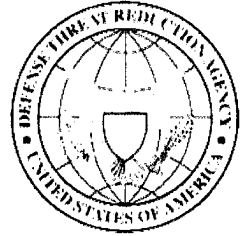




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FINAL REPORT

*Mitigation of Threats to the Continuation of
Marine Recruit Training Posed by a Category
4/5 Influenza Pandemic*

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Executive Summary

In the final analysis, we recognize that the challenges to continuity of recruit training during a Category 4/5 influenza pandemic are so formidable, and the non-pharmaceutical interventions to counter them so limited, complicated, and prone to error in implementation that we reluctantly conclude that the most sensible course, in the absence of an effective vaccine or reliable and safe antiviral prophylaxis, may be to rely on personnel actions other than recruit input to maintain force levels during a pandemic this severe.

A Category 4/5 influenza pandemic would threaten recruit training at the Marine Corps Recruit Depot (MCRD) San Diego (and at recruit training facilities elsewhere, as well). A pandemic that severe would likely prevent many young men and women from meeting their shipping dates because they would be caring at home for ill relatives, in home quarantine because of their contacts with a flu patient, ill themselves, or dead. Commercial airline schedules would likely be altered. Even if healthy and able to travel, incoming recruits or their parents might opt not to ship because of public health guidance to limit contacts with other persons and to increase distance from others; they might logically conclude that they stand a better chance of surviving by staying at home where they would have more control over the frequency of, and distance from, their contacts than at a recruit training depot, where closeness is the norm. At the Depot itself, a pandemic that severe would produce such high numbers of sick and dead staff and recruits that training schedules would certainly be disrupted and medical treatment capacity further strained. Furthermore, MCRD San Diego is located in the midst of a large urban area, and may come to be viewed as a public health threat by the community especially if the disease wave has already passed through San Diego and the Depot is perceived to be a weekly source of new infections as recruits arrive from areas where transmission is still active. An influenza pandemic this severe began in 1918, lasted until 1920, and created havoc on military bases in the US.

Objective

From September 2006 to February 2007, the Defense Threat Reduction Agency (DTRA) attempted to develop an operational concept that would help MCRD San Diego continue with its recruit training mission during a Category 4/5 influenza pandemic by mitigating, to the extent possible, the threats posed by that pandemic. We did not attempt to examine the range of measures that would be more applicable to a less severe pandemic. We are aware of healthcare

facility planning for an influenza pandemic that focuses on increasing patient care capabilities, and we (CDiG and ASM) participated at the federal level in the just-released community mitigation planning (“targeted layered containment”) that attempts to make more manageable the course of each wave of the pandemic as it attacks our cities and towns. This DTRA project duplicated neither of these efforts but, instead, attempted to develop a continuity-of-operations concept for MCRD San Diego (that might be useful at other recruit training installations, as well). We carried out this project through observations of recruit training and discussions with numerous Marine officers and Naval medical officers and officials (Section II). We also, of course, relied on our own knowledge, experiences, and research.

Vulnerabilities

A military recruit training depot is especially vulnerable to an influenza pandemic. The Depot would likely experience a higher disease attack rate, and, hence, death rate, than most civilian facilities and communities because the recruit population is age-susceptible to this infection and the living and training arrangements at a training facility create ideal conditions for the aerosol and droplet transmission of the virus. A mitigation strategy that relies only on surveillance, early detection of clinical illness, and rapid isolation and treatment of patients might be adequate for a mild or even moderate pandemic, but would be inadequate for a more severe, i.e., more deadly, pandemic, especially given the 24-hour period of preclinical transmission of the virus. To try to test all incoming recruits for the presence of the flu virus is unrealistic; the so-called “rapid” laboratory tests are currently unreliable, and laboratories capable of reliable testing will be swamped during a pandemic. Currently, as with civilian community mitigation planning, development of strategies at a military recruit training facility must assume the absence of vaccine. A vaccine effective against a pandemic influenza virus will not likely be available for at least the next 18 months, and production of an agent-specific vaccine in the quantities needed would not likely occur until we are well into the first wave of the pandemic. The pharmaceutical picture may be brighter with two neuraminidase inhibitor antiviral drugs, oseltamivir and zanamivir (see Section I). H5N1 thus far generally retains susceptibility to these drugs, and their production is increasing. We discuss, below, the possible role of these drugs in mitigation strategies for recruit training.

Quarantine, Sequestration—and their Shortcomings

Even if recruits could have their temperatures taken and reported accurately just before shipping, there is no way of reliably identifying those who might be transmitting the infection prior to the development of signs or symptoms, or those who might have acquired the infection en route from their homes to MCRD San Diego. Introducing a recruit who is transmitting a pandemic influenza virus into a recruit class at the Depot would be potentially devastating with a virus that produces 2-3% mortality, as was the case with the

1918 pandemic virus, let alone the H5N1 virus that has over a 50% fatality rate. The only way to identify which incoming recruits may be infected, and to limit their ability to transmit their infection to other recruits, is to place incoming recruits, immediately upon arrival at the Depot, into quarantine for seven days. As we discuss in Section I, the details of quarantining recruits are so complicated that we do not believe this measure is realistic.

Even if recruits could be quarantined for seven days, then released to begin their training, they would, at that point, have to be protected from the threat of infection by contact with the training and support staffs at the Depot. Sequestering staff, as we discuss in Section I, would be at least as complicated, and unworkable, as quarantining recruits.

Non-Targeted, Long-Term Prophylaxis with Antiviral Drugs

It may be possible to give MCRD San Diego training staff members a neuraminidase inhibitor antiviral drug as prophylaxis against infection during the entire wave of transmission in San Diego and thereby eliminate the need for them to be quarantined and protectively sequestered. This would obviously simplify transmission control issues at the Depot and might actually make it realistic to continue recruit training during a Category 4/5 pandemic. At this time, however, there are insufficient data regarding side-effects and long-term safety issues of oseltamivir (Tamiflu^R) and zanamivir (Relenza^R) for us to recommend this course of action, but we do urge health officials responsible for Marine health to monitor the literature for additional information about long-term, untargeted prophylactic use of these drugs. It should be remembered that in any prophylactic strategy, all that can be realistically achieved is a reduced number of cases, not their elimination.

Other Interventions

If MCRD San Diego were to continue to train recruits during a severe pandemic, the Depot should be closed to outsiders and non-essential personnel. Base activities other than recruit training should be shut down, and graduation ceremonies cancelled.

The MCRDs in San Diego and at Parris Island (PI), South Carolina, are located in civilian communities and are members of those communities. As mentioned above, mitigation strategies have been developed to influence the course of the pandemic in communities throughout our nation and have recently been rolled out to the public. These community mitigation strategies, independently of the proposals we offer in this report, will affect the functioning of each depot (San Diego perhaps more so than Parris Island). Depot commands should ensure that any continuity of operations planning is compatible with these community mitigation strategies, particularly with regard to likely personnel shortages that will result from these community strategies. In addition, there is a

stark conflict between recruit training and these community mitigation plans that must be addressed. Community mitigation strategies for a Category 4/5 pandemic call for closing schools, discouraging youngsters and teenagers from congregating in crowds after schools are closed, and encouraging adults to limit their contacts and increase their distance from others when outside of the home. If health officials urge compliance with these strategies to promote public health and improve the odds of individual survival during a severe pandemic, how should young men and women, and their parents, square away the differences between these strategies and the daily realities of life in a recruit training depot? This apparent contradiction will certainly be noted by recruits and their parents and will likely result in fewer arrivals at the depots.

Given the different housing and logistical situation at MCRD Parris Island, and its semi-rural location, Marine officials may wish to consider shifting recruit training from MCRD San Diego to MCRD Parris Island during a Category 4/5 pandemic. The quarantine and sequestration measures we discuss in this report might be more easily implemented at PI than at San Diego. Also, the CRUCIBLE experience for recruits at MCRD San Diego requires movement to Camp Pendleton, whereas MCRD PI recruits stay at the Depot for it. San Diego training staff could be assigned temporarily to PI.

Preparing for an influenza pandemic should include the development of plans to increase the numbers of recruits shipped and trained at both recruit depots during the inter-wave periods of the pandemic. As noted in Section I, influenza pandemics can occur in waves (the 1918-20 pandemic had four waves), and even a mild or moderate pandemic will likely impact adversely on recruit training. Ways to take advantage of the “lull” between each wave should be sought and exploited.

Conclusion

We have outlined in this paper a series of non-pharmaceutical strategies that might mitigate the effects of a Category 4/5 influenza pandemic at a Marine recruit training depot. These measures, we believe, are so limited, complicated, and prone to error in their implementation that we reluctantly conclude that the most sensible course, in the absence of effective vaccine or anti-viral prophylaxis, may be to suspend currently-underway and new recruit training during a pandemic of this severity and rely on other means to maintain force levels.

Section I: Background

When the next influenza pandemic will start, what influenza virus will cause it, and how severe (or mild) the pandemic will be are questions which are currently unanswerable. Unlike annual, seasonal influenza that is caused by flu viruses that undergo relatively minor genetic alterations from year to year, an influenza pandemic is caused by the emergence of a new virus which, regardless of its original natural host, e.g., birds, acquires the capability of sustained human-to-human transmission; furthermore, because this new virus will be significantly different antigenically from circulating sub-types, humans will possess no immunity to it from prior exposure. In the past 100 years, the world has experienced three pandemics; the pandemic of 1918-20 was the deadliest and most disruptive to the world's human population, while those of 1957 and 1968 were less significant; in fact, the 1968 pandemic was only slightly more serious than seasonal influenza. Thus, influenza pandemics are not necessarily catastrophic; their seriousness is, however, unpredictable until the pandemic starts.

In 1996, scientists reported a new influenza virus in China that devastated the poultry flocks it infected. The following year, in Hong Kong, this virus, H5N1, demonstrated its ability to pass from infected chickens to 18 humans (all documented with H5N1 infection), of whom six died. Scientists have monitored this virus since then, but for the next seven years it remained confined to China and neighboring countries, mainly in avian species. In 2004/2005, a variant H5N1 virus was detected in migratory birds, and, starting in mid-2005, cases of infections in poultry, migratory birds, and other animals began to occur in many countries around the globe. By mid-November 2006, 25 countries in Asia, 23 in Europe, and eight in Africa had reported occurrences of H5N1 infection in their animal populations. By 27 December 2006, 10 countries had reported a total of 261 human cases of H5N1 influenza, of whom 157 (60%) had died. The top four countries for human cases (as of 27 Dec 06) were Viet Nam (93 cases, 42 deaths, 45% fatality rate), Indonesia (74 cases, 57 deaths, 77% fatality rate), China (21 cases, 14 deaths, 67% fatality rate), and Egypt (18 cases, 10 deaths, 56% fatality rate). The vast majority of these human cases developed in people who had close contact with infected animals, primarily poultry, but a small number of these cases appear to have resulted from human-to-human contact, and one case appears to have resulted from human-to-human-to human contact. These instances of transmission among humans were, fortunately, not sustained.

Because this virus is constantly changing and may develop the ability to transmit from human-to-human in a sustained fashion and thereby start a global pandemic, the US Government and governments of other nations, along with the World Health Organization (WHO), are developing plans to protect their peoples from it. The acquiring of the ability by H5N1 to transmit efficiently between humans will likely be accompanied by other genetic changes that may result in a virus that is different than the H5N1 virus of today; what effects those changes

will have on the virus's rate of infectivity, its fatality rate among humans, and possibly its susceptibility to antiviral drugs are impossible to predict at this time. Thus, to be prudent, those who are involved with pandemic planning are considering a range of pandemic severities. With limited resources and time, the approach we took in this Defense Threat Reduction Agency (DTRA) continuity-of-operations project at the Marine Corps Recruit Depot (MCRD) San Diego was to focus on a Category 4/5 pandemic with the assumption that preparations can be throttled back if the pandemic is less severe. The need for continued planning and preparation for an influenza pandemic was articulated recently by a WHO working group of 22 of the world's leading influenza researchers who met in Geneva on 21-22 September 2006 and acknowledged "that the seriousness of the present situation, including the risk that a pandemic virus might emerge, is not likely to diminish in the near future" (1). Those who take comfort from the fact that H5N1 has not yet demonstrated the ability to move efficiently from one human to another should keep in mind that the bird flu virus which started the 1918-20 influenza pandemic, H1N1, probably had been around for some years before it mutated into a form that efficiently transmitted between humans.

Seasonal versus Pandemic Influenza

Protection against *seasonal* influenza viruses is achieved through immunization with the annual inactivated virus "flu shot" or with inhalation of a live virus preparation, "FluMist." Protection against seasonal influenza viruses is also available with neuraminidase inhibitor antiviral drugs, such as oseltamivir (capsule taken by mouth) and zanamivir (powder that is inhaled), if they are taken promptly after likely exposure to a patient with influenza (targeted prophylaxis) or, rarely, when used through the season of transmission (non-targeted prophylaxis). These antiviral drugs are also effective in treating patients with seasonal influenza; if given shortly after symptoms appear, the drugs have been shown to reduce the duration of influenza symptoms by approximately one day and to prevent complications.

Against a *pandemic* influenza virus, unfortunately, the roles and availability of these kinds of pharmaceutical agents are more problematic. Developing and producing an effective vaccine against H5N1 is proving to be vexing because of difficulties in achieving an adequate immune response with a reasonably small amount of virus per vaccine dose, and of problems created by the divergence of circulating viruses into several distinct genetic and antigenic groups. (There are now two clades [genetically distinct groups] of the virus, and the second clade has developed into three distinct sub-clades. These changes in the virus make the development of a vaccine difficult because the target is constantly shifting.) Vaccine experts speculate that an effective prototypic vaccine may not be available even in small quantities for at least another 18 or so months. Even then, after the pandemic virus starts spreading, adequate amounts of a vaccine which is targeted specifically against that virus may not be available because of production problems until we are nearly through with the

first wave of the pandemic (which may last four to six months). (Influenza pandemics tend to occur in waves, e.g., the pandemic of 1918-1920 occurred in four waves during this two-year period; in general, the deadliest wave was the second wave, which ran from September through December of 1918, but some communities, including ones in the US, reported their highest mortality rates in the third wave in 1919 and/or the fourth wave in 1920.)

Antiviral Drugs

There is, of course, no experience in the use of neuraminidase inhibitor drugs for either treatment or prophylaxis during an influenza *pandemic*. Oseltamivir, sometimes in higher doses than used in seasonal influenza, has been used by physicians who have treated patients with H5N1 infection. Limited data suggest that, even with larger-than-standard doses, the side-effects profile of oseltamivir remains benign, but these data do point out increasing incidence of such side-effects as headache and nausea as dosage increases. In one unpublished study (2), 445 otherwise healthy adults received 150 mg twice daily for five days, and 200 healthy volunteers received either 225 mg or 450 mg twice daily for five days; in them, there did not appear to be an increased risk for serious adverse events, although there was a dose dependent increase in nausea, vomiting, and dizziness over placebo subjects. There are no safety data available on higher doses in children; all clinical studies have been conducted with 2 mg/kg dosing. The safety profile in adults has, in general, been predictive of safety profile in children. In a published review of the potential use of oseltamivir in an influenza pandemic, the authors noted that, “. . . Safety data from dose ranging studies show that 5 day courses of 150 mg twice daily for treatment and 6 week courses of 75 mg twice daily for prophylaxis were as well tolerated as the approved dose regimens. . .” (3).

While side-effects such as nausea and vomiting may be ignored with short-term use, such as for treatment of infection or for targeted prophylaxis following exposure to a patient, use of this drug for non-targeted prophylaxis over a prolonged period of time (i.e., throughout a pandemic wave) may strain the willingness of Depot training staff to remain compliant. Apart from side-effects, people may decide to stop taking a prophylactic drug for any number of reasons. Non-compliance could result in diminished protection, and raise the risk of disease transmission within the Depot.

H5N1 currently retains susceptibility to oseltamivir, although occasional viral isolates have demonstrated reduced sensitivity. There is less experience with the use of zanamivir against H5N1, but it is part of the stockpile in the event of increasing oseltamivir resistance.

Decisions regarding the neuraminidase inhibitor antiviral drugs also need to take into account issues of drug availability. Although the manufacturer of oseltamivir has ramped up production, a serious influenza pandemic would likely

consume large quantities of the drug for patients requiring treatment or for their contacts who need targeted prophylaxis. The quantities that would be required for large-scale, non-targeted, long-term prophylaxis may not be available unless purchased in advance. It should also be anticipated that if a very severe influenza pandemic did occur, Depot training staff may insist that their family members also receive antiviral drug prophylaxis, and may actually give their own allotment of drug to their family. Thus, the widespread, prolonged use of antiviral drugs for non-targeted prophylaxis, apart from issues of safety and tolerance, may become economically unreasonable (4). Stockpiling of oseltamivir and, to a lesser extent, zanamivir is already underway by several entities in the US and abroad to ensure drug availability for treatment and targeted prophylaxis of their staff members. If stockpiling is considered for prophylactic use by the MCRD training staff, we would recommend supplies for 12 weeks.

Non-Pharmaceutical Interventions

With the likely absence of an effective vaccine and with uncertainties about the role and availability of antiviral drugs for prophylaxis, much of the work to develop mitigation strategies has focused on non-pharmaceutical interventions (NPI), tailored to the severity of the pandemic.

Federal public health officials anticipate that a pandemic set off by the H5N1 virus will start outside the continental United States and not reach our shores for two or three months. During this time, they believe, they will be able to monitor the virus' reproductive characteristics and attack rates, age-specific case fatality, risk factors for infection, and other indicators so that they will be able to predict the seriousness of the pandemic and initiate appropriate control measures when the virus does arrive in the US. Even then, they plan to analyze continuously the actual situation, revisit planning assumptions, assess the impact of chosen interventions, and finely tune response interventions as the pandemic unfolds.

NPI include such measures as public education, respiratory etiquette, the avoidance of shaking hands, and the wearing of respirators. They also include such "social distancing" measures as avoiding close contact with other persons outside the home, discouraging congregations of people and public gatherings, and closing schools. NPI include other measures to limit the spread of infection such as isolating persons who are ill with influenza and quarantining persons who have had recent contact with influenza patients. Antiviral drugs have been included in some of these scenarios.

Some of these NPI measures, such as closing schools and encouraging people to stay at home and away from their places of work or recreation, will be economically costly and socially disruptive. They may also produce a host of secondary consequences such as diminished nutrition for school children who rely on schools for healthy meals, and the potential for increasing household

violence as the novelty of staying home wears off. It is reasonable to ask what is the evidence that NPIs, taken singly or in some combination, are likely to be effective in mitigating the spread of pandemic influenza in American communities. The evidence that bears on this question comes from an examination of the history of previous pandemics, from mathematical modeling, and from biological experiments. At best, this evidence is currently thin and controversial (4,5), although recent statistical analysis of historical data from the 1918 pandemic suggests that the NPIs which several larger cities implemented may have benefited them, and, applied in the next pandemic in a layered fashion, may delay the onset of an infectious wave in a community and lessen the peak of the occurrence of illness so as to make the outbreak more manageable and less catastrophic. (Recently initiated research studies on the effects of NPIs on seasonal influenza may soon provide more relevant data.) In the absence of pharmaceutical agents, these measures are all we will have to control an influenza pandemic, at least initially. Accordingly, the federal government, after considerable consultation with pertinent stakeholders in the nation, has just issued guidelines to the public that outline the use of NPIs in a “targeted layered containment” (TLC) strategy, geared to the severity of the pandemic, to help alter the course of pandemic influenza in communities in the United States.

Weaknesses of NPI for Continuity-of-Operations Planning at MCRD

During any health emergency, public health officials focus their efforts on the steps needed to safeguard the health and safety of the greatest number of residents in their jurisdictions. One key measure of their success is a lower number of fatalities than what might have occurred without their intervention. We did not believe this goal and measure of success were adequate objectives in this DTRA project. The presence of H5N1 in a recruit depot, with its closely confined recruits and staff, would likely produce even higher morbidity and mortality than in a civilian community and could potentially result in a disaster, given H5N1’s current lethality. Even if we developed a plan that cut anticipated fatalities in half—a remarkable outcome by conventional standards—recruit training at MCRD would probably be impossible to continue, given the likely numbers of sick and dead recruits and staff.

Therefore, in this DTRA project, we sought stricter control of the spread of a pandemic influenza virus than would likely result from TLC. We also did not believe that social distancing or the wearing of a face mask or respirator was practical during recruit training. We encourage hand washing as a simple way of effectively limiting the spread of many microorganisms, but caution that there is no clear evidence that hand washing will interfere significantly and specifically with the transmission of influenza viruses. (A research study, funded by the Federal Centers for Disease Control and Prevention, is about to get underway to examine the role of hand washing in interrupting the transmission of seasonal influenza viruses.) We are aware that pandemic influenza contingency plans at some military installations focus on enhanced surveillance and prompt isolation

and treatment of persons who develop influenza. Our concern with these plans is that they would not detect or interrupt the spread of virus by the influenza carrier who remains asymptomatic for up to 24 hours before beginning to show signs and symptoms of influenza, and this shortcoming, in a truly severe pandemic, could have significant consequences; furthermore, timely laboratory screening of large numbers of recruits for H5N1 virus is not realistic with currently-available tests and resources.

Protective Sequestration

The model we chose to pursue in this project incorporates some features of TLC but relies primarily on “protective sequestration,” a strategy developed and employed by a few selected communities during the deadly second wave of the 1918-20 influenza pandemic. Protective sequestration was the only protective strategy we found in our study of the history of the 1918-20 pandemic that resulted in 0-1 deaths in communities where one would have expected higher death rates (6). Nearly all communities in the US during the 1918 pandemic incorporated many of the ingredients of protective sequestration in their disease containment strategies. What appeared to distinguish those very few communities which were successful in keeping themselves relatively free of virus from their neighbors who were less successful were the following decisions and actions. First, the leaders of the successful communities were prescient, decisive, and bold enough to institute protective measures before the infection arrived in their community. Whether military or civilian, they exercised command leadership. Second, they enforced these protective measures strictly and with stern penalties for disobedience. Third, these measures included a cordon around the community that prevented movement in or out of it; for example, in the case of Goat Island Naval Base, the cordon was provided naturally by the surrounding waters of the San Francisco Bay, whereas in Gunnison, Colorado, the cordon was established and enforced by law enforcement officers. Fourth, families were kept intact in these communities, and activities were planned within them so as to preserve some semblance of a normal life. We must emphasize that protective sequestration is not a public health measure because it is unrealistic for the majority of communities. It does, however, offer a model to consider when the objective is continuity of operations and the achievement of that objective requires disease containment measures that produce little morbidity and mortality.

Following are the details of that model, applied to MCRD. In its details, however, we have come to question its feasibility at the Depot.

Incoming recruits must be quarantined for seven days starting immediately upon their arrival at MCRD to ensure that any carriers of the influenza virus are prohibited from infecting other recruits or staff. To limit the potential spread of infection, no more than four recruits should be quarantined together in a room with its own shower/toilet facility. Quarantine would consist of confinement to

that room. A team, composed of a medical officer/physician's assistant and required number of corpsmen, would be quarantined with each class of recruits, and would begin the recruit health records, administer routine vaccinations, and monitor recruits for the onset of flu-like signs and symptoms. Recruits who develop a temperature of 38⁰ C or higher accompanied by respiratory or gastrointestinal signs or symptoms should be removed from quarantine; placed in isolation at the Depot in a "light duty" in-patient ward; treated with bed rest, fluids (by IV if necessary), antipyretics, supplemental oxygen if necessary, and a neuraminidase inhibitor drug at therapeutic doses; monitored, and transported by ambulance to the Naval Medical Center San Diego (NMCS D) if their respiratory rate reaches 25/minute or higher and pulse oximetry reaches 90% or less. The three roommates of this recruit should be started on neuraminidase inhibitor prophylaxis, as should the Depot medical team taking care of patients in the isolation unit. The medical personnel cohorted with the recruits in quarantine, and certainly those in the isolation unit, must follow strict infection control procedures to keep themselves healthy and to avoid transmitting infection from one room or patient to the next. To do this safely, these medical personnel will need to be trained, equipped with personal protective gear and fitted with N-95 respirators, given practice opportunities, tested, and monitored.

Even if recruits could be quarantined for seven days, then released to begin their training, they would have to be protected from the threat of infection by contact with the training and support staffs at the Depot. Many of the staff have young children; young children can shed significant amounts of influenza virus during regular flu seasons, sometimes for three or more days before they begin to show signs or symptoms of illness. The Depot command should designate those personnel who are essential to the training of the recruits, form them into shifts, and "deploy" one shift to the Depot, where they would be protectively sequestered for a period of time while they train the recruits, then released to home and be replaced by the next team. Teams coming off home leave would need, like the recruits, to be quarantined for seven days prior to assuming training duties and contact with the recruits. The Depot command would have to decide how to handle "deployed" personnel whose family members become ill and who request emergency leave to be with them.

Psychosocial Support Issues

Many if not most MCRD military personnel and civilian employees will not be aboard MCRD during an influenza pandemic. They will be at home, ill, caring for someone who is ill, in quarantine because of their exposure to a contact, caring for a child whose school has closed, or following the federal government's guidelines for social distancing. Few people, regardless of their advanced preparation, will be able to sustain themselves at home for the periods of time that may be necessary during an influenza pandemic. They will run out of supplies needed for daily living. Furthermore, as the novelty of staying home wears off, the potential for domestic violence and other inappropriate acting-out

behaviors will increase. The need for help in meeting the requirements for daily activities and in relieving stress will increase as the pandemic progresses. These needs became acute for those in home quarantine in the Greater Toronto Area during the SARS epidemic in early 2003 (7), where the duration of quarantine was only 10 days.

Providing this logistical and psychosocial support would probably most appropriately be handled through the service-member's or employee's chain of command. As part of its preparation for continuity of operations during a pandemic, the MCRD command may wish to examine its role and capabilities in these support activities. Adequate psychosocial support could be provided simply through periodic phone calls, exchanges of email, or intranet chat rooms. If not already available, a password-protected website could be useful for the Command's members to post and exchange messages.

Triggers

We expect that military health officials would take their cues regarding appropriate levels of disease containment strategies to employ, the timing of their initiation, and the timing of their discontinuation from federal public health and emergency management officials. We, therefore, did not attempt to provide trigger-events that would signal the need to impose these measures. Finally, we repeat that not all influenza pandemics are "worst-case scenarios." Mitigation strategies must be tailored to the severity of the pandemic.

Section II: Information Received during On-Site Visits

Processing Recruits upon their Arrival at MCRD San Diego

At the beginning of each week, for 40 of the 52 weeks each year, 300 to over 600 young men arrive at MCRD San Diego to begin 12 weeks of physically demanding basic training. Following successful completion of this training, the recruits are graduated as Marines and leave MCRD for further training elsewhere. These recruits come to MCRD San Diego primarily from communities throughout the western half of the US, from Alaska, and from countries in the Pacific basin. MCRD San Diego produces approximately half the enlisted Marines needed by the Marine Corps each fiscal year. (The other half comes from MCRD Parris Island, which receives male recruits primarily from the eastern half of the US, Europe, and elsewhere outside of the continental US. PI also receives and trains all female recruits, regardless of the locations of their hometowns.)

The number of recruits who are “shipped” by their recruiters to MCRD San Diego each week is determined several months in advance by Headquarters Marine Corps and is based on projected needs of the service and the anticipated attrition rate during recruit training. Table 1 lists, for FY-06/07, the average number of new recruits shipped to MCRD San Diego weekly each month, and the number of weeks in that month that MCRD accepts new recruits.

Table 1. Average Number of Recruits Shipped to MCRD San Diego
Each Week during FY-06 and FY-07

Month	Average Number of Recruits Shipped Each Week- FY06	Number of Weeks Recruits Received Each Month- FY06	Average Number of Recruits Shipped Each Week- FY07	Number of Weeks Recruits Received Each Month- FY07
Oct	571	3	534	3
Nov	393	3	420	3
Dec	478	2	312	3
Jan	514	4	486	4
Feb	317	3	312	3
Mar	313	3	311	3
Apr	306	3	323	3
May	314	4	403	3
June	639	4	624	4
July	643	3	573	4
Aug	497	5	597	4
Sep	632	3	590	3

From Table 1, it is seen that the number of recruits who would have to be quarantined would vary from month to month. A pandemic during February-May would involve fewer recruits, and presumably training staff, than a pandemic at other times. Possible quarters for quarantining recruits, proposed by MCRD senior staff, included BEQs, tents, and a rented hotel. Also discussed were issues associated with supporting recruits in quarantine (food, laundry, etc.) We appreciate the relative ease of housing them in tents that could be set up at the Depot, but are concerned that tents would not be conducive to effective infection control procedures and would, therefore, run the risk of aiding the spread of any infection present beyond those men confined to a given tent.

Sequestration of Training Staff

We explored with MCRD San Diego staff how and where essential training personnel might be quarantined after they report from home and before they assume their training duties, and how and where they might be sequestered after they emerge from quarantine and begin their training and training support duties. MCRD San Diego has minimal base housing; unlike PI, most of the Marines assigned to MCRD San Diego live in the surrounding civilian communities. Similarly, the logistical support of these sequestered staff members remained unresolved, other than the recognition that any support would have to avoid risk of infection.

Healthcare Support Issues (Branch Medical Clinic)

To provide healthcare support to a class of 300-350 recruits in quarantine for seven days, the Branch Medical Clinic at MCRD San Diego would need to quarantine with the recruits one physician or physician's assistant, two-four corpsmen, and one mental health technician. These healthcare personnel would, during this seven-day period, begin health records on the recruits, provide them with the battery of immunizations given to all incoming recruits (bicillin, pneumovax, MMR, PPD, hepatitis A and B, meningococcal vaccine, seasonal influenza vaccine or FluMist, and draw titers for varicella). They would also monitor the recruits' temperatures and health status daily, and evaluate and treat presentations of any new illnesses. To provide healthcare support to the recruits who would already be in training and to the essential training staff and support personnel who would be in protective sequestration on the base, the Branch Medical Clinic would be staffed with 60-75 healthcare professionals 24/7; the Clinic currently has 130 healthcare professionals on its staff. There would also be a skeleton dental staff to provide emergency dental care.

Three significant healthcare issues would likely occur which would require further thought and planning.

First, the onset of signs and symptoms of influenza may be indistinguishable from the presenting picture of adenovirus infection and other common recruit camp respiratory infections. Given this problem in differential diagnosis and the lack of timely and helpful laboratory assistance to aid in the diagnostic process, Branch Medical Clinic would likely remove from quarantine any recruit who presented with signs and symptoms suggestive of “flu-like” disease, isolate that recruit for further evaluation and treatment, and initiate antiviral prophylaxis against influenza with the roommates who were in quarantine with that recruit.

Second, for the medical personnel who would be quarantined with the recruits to be able to perform their duties safely during this seven-day period, they would need to follow strict infection control procedures as they moved from room to room and from recruit to recruit. Any break in procedure would risk their health and would also risk spreading infection from room to room in the quarantine facility. Healthcare personnel in quarantine with the recruits would require an adequate amount of protective garments, would need to be issued N-95 respirators and appropriately fitted, and trained rigorously in the use of these items and in infection control principles and practices. During the prepandemic period, Branch Medical Clinic healthcare personnel should be given ample opportunity to practice infection control procedures under qualified supervision.

Third, the Branch Medical Clinic at MCRD San Diego currently transfers to local civilian hospitals or to the Naval Medical Center San Diego (NMCS D) any medical or surgical problem that is beyond their scope of care. That support mechanism for the Clinic would not likely be as available during a significant influenza pandemic as during more normal periods. San Diego’s civilian hospitals have no surge capacity and would likely exhaust their bed spaces, including intensive care beds, ventilators, and other resources as the incidence of influenza rises in the County. NMCS D would likely have the same shortages. Even if field hospitals could be deployed to San Diego and set up, staffing them would likely be difficult because reserve medical personnel would not be available for call-up; they would be essential to their own communities. Therefore, MCRD’s Branch Medical Clinic should anticipate, and prepare for, the possibility that it would have to expand its own capabilities, including establishing its own in-patient “light duty” ward for non-flu-like-illnesses and an isolation ward for the evaluation and treatment of quarantined recruits who developed a flu-like illness.

Patients in this isolation ward would be monitored and transported to NMCS D if they required ventilation or other intensive care, e.g., a respiratory rate of 25 or higher per minute, and pulse oximetry of 90% or lower. To staff the isolation unit, augmentation of the Branch Clinic’s staff from NMCS D might be necessary, but difficult to accomplish. The Clinic and MCRD command would have to decide where to locate this isolation facility; supplemental oxygen could be provided patients who needed it from large 72 cubic foot green oxygen

cylinders, rather than from more elaborate in-wall systems. As with the medical personnel in quarantine with the recruits, medical personnel assigned to the isolation facility would need to be able to follow infection control procedures strictly. NMCS D infection control personnel could provide the training and equipment before a pandemic starts, but would probably be unavailable to monitor compliance in the midst of a pandemic. The isolation unit medical team should also be provided with neuraminidase inhibitor prophylaxis.

Healthcare Support Issues (NMCS D and other Naval Medical Facilities)

NMCS D Pandemic Influenza Planning

Influenza planning is actively underway at NMCS D. As of now, NMCS D expects that the branch medical clinics would remain open and that NMCS D would be able to continue to provide limited support to them, although perhaps by specialists who are not normally in that position, e.g., neonatologists. NMCS D envisions that the 32nd Street Naval Station would close and healthcare manpower there would be “pulled back” to NMCS D. Essential care would continue at NMCS D, at the branch clinics, and at the large Tricare Outpatient Clinics, but non-essential services such as elective surgery and well-baby checks would be cancelled. NMCS D would become a “flu hospital,” and nurse-to-patient ratios would be modified to permit the hospital to accept more patients for in-patient care.

NMCS D’s new neonatal and pediatric intensive care units are temporarily closed while their air ducts undergo cleaning. The cardiac care unit has 7-10 beds, with separate rooms currently operating as the intensive care units for neonatal and pediatric patients. NMCS D’s newly renovated intensive care unit has 16 separate beds in controlled air flow rooms. Ventilators in the intensive care units and elsewhere in NMCS D are being reassessed with the goal of increasing their numbers. Upon replacement, the older machines are being stored for emergency use and not sent for Defense Reutilization Marketing Office (DRMO) processing. In addition to the larger machines, NMCS D has 50 IMPACT portable ventilators, and isocontainers with additional equipment (including N-95 respirators) have arrived.

The USNS Mercy (TAH-19) has approximately 80-90 ventilators: 50 full-sized models with recently acquired Puritan Bennett 760s and several models capable of neonatal ventilations, plus 25-30 IMPACT portable ventilators. The hospital ship’s 18 anesthesia machines also have ventilation capability. (Despite its size and bed capacity, the USNS Mercy has only limited respiratory isolation facilities [16 gurney-sized beds in very close proximity]. Also, the Mercy’s close quarters and open ward areas further limit its potential role in caring for large numbers of influenza patients during a severe pandemic. It does have its own oxygen plant. Furthermore, the hospital ship’s medical staffing comes from

NMCSO and other Navy medical facilities; these personnel would likely be unavailable for deployment to the hospital ship during a severe influenza pandemic, and the recall of military healthcare reservists is also not a likely option because of their need in their civilian communities.)

Laboratory Diagnostic Support

NMCSO has no viral diagnostic capability for influenza other than rapid influenza testing which lacks adequate sensitivity and specificity.

The Naval Health Research Center (NHRC) is an epidemiological research organization and is not charged with routine clinical diagnostic support to physicians for clinical care decisions. NHRC is capable of 5,000 flu tests per week when fully focused on influenza testing. NHRC is certified by the College of American Pathologists (CAP) for influenza viral culture and polymerase chain reaction (PCR) testing. Triangulation Identification for the Genetic Evaluation of Risks (TIGER) technology, which employs a combination of PCR, mass spectrometry, and signal processing, is also available at NHRC, but TIGER is not yet CAP-certified.

The Navy Environmental and Preventive Medicine Unit Five (NEPMU-5) in San Diego has PCR laboratory capabilities (a small light cycler) and could perform 10-15 PCR pandemic flu tests per day with its available personnel. NEPMU-5 currently has primers to detect H5 influenza.

Oseltamivir

NMCSO currently has 5,000 treatment courses (twice daily for five days) of oseltamivir for treatment of staff at dosages for seasonal influenza. H5N1 may require higher treatment dosages and, thereby, limit the coverage with this stock. The drug has a shelf-life of approximately five years. Additional neuraminidase inhibitor purchases would require guidance from the Navy's Bureau of Medicine and Surgery and, if for MCRD, they would require local decisions between the MCRD Commanding General and the NMCSO Commander.

Establishing Restricted Areas at MCRD San Diego

Passage through MCRD's gates would be limited to essential personnel, service providers, and deliveries of needed supplies. The Depot would be off-limits to visitors, tourists, and other non-essential personnel during a pandemic's wave. That part of the Depot that is essential to recruit housing, feeding, and training should be off-limits to anyone not involved with those activities; the Provost Marshal's Office estimates this would be about half the Depot. Security would also need to be established around the facilities housing people in quarantine. By calling on reserve military police forces available to it from the

Headquarters and Service Battalion at MCRD San Diego, the Depot's Provost Marshal's Office believes it could undertake these security missions.

Continuing deliveries of essential goods is likely to be critical during a pandemic, with our just-in-time economy. Threats of disease transmission posed by these deliveries would most likely come from delivery personnel, who could be instructed to off-load their packages at some secure site, and leave. Depot personnel would then retrieve them. Another potential threat of disease transmission results from the fact that seasonal influenza virus has been shown to survive on surfaces for 24-48 hours. Decontamination of these surfaces might be possible, in accordance with approved disinfection procedures, or these packages could simply be left "in quarantine" for a little over 48 hours. A more difficult issue arises from the unlikely but possible contamination of perishable food items that could not be easily decontaminated. Because they are perishable, they need to be refrigerated; cold temperature, however, prolongs virus survivability. At present, there are few data to guide safe processing of these food deliveries.

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