a nearly 100% case-fatality rate when untreated. Thus, policy-makers and administrators would not follow the "Transmissibility" Dimension alone in deciding whether or not to quarantine a traveler: Given the respective "Severity" of these two diseases, it would be absurdity incarnate to quarantine a cold sufferer; by contrast, it would verge on "public health malpractice" to *fail* to quarantine or isolate a possible carrier of pneumonic plague.

Another example might be the parvoviral childhood ailment erythema infectiosum (a.k.a. "Fifth disease") and variola major (the severe variant of smallpox). Both diseases are readily transmissible via respiratory secretions—but as a generally mild, self-limited disease for immunologically-intact persons, fifth disease obviously differs considerably from variola in its symptomatic impacts, and policies to control them should evidently reflect this "Severity" difference. (*See, e.g.,* Handbook of Infectious Diseases 2000, at 100-01, 562.)

Lest the above independence of the "Dimensions" seem obvious and unimportant for policy-making purposes, history has shown that a failure to distinguish between these independent Dimensions has often created major mischief and injustice:

For example, no one would argue that leprosy is a mild disease on a "Severity" spectrum*:* for thousands of years, HD's potential physical effects of numbness, limb resorption, skin lesions, deformity, and blindness have helped provoked the deepest kind of terrors and social ostracism (*see* Chapter I). In response to this gruesome visage of leprosy, it has been seen, many ancient laws—as well as some fairly-recent laws in Hawai'i, Louisiana, Massachusetts, Puerto Rico, the Virgin Islands, and other U.S. jurisdictions--banished leprosy victims to high-walled lazarettos on bleak islands and promontories. The lawmakers assumed—as did many of their constituents—that leprosy's extremity on the "Severity" scale also implied a violent "Transmissibility." But this premise is scientifically wrong: In reality, leprosy is one of the most least transmissible of all contagions. Genetic factors play a major role in susceptibility, making it only a danger to some 5-10% of all exposed people, and that usually after long-term, close interpersonal contact. Of course, it is recognized that there remain elements of biomedical uncertainty about this disease, and they can add to public fears: For example, it may be hard at present to easily determine just *who* might be vulnerable to the depredations of the pathogen, *Mycobacterium leprae.* Also, the specific mode of leprosy transmission remains uncertain even today (is it transmitted by air? does it require tactile contact?). Nevertheless, as a policy matter, there is little scientific grounding for the extremely harsh, life-long quarantines that were long imposed by societies on so-called "lepers."

Another classic differentiation on the Severity and Contagiousness spectra has been the one between the two important strains of influenza that have circulated during the last decade (see above discussion): On the one hand, there is the new strain of A/H1N1 influenza that broke out in Mexico during 2009. While the press took to calling this disease "swine flu," it was readily transmitted from human to human, and it became pandemic within a very short time. Fortunately, however, its mortality rate was relatively low for most population groups, being actually only about 4% of the ordinary manifestations of winter flu virus (although young children, pregnant women, and the immune-compromised were exceptionally prone to developing severe symptoms). By contrast, the strain of highly-pathogenic A/H5N1 influenza (so-called "bird flu") that also appeared several times during the same decade was only poorly transmissible between humans during that period; at that time, it seemed mainly to infect people in East Asia and Egypt who worked with poultry. Which was fortunate for mankind in general during those years, since this disease was spectacularly lethal, having a known death rate among the infected of up to 60% (see, e.g., CDC, "Key facts about avian influenza (bird flu) and highly-pathogenic avian influenza A (H5N1) virus," [11/21/10], www.cdc.gov/flu/avian/gen_info/facts.html, accessed 3/15/11). (To put this rate in perspective, it has been estimated that the terrible "Spanish influenza" pandemic of 1918-1919 that killed some 500,000 Americans and perhaps 40 million people across the globe only had a U.S. case-fatality rate of about 2.5%. [See, e.g., WHO, "Global alert and response—Avian influenza: Frequently asked questions," www.who.int/csr/disease/avian_influenza/avian_faqs/en/#vaccine, accessed 3/15/11.]) …Of course, the most classic feature of influenza A virus is its mutability and plasticity: It has great recombinant powers, so influenza experts are well aware that flu viruses from various host species can mix, "reassort" or adaptively mutate, and take on new properties; this can allow them to undergo periodic dramatic "antigenic shifts" as well as continual minor "antigenic drift." -- Thus, a new strain of avian flu may well appear in which the divergent dimensions of severity and contagiousness converge, creating a deadly form that spreads like the common cold.

The term "virulent," which is often used to describe pathogens in ordinary parlance (and even sometimes in technical usages), reflects such a blurring of conceptual Dimensions. For example, one standard reference source defines “virulence” as “[t]he ability of an infectious agent to invade and damage tissues of the host; the degree of pathogenicity of an infectious agent, often indicated by case-fatality rates” (Control of Communicable Diseases 2008, at 716). However, it is submitted here that such a definition groups together two attributes of pathogens that actually have important Dimensional differences: The first clause of the definition emphasizes mainly the Transmissibility of the agent (which is one Dimension), and the second addresses the Severity of the disease that it can produce in many hosts (which is a second—and, as has been seen, sometimes very different--Dimension).

The *other* functional “Dimensions of Contagion” are also independent of one another in many important ways: For example, measles and yellow fever can be *prevented* by excellent vaccines—but, once contracted, medicine can only offer good nursing to see the patients through and relieve their symptoms. By contrast, there are presently no vaccines to prevent syphilis and gonorrhoea--but despite some rising problems with microbial-resistance, those diseases are still readily *treatable* with antibiotics.

G. <u>The Algorithm in This Model Would Incorporate the Above Dimensions—Checklist and Algorithmic Flow Chart</u>

Under this model, all of the foregoing hypothetical "Dimensions" of Communicable Diseases would go into an Algorithm to help draft laws for the control of such diseases by quarantine.

Table 1 (below) presents a simple **Checklist** of normative contagion characteristics that legislative or administrative draughtsmen could first use in developing statutes or regulations that are pertinent to particular contagions, their varying manifestations, and their different phases during epidemics.

Figure 1 (below) proposes a hypothetical **Algorithmic Flow Chart** that could assist lawmakers in the preparation of contagion-control statutes and/or regulations that would be effectively targeted to particular contagions and their phases. Like the Model above, the Chart directs the draughtsman to ask a sequence of "questions" regarding the normative character of the specific contagions, which might or might not indicate whether quarantines and like socio-legal controls were appropriate measures for the abating of such outbreaks. Also as in the Model described above, those "questions" would be framed as “Dimensions” of contagion, and some of these Dimensions would either strongly favor or disfavor the use of such measures (“Quarantine-Directing Dimensions”), while other Dimensions would not preclude the use of Quarantines and the like, as part of a multi-pronged strategy—but might make them *particularly important* in the absence of more technological control measures (“Quarantine-Supporting Dimensions”).

Contagious Disease	Severity Dimension			Infectivity Dimension		Transmissibility Dimension									Temporal Dimension			Asymptomatic Carriage			Pathogen Virulence			Ease of Diagnosis			Preventability			Treatability		
	Not Severe	Moderate	Severe	R_0- R_3	R_4 and above	Type VIII	Type VII	Type VI	Type V	Type IV	Type III	Type II	Type I-B	Type I-A	Chronic	Sub-Acute	Acute	Long	Moderate	Brief	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
"Common Cold"	X				X									X			X		X				X	X			X			X		
Pneumonic Plague			X		X									X			X		X				X			X	X				X	
Hepatitis A		X			X							X					X	X			X					X			X	X		
Hepatitis B			X	X					X	X					X			X			X					X			X	X		
Tinea Pedis	X			X							X				X			X				X				X	X					X
Typhus			X	X				X									X			X	X					X			X			X
Chlamydia STI		X		X					X						X			X			X					X	X					X
Rickettsial pox	X			X R_0=0				X									X			-	X			X			X					X
Botulism			X	X R_0=0		-											X			-						X	X			X		
Psittacosis			X	X R_0=0		-														-			X			X	X					X

Table 1: A Proposed Checklist of Normative Contagion Characteristics for Guidance in the Preparation of Legislation

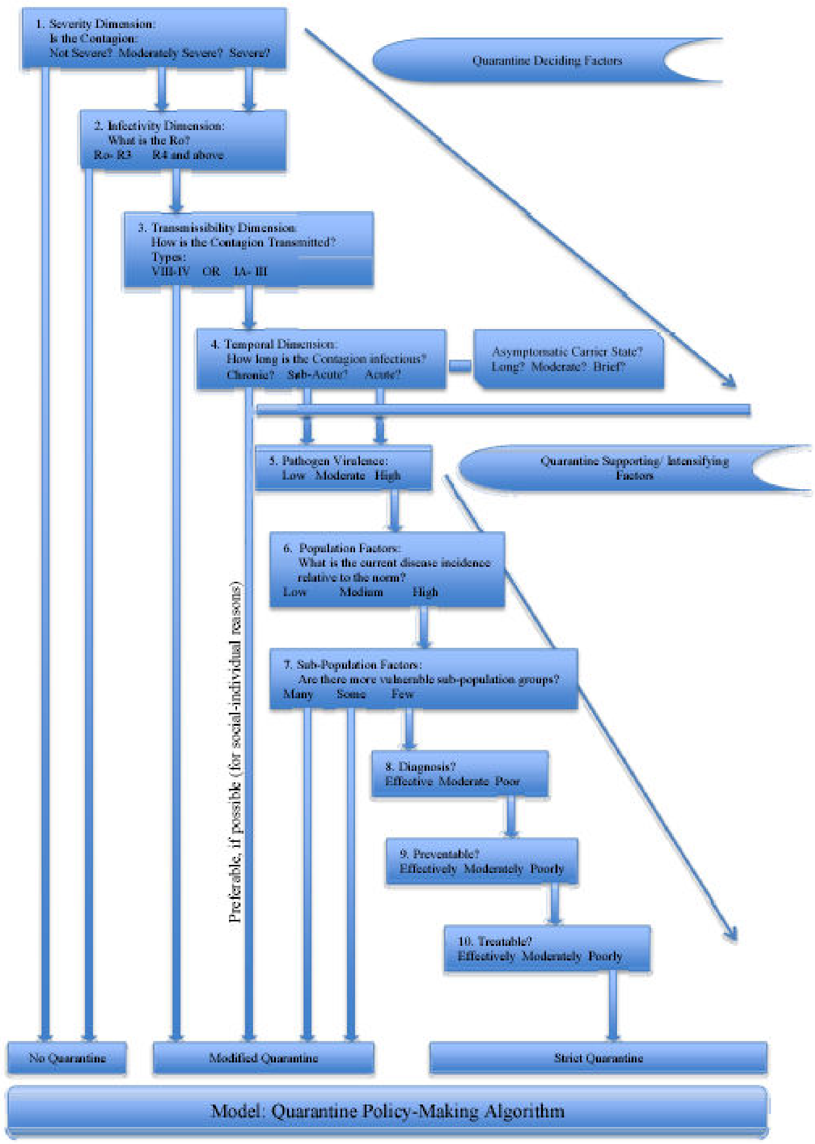

Figure 1: Proposed Algorithmic Flow Chart for Developing Statutes/Regulations for Socio-Legal Contagion-Controls that Are Based on the Specific Characteristics of Contagions

H. An Example of Applying the Proposed Algorithm to a Particular Contagion: SARS

To illustrate the use of this Algorithm, one can take a contagion and see how it fits for policy-making purposes. Once again, **SARS** would be a good example:

1. "<u>Severity" Dimension</u>

As its very name indicates, SARS is a "severe" disease:

After an incubation period of two to twelve days (mean--4.6 days; variance—15.9 days), clinical SARS presents with two or three major symptom phases (Vijayanand, Wilkins, & Woodhead 2004): First, there is a high fever (exceeding 38^{o} C.), chills and rigors, cephalgia, sore throat, malaise, and myalgia. Tachycardia and tachypnea appear in a number of cases (Rainer <u>et</u> <u>al.</u> 2003). In about 40-70% of the time, there are also some gastro-intestinal symptoms—mainly diarrhea (Plague, SARS—Hong Kong 2006, at 70).__ There can then be a brief period of seeming abatement, with a reduction in fever. After a week of illness, however, some patients deteriorate, and a proportion of them now develop a severe atypical pneumonia with severe tussis and acute adult respiratory distress (<u>e.g.</u>, Ooi, Lim, &

Chew, 2005), perhaps because of an excess immune reaction to their initial infection. Hospital stays before recovery are often long (mean, 25 days in Hong Kong); time from admission to death has been 36 days on average (but with much variability) (Anderson *et al.* 2005).

In some patients, the SARS infection process can consolidate pulmonary tissues into an impenetrable mass (visible on x-rays), and they become exhausted simply trying to breathe. WHO made this form of "severe acute respiratory distress" the official name of the disease. More graphically, Chinese observers began calling the disease "*ling ren zhi xi de"*—which meant "*breath-taker*," or "*breath-stalker*" (Greenfeld 2006, at 89).

(In early 2003, a Hong Kong virologist named Guan Yi surreptitiously entered the Guangzhou Institute for Respiratory Diseases in the PRoC's Guangdong Province to obtain sputum samples from SARS patients for study [the outbreak was being actively hidden by governmental authorities at that time], and he later described the new syndrome to a journalist:

> Most striking was the depleted look in their eyes. They didn't move their eyes to follow [me] as [I] passed through their rooms, the way most patients did. Nor were they asleep.

> Instead, they gazed upward, the act of breathing required all their strength and concentration…. 'Listless' was too vibrant a word to describe these cases …. They seemed to be the living dead.

[Greenfeld 2006, at 105].)

The average death rate for SARS was about 14% (although this varied considerably for different sub-population groups, *see below*).

This standard syndromic pattern and mortality rate certainly makes SARS a prime candidate for aggressive public health intervention—including socio-behavioral controls.

2. "<u>Mode of Transmissiblity" Dimension</u>

As a "*Type I-B*" contagion, SARS spreads via the respiratory modality—but its heavy-droplet vehicle provides a prospect of some control via standard barrier-protection practices. This is yet another factor favoring isolation-type responses. (The Amoy Gardens episode [*see* Chapter I] indicated that under some exceptional circumstances SARS can also spread by other modalities—including the aerosolization of infected foecal matter, but this appeared to be a very unusual means of spread [*e.g.,* Peiris, *et al.,* 2003], and it would not necessarily work against an isolation intervention strategy.)

3. "**<u>Epidemic Variables Dimension"—Including Ro</u>**

The SARS-Covirus has an Ro of about R2-R3, which makes it prone to epidemic spread without proper controls—yet it does not spread so widely so rapidly that it virtually suffuses a population before it can be stopped (like measles). This factor also favors SARS isolations.

4. "**<u>Duration of Infectiousness and Disease" Dimension</u>**

SARS also does not induce a prolonged asymptomatic carrier state—in fact, it appears to have a "lag period" of some 5 to 10 days *after* the onset of symptoms and *before* the point of maximum viral shedding (by contrast with the flu, which is communicable *before* its first significant overt symptoms). This provides an opportunity to stop SARS by isolating its victims.

Moreover, the somewhat limited epidemiological data on SARS did not disclose a major impact from *asymptomatic* carriage of the disease (*see* Day, *et al.,* 2006; Chan, *et al.,* 2003; Cherry JD & Lee, *et* *al.*, 2003; Peiris, *et al.*, 2003), which would argue at least for *isolation* of the symptomatically ill.

The duration of SARS as a disease *and* as an infectious state is clearly acute and short-term in most patients, so isolation would not become a lifelong burden (as with leprosy, TB, or typhoid).

5. **General Pathogenic Dosage of Agent**

Accounts of nosocomial SARS indicated that it *could* be contained by isolation and vigorous barrier-nursing practices. (Spread among hospital staffs often followed the heroic use of certain respiratory intubation procedures, which could cause the wide emission of viruses within a certain area. However, many clinicians and other staff members became exposed in the weeks before the disease's mode of spread was recognized. It would appear that the very careful use of such therapies only when necessary, and within the settings of closed isolation units, would considerably lower the dangers of transmission.)

6. **Susceptible Groups**

The population demographics of SARS showed that it is particularly detrimental to some of the most immunologically-compromised sub-population groups—including notably the elderly; however, youngsters seemed to be generally less prone to severe illness from it (*e.g.,* Booth, *et al.,* 2003; Cherry & Krogstad, 2004; Chiu, *et al.*, 2003). As noted previously, however, SARS' *infectiousness* appears to have been marked by the disparate impact of some individual *"super-spreaders,"* who seemed to cause multiple cases of the disease among their contacts (*see*, *e.g.,* Donnelly, *et al.,* 2003; Peiris, *et al.*, 2003). It should be noted that this reported phenomenon was to some extent anecdotal in character, rather than being closely studied epidemiologically or pathobiologically. Nevertheless, if it was a genuine phenomenon, it, too, would lend some support to the use of at least targeted and individualized isolation procedures.

On the other hand, the evidence cast considerable doubt on the cost-effectiveness of some rough-and-ready SARS-control measures, such as the mass temperature screenings at airports and ports. It is also debatable whether some of the authoritarian actions taken by countries like Singapore and the PRoC (including mass public quarantines) were justified by their outcomes in controlling SARS *vis-*

à-vis their social impacts.

7. <u>Technological Dimensions of Contagion</u>

As was indicated above, WHO coordinated an international "crash" program to identify the aetiological agent of SARS, and this endeavor did yield the causative coronavirus within a mere matter of weeks. Relatively slow diagnostic tests followed (*e.g.,* Chan, *et al.,* 2004; Cherry & Krongstad, 2004; Peiris, *et al,* 2003).

However, it is regrettably true that medical research never developed any vaccines or therapies against SARS. This clearly reflects human and societal failings: Once the SARS epidemic was scotched by old-fashioned socio-behavioral controls, within just 8 months of its first appearance, the disease no longer frightened governments and publics, and research money for it quickly dried up.

On the other hand, SARS is not really gone—merely quiescent at this time in its animal reservoirs, ready to return to the human world whenever the right combination of natural factors and human sloppiness enable it to do so. Then, there would be no "high-tech," 21st-century defenses against it--just the ancient social-distancing methods that go back thousands of years (with a few simple refinements).

In 2003, these antique public health weapons may have helped save the world from SARS—and they may also have to become mankind's first-line response to a return of this contagion in the future.

I. Summary Statement for Chapter II

In conclusion, this Chapter of the present Dissertation has presented a functional model by which policy-makers, lawmakers, and PH administrators can evaluate individual contagions for purposes of deciding what controls would be optimal in particular types of contagion situations. In the case of some highly mutable and changing communicable diseases such as influenza, different controls might even be employed for different epidemic manifestations of the same general contagions. Even different phases of single epidemics or pandemics might sometimes call for different controls. It is important that a certain rational and scientifically-supportable degree of flexibility be built into relevant laws, policies, and actions.

While some of the characteristics of contagions mentioned in the above model are already recognized and used in the field, it is submitted that the present proposed functional use of them in a broad and multi-dimensional algorithmic combination is relatively new. Moreover, this model varies somewhat from standard approaches on a number of individual specifics, reflecting functional premises raised here.

At this juncture, it is worth stressing once more that although the focus of this Dissertation has been on the ancient socio-legal contagion controls such as quarantine and isolation, these measures would ordinarily be used as part of a pre-planned and coordinated *multi-pronged* response to threatened contagions. Many host, pathogen, and environmental variables would have impacts on complex response plans, putting differing emphases on modern technological responses and ancient socio-behavioral responses in different circumstances. The main goal would be to bring considerations of "rolling" scientific evidence--and jurisprudential thought—into the development of laws and plans.

CONCLUSION OF DISSERTATION:

THE ONCE AND FUTURE PLAGUES—AND MANKIND'S RESPONSE

As was noted at the start of this Dissertation, the Western World may now be seeing an end to its extraordinary "Window Era"—several decades that were unique in modern human history in having a relative freedom from most lethal pestilences. Influenza and VD, including HIV/AIDS, were the main exceptions to this freedom during the "Window" years--and even those diseases may prove to have been only pallid versions of the scourges to come. (Between the mid-1950s and 2012, influenza did reappear at least three times in major pandemic forms—as the so-called "Asian Flu," "Hong Kong flu," and the 2009-10 A/H1N1 pandemic that started in Mexico. However, these were not lethal manifestations of flu in any "Severity" sense that approached the "Spanish Influenza" of 1918-19--or in any sense that approach the sporadic forms of human HPAI H5N1 now being seen in Southeast Asia. By contrast, HIV/AIDS and some other STDs were highly prevalent in the West during the "Window Era"; many of these diseases *were* “Severe” in character, and HIV/AIDS remains basically incurable—but, like “*Type V”* contagions in general, they were almost lumbering in speed compared to the “*Type I*” contagions that may haunt the human future.)

Already, there is some awareness in the field of public health and allied disciplines that it is no longer tenable to retain the “Window Era’s” complacent dismissal of mass contagion as a major threat to human health and social well-being. The possible imminence of mutated influenza in a deadly and fast-moving form has motivated some modern-day advance preparations—and this is certainly a notable improvement over the reactive and erratic responses to many epidemic threats in the past. However, much remains to be done in order to develop a rational and flexible societal response to the HPAI-influenza challenge. Moreover, attention must be paid to the potential threat of diverse contagions besides flu in the current and future ecological situation. As occurred in the very real case of SARS, a myopic focus on influenza could overlook the hydra-headed dangers of infectious diseases that have a plethora of different characteristics, calling for differently-tailored responses.

Finally, it is also submitted here that while the global public health response system to contagion has made some strides forward in this millennium (as again exemplified by the SARS episode), it has also slipped back in many respects--under the impact of many socio-political pathologies, including reduced PH funding in many polities. There also remain major differences in the contagion-preparation of different polities across the world—and major gaps in communication and coordination between them. Some of these gaps relate to differences in wealth and ideologies, and some of them stem from ancient fragmentations of authority and cooperation within and between nation-states--but the long view of history has shown that pathogens will often benefit from the conflicts between humans.

This Dissertation has looked backwards to long-forgotten experiences in the history of public health and contagion-control in order to draw some understanding of how mankind once reacted to scourges before modern technology entered the picture. It is submitted that many of those historic lessons are still valid—just as the old quarantine laws themselves remain in technical force in many modern jurisdictions. Those old defensive measures *will* have a place in future human responses to pathogen threats—but they surely need thoughtful reexamination in the light of modern bioscience, social science, and jurisprudential thought. There is a need to rebalance the great policy scales to reflect the realities of the present-day world. And such a rebalancing should be done before the plague ships (or planes or flocks) appear over the horizon….

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