Contemporary Perspectives on Risk Perceptions, Health-Protective Behaviors, and Control of Emerging Infectious Diseases

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Emerging and re-emerging infectious diseases present a significant and growing threat to human health within individual countries and globally [1–4]. Of some concern are evolving or novel strains of infectious disease agents where human immunity may be limited including the highly pathogenic avian influenza A(H5N1), subtypes of influenza A(H1N1) (associated with the deadly 1918 and the 2009–2010 pandemics), the virus responsible for severe acute respiratory syndrome, and multidrug-resistant bacterial strains [1, 2, 5, 6]. Local or widespread outbreaks, including influenza pandemics, are largely unpredictable and periodically emerge with a potential for extreme public health, economic, and social consequences [2, 3, 6–9]. Importantly, human behavior plays a major role in the spread of infectious diseases [6, 10]. Public health strategies to reduce an outbreak's impact rely heavily on prompting timely individual actions, including decisions about vaccines and other health-protective behaviors [2, 6, 11]. However, evidence from psychology, behavioral medicine, and public health reveals that many at-risk individuals are reluctant, refuse, or are unable to act in a timely manner despite strong precaution adoption recommendations during a confirmed public health emergency or infectious disease outbreak [8, 10, 12–14].

Individuals' failure or inability to adopt prescribed precautionary behaviors is an anticipated major challenge for minimization of mortality and morbidity during an infectious disease epidemic or pandemic [6, 15, 16]. Furthermore, precaution adoption is often unequal across subpopulations within a country and frequently varies across

segments of society defined by race or ethnicity, socioeconomic circumstances, geography, education, and other determinants of social position [3, 12, 13, 16–21]. Providing the public with facts about an emerging infectious disease episode is a necessary but insufficient step for containment. Public knowledge about infectious disease risk, experts' views about effectiveness of health-protective actions, or access to pharmaceutical interventions (e.g., vaccines) will not be the sole or even most significant determinants of health-protective behaviors during an emerging episode [22–23]. Risk perceptions and subjective appraisals of the situation greatly influence whether and when a recommended protective action is likely to be adopted [24–27]. Health and risk communications during an outbreak must address those perceptions, life circumstances, and other forces that may be incompatible with suggested behavioral change [13, 14, 18, 19, 28]. This requires an understanding of the psychology of risk perceptions and precaution adoption, and the influence of social, economic, and cultural contexts within which individual-level responses are embedded. Without this informed approach, planned public health interventions will have limited success [21, 22, 29].

Over the past two decades, significant progress and discoveries have been made in understanding risk perceptions, their relationship with health-protective behaviors, and central role in public health efforts to control emerging infectious diseases [25, 30–32]. Theoretical perspectives and empirical research increasingly are more comprehensive in defining what contributes to risk perceptions, situation awareness, and risk-reduction behaviors during an emerging infectious disease incident. Traditional psychological models of precaution adoption or health behavior change have been used to explain health-protective actions during an infectious disease threat, and these mostly have

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emphasized cognitive dimensions of risk perceptions (e.g., perceived susceptibility, perceived severity of the threat) [25, 33–38], including appraisals of the safety, effectiveness, and necessity of recommended actions [14, 34, 36, 39]. The majority of these models consider responses in isolation of prior experiences and life circumstances that affect how individuals evaluate risk information [14, 16]. In contrast, more contemporary perspectives also take into account broader influences such as emotions, social processes, cultural values or beliefs, socioeconomic conditions, trust in public health authorities, and the timing or characteristics of events associated with the infectious disease outbreak. Newer perspectives build on traditional models in several ways and consider the strong association between certain emotions (e.g., regret, fear, worry) and health-protective behaviors [15, 27, 40–43], the persistent social disparities in the adoption of precautionary actions and the effectiveness of risk-reduction policies [7, 12–14, 41, 44], the effects of cultural and social processes on perceptions and behaviors [7, 16, 44–46], and the dynamics of infectious disease episodes that may prompt modifications in responses as individuals react to situational developments [13, 14, 22, 47–49]. For example, as an infectious disease event progresses, changes can occur in profiles of those most vulnerable to infection or medical complications, proximity to or personal knowledge of affected individuals, seriousness of average or extreme cases, and perceptions of social norms regarding risk or recommended actions [13, 22, 25, 47–50].

This special issue of *IJBM* includes five empirical articles that reflect these more contemporary views of infectious disease risk perceptions and their relationship with precautionary behavior. Several articles also demonstrate the challenges of controlling infectious diseases across diverse populations. The first article by Goodwin et al. [51] considers associations between worry about a pandemic influenza threat and behavioral responses. The paper reports results of an online questionnaire study of predictors of early reactions to the 2009 H1N1 pandemic among European residents of Portuguese, British, or Finnish background. Goodwin et al. found an association between personal worry about H1N1 and avoidance and preparatory behaviors, and that those who held certain cultural values and beliefs that family and friends worried about the influenza threat were more concerned about personal risk and risk to family members from the outbreak. The significant association between personal worry and judgments about the level of worry of significant others suggests the potential importance of social processes in how individuals react to an emerging infectious disease pandemic. The authors also noted that their study occurred early in the pandemic and that responses could be time sensitive.

In the second article of this series, Liao and colleagues [52] also adopt a broader perspective on contributors to individual-level responses during an infectious disease outbreak. The authors describe a study of health-protective actions (non-pharmaceutical) and consider the relative role of worry and cognitive factors in the adoption of personal precautionary behaviors. Liao et al. examined strength of associations between trust in formal and informal information sources, knowledge, perceived effectiveness of precautionary behaviors, perceived risk susceptibility, worry and precautionary practices, and used structural equation modeling to identify pathways that link these concepts. Two independent survey datasets were used to test associations and represented different infectious disease circumstances. Samples were drawn from the general Hong Kong population, but the first survey focused on avian influenza A(H5N1) responses during the epidemic's peak in Southeast Asia during late 2005 and early 2006, and the second measured responses during early stages of the 2009 influenza A(H1N1) pandemic. Survey data found support for the role of knowledge, trust in formal information sources, and perceived effectiveness of precautionary practices in the adoption of health-protective behaviors. Liao et al. also found that trust in formal information may influence behavior partially because it affects judgments about the effectiveness of personal precautionary actions. However, there were differences between the surveys in the association between worry and precautionary behaviors, and Liao and colleagues speculated that characteristics of an influenza outbreak (e.g., severity of cases) or the historical context of an emerging infectious disease could affect relationships among trust, risk perceptions, worry, and personal hygiene practices.

The third article by Wong [53] highlights the importance of considering broader social, cultural, and economic contexts of infectious disease control in multiethnic, multi-religious societies, and within medically underserved populations. This study examined behavioral intentions to receive a newly introduced vaccine to reduce the risk of human papillomavirus (HPV), a sexually transmitted infectious disease agent associated with cervical cancer. Wong considers possible challenges of HPV immunization in a population of ethnically diverse rural women in Malaysia where barriers to a successful immunization program not only include the availability and cost of the vaccine but also could include social and cultural factors, certain risk perceptions, and knowledge about HPV and vaccine benefits. Wong found that knowledge about HPV and the new vaccine was extremely low, and varied by education, age, relationship status (e.g., married or single), and ethnicity, with Chinese women less knowledgeable about HPV, risk factors for cervical cancer, and the vaccine than women from a Malay or Indian background. After

interviewers provided information about HPV, the majority indicated an intention to receive the vaccine. However, a significant percentage still would refuse vaccination, and reasons included doubts about vaccine safety and effectiveness, embarrassment, and a low perception of risk from HPV. Wong noted that embarrassment was mentioned by many women in the study, but was much more likely to be a factor for Muslim women. Wong emphasized the importance of closing the knowledge gap about HPV in this diverse population but argued that efforts also should be made to address perceptions and social stigma that may limit vaccine acceptance and uptake.

The next article in this series by Wong and Sam [54] considered knowledge and risk perceptions as possible contributors to success or failure of control and containment strategies during an emerging infectious disease outbreak. Within multiethnic communities in Malaysia, the authors examined attitudes and knowledge about the 2009 H1N1 influenza outbreak soon after the WHO had declared a worldwide pandemic. This population-based interview study included diverse ethnic and sociodemographic groups and explored cultural and social variation in perceptions of H1N1 risk, knowledge, and the stigma associated with H1N1 infection. The study revealed ethnic and other sociodemographic differences in the prevalence of misconceptions about how H1N1 infection could occur and the mortality rate once infected. In addition, knowledge about the outbreak varied across sociodemographic groups with lower knowledge scores associated with being male, of Malay background (as opposed to Chinese or Indian), having less formal education and income, and residing in rural localities. Individuals tended to perceive themselves and family members as being at low risk for contracting H1N1 and were confident that they could prevent infection. Different sociodemographic groups varied in the likelihood of these perceptions. The results also confirmed the prevalence of influenza A(H1N1)-related stigma among certain populations and ethnic differences in beliefs about the stigma associated with contracting H1N1. As the authors discussed, there may be different information needs, misconceptions, and concerns among diverse subpopulations within a country, and these could influence the success of containment efforts for an emerging infectious disease.

The final article in this series illustrates the value of understanding broader social circumstances of potentially affected populations when designing public health communication campaigns to contain an infectious disease outbreak. Within a sample of young adults in Karachi, Pakistan, Farid-ul-Hasnain and Krantz [55] conducted a population-based questionnaire study of risk factors for involuntarily leaving school or college and implications for awareness about HIV/AIDS and sexually transmitted diseases (STDs). Overall, there was low awareness of

STDs in this sample. However, the authors found that economic disadvantage, migrant residential status, and living in an extended family were associated with a greater likelihood of dropping out of school or college and that some of these individuals, specifically the young adult males, had even lower awareness rates and knowledge of HIV/AIDS and STDs than others. Although this cross-sectional study cannot demonstrate a causal association between school dropout rates and levels of awareness of STDs, it provides a profile of a group of young adults where efforts to provide information about certain infectious diseases should be prioritized and life circumstances reflected in public health outreach strategies.

In summary, the five articles in this special series reflect newer “contextual” perspectives on relationships between risk perceptions, protective behaviors, and the control of emerging infectious diseases. Many public health strategies for containment and mitigation depend on a significant percentage of the population acting in prescribed ways to prevent infection and reduce disease transmission. This series suggests that infectious disease communications and policies must be responsive to perceptions, emotions, trust, knowledge, social stigma, and other barriers to behavioral change that may be present to different degrees in dissimilar social and cultural “environments.” This special issue of *IJBM* provides convincing evidence for the necessity of comprehensive frameworks to understand human behavior and decisions during an emerging infectious disease epidemic or pandemic.

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