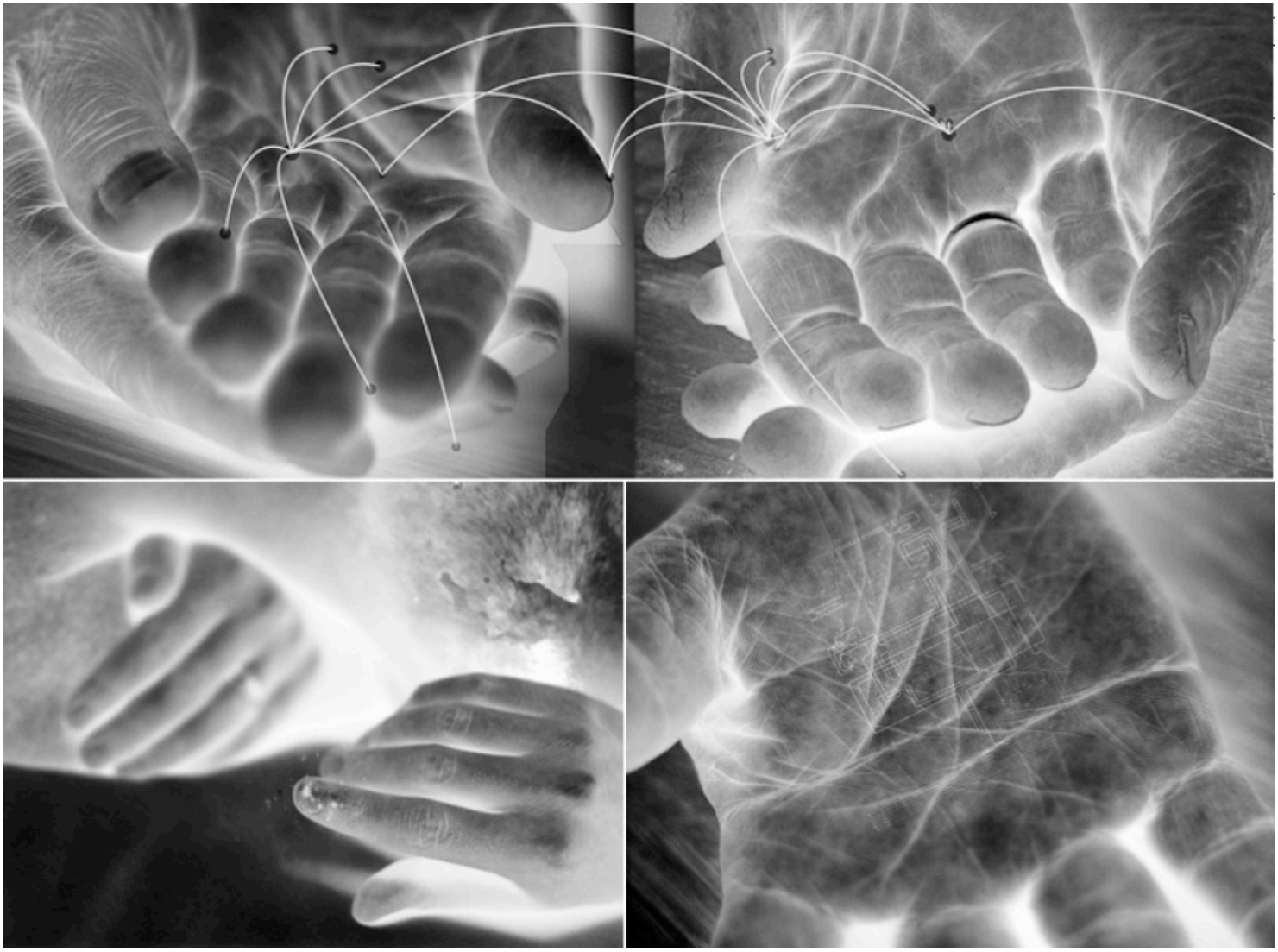
HEALTH SCIENCE INQUIRY

A publication platform for graduate students to discuss, discover, and inquire…



Cover By: Karen Garrett de Luna
http://www.delunatic.net

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Artist In Residence

Karen Garrett de Luna is a Vancouver based artist working primarily in photography, movement and interactive installation. Currently a graduate student at Emily Carr University of Art + Design, she is working on an interactive installation (a swarm of LED fireflies called 'Ning Ning') for Toronto's Nuit Blanche in the fall. Working at the intersection of body and spirit, her work often reflects overlooked details of the human experience. In addition to designing the cover art for this issue, Karen also has a few of her art pieces displayed throughout the journal.

EDITORIAL TEAM

Get Involved!

Health Science Inquiry will be publishing a new issue every year (around June), and we welcome all Canadian graduate students to get involved with journal. As always, we continue to accept applicants who are interested in becoming **reviewers**, **outreach representatives**, **layout associates**, **website designers**, or any other editorial position which could benefit the journal. If you're interested, feel free to email us (healthscienceinquiry@gmail.com) and visit our website (http://hsinquiry.sa.utoronto.ca) for more details on how to apply.

Introduction

FROM THE EDITOR-IN-CHIEF

Dear Readers

We would like to welcome you to the inaugural issue of Health Science Inquiry! As graduate students, research plays a definitive role in our training and understanding of the scientific process. In establishing this journal, we hope to provide graduate students with an opportunity to discuss and share their thoughts on the many issues that help make science such an exciting subject. Though based at the University of Toronto, Health Science Inquiry is a Canada-wide publication with student and faculty involvement from over 10 Canadian universities. We are also very privileged to have partnered with The Lancet Infectious Diseases – a world-class journal in infectious diseases – for this first issue. To that end, I would like to thank John McConnell (*Editor, The Lancet Infectious Diseases)* for providing us with this invaluable opportunity, which is undoubtedly one of the highlights of this publication.

Rather than having a wide spectrum of topics covered in each issue, a decision was made early in the process to focus on a single topic every year. Choosing the H1N1 pandemic as a topic of interest this year presented us with a platform for leveled discussion on something that was both relevant and appealing to the scientific community. Students were asked to comment on the management of the H1N1 influenza as a global pandemic from a variety of different aspects. What we have is a collection of 13 commentaries covering a wide spectrum of interesting perspectives.

I would like to take this time to also personally thank all the students and faculty members who have dedicated their time and efforts in creating this publication. A special thanks goes out to Dr. Michelle Arnot (*Department of Pharmacology, University of Toronto*) for her generous support and contribution during the early stages of the journal. It's been almost a year in planning, and I think everyone's hard work and commitment to the journal really shows in the coming pages. As a reader, I hope you will enjoy this first issue as much as the editorial team and authors enjoyed putting it together. If you have any comments/suggestions or would like to get involved with the next issue, feel free to email (healthscienceinquiry@gmail.com) or visit us at our website (hsinquiry.sa.utoronto.ca).

Sincerely,

Wilson Kwong
Founding Editor-in-Chief

How HSI Works

Call for Submissions

Back in December of 2009, graduate students from all across Canada were asked to submit commentaries on various aspects of the H1N1 pandemic. The commentaries were 600-700 words in length (maximum of 15 references) and focused on one of three specified topics of interest:

- Development and deployment of ***vaccinations***
- ***Surveillance*** and ***response*** to H1N1
- H1N1 as a ***global pandemic***

Review / Revisions

Starting in late March, each submission was reviewed by 2 different members of our editorial review board. Reviewers provided feedback to the authors by critically assessing the content and writing of each commentary. After receiving comments from the review board, authors were given 2 weeks to revise their submission and resubmit their manuscript to the journal. A Senior Editor was then given the task of going through each commentary and providing final comments to the authors.

Judging Process

Faculty members from Canadian universities (see Page 5) were recruited as advisors, playing an instrumental role in the judging process of the journal. For each of the above three categories, 3-4 faculty advisors were assigned to rank each of the submissions in order of preference. A score was then assigned to each paper depending on how it was collectively ranked by all faculty members:

Example:
Rank #1: Paper 1C = 5 Points
Rank #2: Paper 1A = 4 Points
Rank #3: Paper 1D = 3 Points
Rank #4: Paper 1B = 2 Points

TIMELINE

Submission
[January to April]
Students submitted **600-700 word** commentaries (max 15 references) on one of 3 areas pertaining H1N1.

Review/Editing
[April to May]
An editing team commented on the writing and content of each submission, giving students a chance to revise their submissions.

Faculty Judging
[Early- to Mid-May]
Faculty members judged the submissions and selected the top paper from each of the 3 categories.

Prize Winners
[End of May]
Authors of each of the 3 top papers were rewarded by THE LANCET Infectious Diseases

Publication
[Early June]
All the submissions were published online and in a distributable pdf format.

Winners

After processing the rankings from all our faculty advisors, a combined score was tabulated for each submission. The authors of the highest scoring paper for each category received a free 1-year subscription to The Lancet Infectious Diseases. In addition, one of the papers were granted expedited review for publication in The Lancet Infectious Diseases.

The quality and creativeness of all the submissions were outstanding, and both the editorial team and faculty advisors highly commend the authors for their achievement and hard work! After tabulating the results, we are pleased to announce the winning submissions for the first issue of Health Science Inquiry. Each of the authors have received a free 1-year subscription to The Lancet Infectious Diseases, and **Chelsea Himsworth**'s paper (*If a Pig Coughs in Mexico the Whole World Should Hear It*) will also be published as a 'Reflection and Reaction' piece in an upcoming issue of the journal.

Development and Deployment of Vaccinations

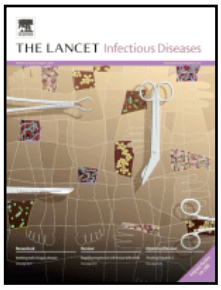
Matti Allen ***(Page 15)***
Public Mistrust as a Barrier to Mass Vaccination During Influenza A (H1N1)

Surveillance and Response to H1N1

Inderjeet Sahota ***(Page 23)***
Post-analysis of the Swine Flu Pandemic: Overreaction or Necessary Precaution?

H1N1 as a Global Pandemic

Chelsea Himsworth ***(Page 29)***
If a Pig Coughs in Mexico the Whole World Should Hear It



Chelsea Himsworth's paper (Page 29) will also be published as a 'Reflection and Reaction' piece in an upcoming issue of THE LANCET Infectious Diseases

Faculty Advisors

We are very fortunate to have the involvement of 11 distinguished faculty members from all across Canada for this first issue of Health Science Inquiry. Each faculty advisor was assigned to one of the three categories students were asked to write commentaries on, and their main responsibilities were to judge and comment on the submissions within each category.

Category 1: Development and Deployment of Vaccinations

Michelle Arnot, PhD

University of Toronto

Dr. Michelle Arnot received a B.Sc. in Life Sciences at Queens University in Kingston, Ontario. Her PhD research was conducted at the University of Alberta in Neuropharmacology with Drs Ian Martin and Alan Bateson, examining the modulation of ion channels following long term drug exposure. After completion of her graduate studies she worked for an educational outreach group in Calgary, Alberta developing educational programs for teachers. Michelle's postdoctoral research focused on ion channels and the regulation of neuronal excitability at the University of Calgary with Dr Gerald Zamponi and at George Washington University in Washington DC with Dr Tim Hales. She held a faculty position at the University of Maryland (College Park) teaching Cell Biology and Physiology. Michelle joined the Department of Pharmacology and Toxicology at the University of Toronto in 2007. She continues to conduct research on the modulation of ion channels in both the brain and the heart; however, her main focus at U of T is teaching, challenging her students and sharing her enthusiasm for pharmacology in a variety of undergraduate courses.

Zabrina Brumme, PhD

Simon Fraser University

Dr. Zabrina Brumme received her Ph.D. in Experimental Medicine in 2006 from the University of British Columbia. She then went on to complete a post-doctoral fellowship at the Ragon Institute of MGH, MIT and Harvard University (formerly known as the Partners AIDS Research Center), in Boston, Massachusetts. She joined Simon Fraser University's Faculty of Health Sciences as Assistant Professor, Molecular Epidemiology of Infectious Diseases, in September 2009. Dr. Brumme's current research integrates molecular biology, epidemiology and computational approaches to study HIV evolution in response to selection pressures imposed by the human cellular immune response. Dr. Brumme is also interested in studying how human immune selection pressures have shaped HIV evolution over the course of the epidemic, and the implications of this on vaccine design. Most recently, Dr. Brumme's work has focused on assessing the consequences of immune escape mutations to HIV replication and viral protein function.

Myron Szewczuk, PhD

Queen's University

Dr. Myron Szewczuk received his Ph.D. degree in Biology & Immunology from the University of Windsor. He had a Killiam and NIH Postdoctoral Fellowship in Cellular Immunology at Cornell University Medical School in New York City. His first appointment was as an Assistant Professor of Pathology at McMaster University in 1978. In 1981, he went to Queen's University and became a tenured Full Professor of Immunology and Associate Professor of Medicine in 1987. Currently, Dr. Szewczuk is still at Queen's teaching undergraduate and graduate students. He also has an active research program training Ph.D. students in the field of immunology.

Category 2: Surveillance and Response to H1N1

Angela Bowen, RN, BSN, MEd, PhD

University of Saskatchewan

Dr. Angela Bowen is an Associate Professor in the College of Nursing and member of the Department of Psychiatry at the University of Saskatchewan. She is a Registered Nurse with extensive clinical, educator, and administrator experience in Obstetrics and Mental Health. Her research focus, Maternal Mental Health, brings these areas together. She is co-principal investigator of a longitudinal study of depression in pregnant and postpartum women in Saskatchewan. Angela received a Saskatchewan Health Research Foundation New Investigator Establishment Award to evaluate the Maternal Mental Health Program that she spearheaded in Saskatoon. She is presently involved in knowledge translation activities to increase awareness of maternal mental health throughout Saskatchewan and she is leading a provincial working group that has developed policy recommendations related to maternal mental health for submission to the government this summer.

Susan Poutanen, MD, MPH, FRCPC

University of Toronto

Dr. Susan Poutanen received her Medical Degree from the University of Toronto in 1996 and subsequently completed Internal Medicine and Medical Microbiology Residencies at the University of Toronto and an Infectious Diseases Fellowship at Stanford University, California. She received her Masters of Public Health with a focus on Epidemiology from the University of California, Berkeley in 2002. Dr. Poutanen is employed as a Medical Microbiologist and Infectious Diseases Physician at Mount Sinai Hospital & University Health Network in Toronto, Canada and an assistant professor in the Department of Laboratory Medicine and Pathobiology and Department of Medicine at the University of Toronto. Dr. Poutanen's responsibilities are shared between clinical service, teaching, and research. Dr. Poutanen's broad research interests include the epidemiology and prevention of antimicrobial resistance and the diagnosis of and preparedness for emerging and re-emerging infectious diseases such as pandemic influenza, *Clostridium difficile*, and Severe Acute Respiratory Syndrome (SARS).

John Calvert, MA, PhD

Simon Fraser University

Dr. Calvert is a political scientist with a specialization in public policy. After completing his BA and MA at the University of Western Ontario, he enrolled at the London School of Economics, where he obtained his PhD in the Government Department. His teaching and research interests are in the areas of Canadian public policy and health, the impact of international trade agreements on health policy, privatization and workers' occupational health and safety. He has published a number of books and articles on Canadian and international public policy and economic issues. Prior to coming to Simon Fraser University, Dr. Calvert worked for a number of years in the BC government as a policy advisor in the trade policy area and in the Ministries of Labour, Employment and Investment and the Crown Corporations Secretariat. Dr. Calvert is currently working on a project examining the effectiveness of workplace health and safety committees in reducing the incidence of occupational accidents in the construction industry. Another of his research interests is how international trade agreements are re-shaping domestic health policy in the countries which are signatories to them and, particularly, the GATS and TRIPS agreements.

Karen Goodman, PhD

University of Alberta

Dr. Karen Goodman completed graduate studies at the University of California, Los Angeles (MPH, MA in Latin American Studies, PhD in Epidemiology). She is currently an Associate Professor of Epidemiology in the Departments of Medicine and Public Health Sciences and AHFMR Health Senior Scholar. Her main research focus is population-based epidemiologic studies of *H. pylori* infection and its link to stomach cancer. An internationally recognized expert on the epidemiology of *H. pylori* infection, Dr. Goodman currently leads the Canadian North *Helicobacter pylori* (CAN*Help*) Working Group, which aims to address community concerns in northern Canada about health risks from *H. pylori* infection. This community-driven research is a broad collaboration of diverse experts including community leaders, epidemiologists, health policy experts, anthropologists, microbiologists, pathologists, clinicians, technology industry consultants, and health services decision makers.

Category 3: H1N1 as a Global Pandemic

Matthew Muller, PhD, MD

University of Toronto

Dr. Matthew Muller completed a degree in biochemistry at McGill University, followed by a medical degree and internal medicine and infectious diseases residencies at the University of Toronto. Following the completion of his clinical training, he completed a PhD in clinical epidemiology, also at the University of Toronto. Currently, Dr. Muller is the associate medical director of infection prevention and control at St. Michael's Hospital and assistant professor of medicine at the University of Toronto. His research interests are in the epidemiology and control of hospital acquired infections, MRSA, ESBL and *C.difficile*. He also has a research interest in hand hygiene, particularly in novel technology to support the improvements in, and measurement of, hand hygiene compliance in healthcare settings.

Gerald Evans, MD, FRCPC

Queen's University

Dr. Gerald Evans is an Associate Professor in the Departments of Medicine, Microbiology & Immunology, and Pathology & Molecular Medicine at Queen's University and an Infectious Diseases specialist at Kingston General Hospital and Hotel Dieu Hospital in Kingston, Ontario. He has an active clinical practice in Infectious Diseases and HIV care. He has published numerous articles and guidelines on the management of infectious diseases. In addition to being Chair of the Ontario Ministry of Health & Long-term Care's Committee to Evaluate Drugs, Dr. Evans is also Past President of the Association for Medical Microbiology and Infectious Disease (AMMI) Canada.

Nicola Cherry, MD, PhD, FRCP, FRCP(C), FFOM

University of Alberta

Dr. Nicola Cherry is an epidemiologist who graduated in medicine and epidemiology from McGill after obtaining a PhD in psychology at the University of London (UK). She has worked in occupational and environmental health on both sides of the Atlantic, first with the UK Medical Research Council, then at the Institute for Occupational Health at the London School of Hygiene, followed by time in Quebec, at the Provincial Research Institute for Health and Safety at Work and then at the McGill School of Occupational Health and the Department of Epidemiology. From there she returned to the UK to be Director of the Centre of Occupational and Environmental Health at the University of Manchester and Head of the School of Epidemiology and Health Sciences. She returned to Canada in 2000, and until 2006 served as Chair of the Department of Public Health Sciences. Dr. Cherry has wide research interests including surveillance, intervention and its evaluation, molecular markers and the effects of chemicals on the nervous and reproductive system.

Lawrence Elliott, MD, FRCPC

University of Manitoba

Lawrence Elliott received his premedical university education at Queen's University, and his medical school education at the University of Manitoba, graduating in 1985. He completed a Family Medicine Residency at Dalhousie University, then practiced Family Medicine in Northern Manitoba, Nunavut, the Yukon Territory, and the inner city of Winnipeg between 1987 and 1992. Having developed an interest in the underlying causes and prevention of illness, Dr. Elliott then completed the Community Medicine Residency Program and Master of Science in Community Health Sciences at The University of Manitoba, from 1992 to 1995. He went on to do a Fellowship in Applied Epidemiology with the U.S. Centers for Disease Control and Prevention, from 1995 to 1997. He then returned to Manitoba to practice Community Medicine and applied epidemiology with the Public Health Branch of Manitoba Health, and serve as the Program Director of the Community Medicine Residency Program at the University of Manitoba. Dr. Elliott has been a full-time member of the Faculty of Medicine since 2000, and was promoted to Associate Professor in the Departments of Community Health Sciences and Medical Microbiology in 2006. His teaching focuses on applied public health epidemiology, and the practice of Community Medicine. His research interests include the epidemiology and prevention of communicable diseases (primarily HIV, STI and tuberculosis), as well as the epidemiology of multiple sclerosis. Dr. Elliott was Acting Department Head from July 2007 to October 2008.

Brief Editorial

Student Writing in Academia

By Inderjeet Sahota

Writing is an integral part of academia. The free flow of information is what allows science to continue developing, and without the ability to write these ideas down in a coherent and comprehensive manner, this transmission would not be possible. As students of science, the ability to write and allow for this exchange is an important component of our training. Scientific advancement, and arguably human advancement on many levels, relies strongly on this element of discussion. Through dialogue we are able to communicate our perspectives and hear the perspectives of others. In this we have the opportunity to gain new insight, develop new ideas and expand our knowledge of the world.

And this is what Health Science Inquiry is about.

When Wilson Kwong, Editor-in-Chief of HSI, introduced the idea to me last year I was thrilled to hear that somebody out there had taken the initiative to allow this element of discussion to flourish between Canadian graduate students in the health sciences. As a strong believer in student-based based communication of ideas, I was already a regular contributor to other publications, such as the UK-based *The Lancet Student.* However, the prospect of being involved in *creating* a forum for discussion between graduate students right here at home was far more exciting. Over the months we slowly started to put the pieces of HSI together. By recruiting student representatives, faculty advisors, editors, reviewers, layout and design specialists as well as proof-readers from across the country, we did whatever we thought possible to make this journal a truly nationwide initiative.

As HSI takes its initial steps in this inaugural issue, I sincerely hope that it will one day become a great publication for students to gain new insight from their peers across the country. I also hope that students from all areas of health science will join and contribute to the discussion by offering their unique perspective on the issue. After all, this journal is for you, and it will only be as great as the students that get involved.

Inderjeet Sahota
Managing Editor

Call for Submissions: Issue 2 (June 2011)

Health Science Inquiry will be publishing a new issue every year (June), and we welcome all Canadian graduate students to submit to us. We will be focusing on **Cancer** for our next issue, and although the full details are still being worked out, we will once again be partnering with a peer-reviewed journal and be implementing a similar competition for students.

In addition to these structured commentaries on various aspects of **Cancer**, we will also be accepting news articles and creative editorial pieces for the next issue of Health Science Inquiry. These submissions can focus on any topic within the health sciences, and serve to compliment the rest of the issue. If you're interested in writing a piece or have any questions about our next issue, visit our website (http://hsinquiry.sa.utoronto.ca) or email us (healthscienceinquiry@gmail.com)!

The Vulnerability of Aboriginal People to the H1N1 Flu Virus

By Lyndsay O'Brecht

In April 2009, the first incident of the 2009 H1N1 flu pandemic occurred in North America[1]. By June, H1N1 had spread internationally, with cases reported in 74 countries[1]. Unlike the seasonal flu, young individuals who were usually more immune to the flu had little or no immunity against this strain[1, 2]. Consequently, it was feared that H1N1 would result in vast worldwide mortality similar to those observed in the 1918-1919 pandemic[1, 3].

With the introduction of a vaccine, the Canadian Pandemic Influenza Plan for the Health Sector (CPIP) issued a prioritization framework in order to protect those most susceptible to infection. The CPIP set out goals to administer the vaccine to all Canadians, monitor the effectiveness of the vaccine and prioritize distribution to high risk groups. High risk groups included children, pregnant women, people with certain underlying medical conditions (i.e. diabetes) and people with severely compromised immune systems[1, 4]. The World Health Organization (WHO) named Aboriginal people (AP) an at risk group to contract H1N1[5].

Canadian Aboriginals consist of approximately 60,000 Inuit, 300,000 Métis and almost 1,000,000 First Nations (FN) individuals[6]. Common to all Aboriginal groups is a heritage of colonisation, which has resulted in loss of culture, language, land, and status. Over time this forced transition left obvious scars, with under education and poverty becoming unfortunate traits of the Aboriginal communities (AC) [2, 7-9]. In AC, accessibility to hospitals is poor, overcrowding is frequent and incidences of medical conditions such as diabetes, respiratory tract illness, immune suppressing diseases (i.e. tuberculosis) and malnutrition is high[6,7,9].

The FN communities, predominantly located in Manitoba and Northern Ontario, are isolated and impoverished[2-4, 9]. Although FN comprise only 10% of Manitoba's population, this

10% accounted for one third of the 685 H1N1 cases as of July, 2009[9]. The Influenza virus may take a longer time to reach isolated AC, but the spread is rapid with higher fatalities compared to non-aboriginal populations[2-4, 9].

The 2009 Health Canada (HC) budget included $305 million over two years allocated to FN and Inuit communities to strengthen health care infrastructure. In April 2009, HC and the Public Health Agency of Canada launched a public campaign to educate Canadians on proper safety precautions to limit the spread, which includes proper hand washing and self-isolation techniques. They made an effort to forward all information to AP using local contacts and conducted confidential surveys to monitor the knowledge acquired by FN people in order to improve communication[4]. The commitment to provide improved health care in remote AC has led to new initiatives aimed at reducing transmission. Local nurse stations are available 24 hours a day, health care personnel are equipped with protective gear and antivirals are available if needed.

Efforts to reduce the transmission of the H1N1 virus are not supported with the appropriate resources in AC. A 2001 AP Survey found that

"34% of Inuit living in the North, 19% of Aboriginals in rural areas and 16% of those in urban areas reported that there were times in the year when their drinking water was contaminated"[6]. Access to clean water or alcohol-based hand sanitizer and proper hand washing techniques can effectively remove the virus and prevent transmission[4, 8, 9]. To address this issue, the government may have been more successful with hand sanitizer distribution until the underlying concerns unique to these communities can be attended to. In addition, prioritized distribution of the H1N1 vaccine to AP is important since it is more difficult for them to reduce risk of transmission.

As reported through laboratory testing, the WHO has conservatively estimated that 16,000 fatalities worldwide have occurred as a result of H1N1[1]. As of June 2009, Canadian provinces and territories had received vaccines for 80% of the population. During the process, some provinces had requested to stop shipment because their current provisions were adequate. As the scare of the H1N1 pandemic has ebbed, it appears that the co-operation of medical technology, the government, and the people has curbed the spread of H1N1 away from the high fatality pandemic that it was originally feared to be[1]. However, underlying issues specific to the AC need further attention as cases were disproportionately represented and AP are more susceptible to the H1N1 virus[2-4, 6, 9].

Acknowledgements

I would like to thank Dr. Gina Cosentino (President, Strategix), Dr. Dianne Bryant (Clinical Epidemiologist, Faculty of Health Sciences, University of Western Ontario), Emmanuel Ewara (MSc Candidate, Department of Epidemiology and Biological Statistics, University of Western Ontario) and Marlene Mastronardi (Compressed Nursing Program Level 3, University of Western Ontario) for their assistance in preparing this manuscript.

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Author Profile

Lyndsay O'Brecht is currently pursuing a MHSc degree in Sports Medicine and Kinesiology from the University of Western Ontario. Her project is investigating the use of platelet rich plasma (PRP) to treat patients affected by plantar fasciitis. She is also interested in immunology – particularly the immune response to allergens and cardiophysiology.

Perceived Risk, Shared Benefit and Social Interaction in Vaccination

By Alan McGreevy

The spread of H1N1 during 2009 was stemmed, at least in part, by widespread voluntary vaccination.[1] Every adult in Canada had the opportunity to consider the perceived costs and benefits of being vaccinated. What were perceived as the risks of being or not being vaccinated and what factors may have affected these perceptions? This paper will look at modeling vaccination response, taking into consideration the communication of risks and benefits.

The decision to not vaccinate is poorly understood.[2] A case study found that only 22% of the staff at a Canadian health care centre received flu vaccines four or more times in the previous five years.[3] This cannot be due to lack of access or information or a rejection of western medicine, and yet, for these people, the risks obviously outweighed the benefits. Being aware of rare and severe reactions to vaccines can have a significant impact on one's choice to vaccinate.[4] An individual's perception of risk is based on experience and knowledge; events that are easily remembered or imagined are most significant in decision-making.[5]

Game theory compares courses of action based on risk – in this case, to be vaccinated or not. The accuracy of game theory relies on accurate models, advanced by the recent recognition that humans are, socially, best described as a scale-free network.[6] This has been found with population dynamics tracked through sexual contact or transmission of avian influenza.[7,8] This model reflects that we are more likely to be infected by immediate friends and neighbours and that some people have more neighbours than others.[6] Risks change for those with many neighbours; they are more likely to have an infectious neighbour and, once infected, they are more likely to transmit the infection.[6] These individuals have more to gain, personally and altruistically, by being vaccinated. The greater efficacy per vaccination makes these individuals critical in the efforts to control the spread of infectious disease.[7-9] Reminders of this larger network and its interconnectivity can increase cognisance of the benefits of vaccination.

A survey by RAND Health in November 2009 regarding the uptake of seasonal influenza vaccine in the United States looked at the choice to vaccinate based on sources of flu-related information.[10] Only 1% of respondents chose the H1N1 vaccine solely, suggesting that those who chose not to get the seasonal vaccine made a similar decision regarding the pandemic H1N1 vaccine. As predicted by a risk-perception model, there is a correlation between those who get flu-related information in more heterogeneous environments, where they are more aware of potentially infectious neighbours, and uptake of vaccine. Employers and healthcare providers were most effective as primary sources of information, increasing vaccination by four times and two times respectively. News media received in more isolated environments, was correlated with a decrease in vaccination.[10] From this, it appears that 2009 H1N1 information in media and advertising was plentiful but not persuasive.

There is evidence that the perception of risk can also apply to the shared benefit of vaccination: herd immunity. A population with a large percentage of individuals immune to infection has less chance of a chain of infection leading to susceptible or immunocompromised individuals; many vaccinations are more beneficial to society as a whole rather than the individual recipient.[11] The RAND Health survey found that healthy adults who are in contact with, or caregivers of, higher risk individuals are significantly more likely to be vaccinated (35%) than other healthy adults (18%).[10] However, in 2009, this group was included in the higher risk group, and was the least vaccinated higher risk population. The three most common reasons not to be vaccinated, accounting for 60% of

responses, were: "I don't need it", "I don't believe in flu vaccines" and "I might get sick or experience side effects".[10] Public health campaigns focusing on the herd immunity and diverse groups sharing contact enables the individual to take ownership of vaccination as a selfless act, stopping the spread of infection from reaching more vulnerable members of the community.[12]

When considering campaigns or resource distribution, governments and medical professionals should consider how individuals get vaccination information, and what affects their decisions. While news media may offer commentary on vaccination, persuasive power lies in the impact of human experience and social responsibility.

Acknowledgements

I would like to thank my colleagues at the National Centre for Foreign Animal Disease, particularly Yohannes Berhane, my advisor Hana Weingartl for her support, and Christina Fawcett for her proofreading.

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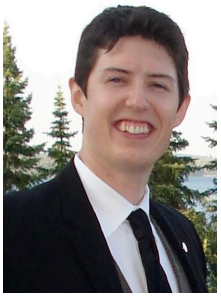
Author Profile



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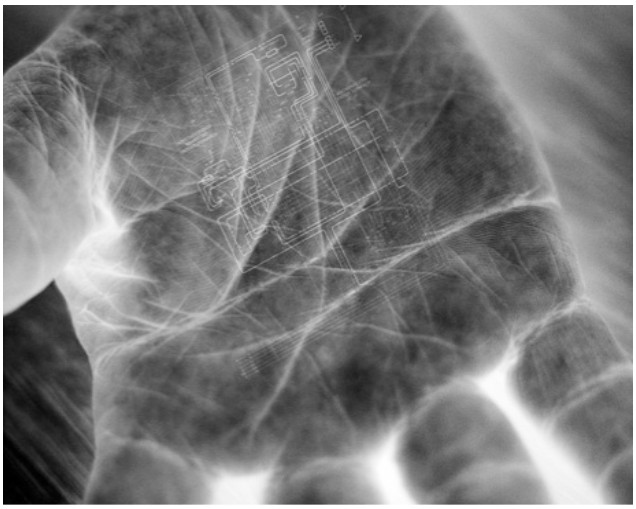
Cytotoxic T Cell Response and Conserved Viral Epitopes: Considerations for Vaccination Against Newly Emerging Pandemic Influenza Strains

By Travis W. Marfleet

The current influenza vaccination strategy aims at the induction of a neutralizing antibody response against viral surface proteins from specific strains expected to have an increased prevalence in the approaching flu season. Selective pressure against these viral surface proteins such as hemagglutinin (HA) and neuraminidase (NA) drives viral antigenic drift, resulting in new seasonal variants. This vaccination approach requires the production of yearly formulations to target emerging antigenically drifted seasonal influenza strains ineffectively controlled by neutralizing antibody developed against previous seasonal strains.

Following the recent influenza A (H1N1) pandemic, it has been shown that a safe, effective vaccine may be developed and distributed following the emergence of a novel pandemic strain. Although the H1N1 pandemic had global health and economic consequences, the impact in terms of mortality was far below global mortality rates of seasonal influenza[1-3], and was marginal compared with past influenza pandemics[4,5]. The limited pathogenicity of H1N1 (2009), in addition to effective epidemiological surveillance allowed for production and distribution of a safe and effective vaccine based on the current vaccine production strategy. Although this unique strategy is currently the best option, it is flawed because a novel strain must be circulating within the population prior to production of a vaccine against the new strain. Upon emergence of a highly virulent influenza strain, the time between strain emergence and vaccine distribution allows for viral spread, and leads to significant mortality rates. Hence, there is a need for implementation of a new vaccination strategy effective against previously unrecognized influenza strains. Although there is merit to mass vaccine stockpiling efforts undertaken against predicted pandemic strains, such as avian H5N1, they are



directed against a single strain and therefore unable to protect against the possible emergence of numerous pandemic viral variants over time.

The development of a universal vaccination platform to provide a broad, protective (heterosubtypic) immune response is needed to protect against newly emerging pandemics. Thus, an attractive vaccination strategy would be directed towards the development of a robust cytotoxic T lymphocyte (CTL) response against the influenza epitopes highly conserved across viral strains, such as the internal nucleoprotein (NP) and matrix protein 1 (M1)[6,7]. Both proteins contribute to the internal viral structure but do not effectively elicit a neutralizing antibody response, which is attempted by current seasonal vaccinations and would be sacrificed for the ability to generate a protective heterosubtypic host response.

The development of a robust CTL response to viral antigens depends upon the cross-presentation of viral peptides by the major histocompatibility complex I (MHC-I), which loads the viral peptides in the cytoplasm of infected cells. Thus, the antigen must be delivered to the cytoplasm

of host cells which can be achieved by various methods, such as DNA vaccine constructs, live attenuated influenza viruses (LAIV), or recombinant viral vectors expressing influenza proteins. Split subunit or inactivated vaccines are not ideal in this case as they primarily elicit an antibody response. Live attenuated or cold-adapted vaccines access the cytoplasmic compartment with greater efficiency and elicit a stronger CTL response. Numerous studies have attempted to deliver native antigen or peptide representing conserved viral epitopes, via DNA constructs or recombinant viruses, to generate a broadly protective response in animal models with varying success (see Reference 8 for review). Several studies have demonstrated a protective response to multiple viral subtypes characterized by a strong cellular immune response following viral challenge in animal models [9-11], in addition to characterizing the human CTL response to influenza vaccination (see Reference 12 and 13 for review).

Although an effective vaccine was developed following emergence of the 2009 H1N1 pandemic strain, our current vaccination strategy will likely fail following the emergence of a highly transmissible and virulent pandemic influenza virus. The development of vaccines aimed at generating a stable and lasting CTL response to protect against a broad range of seasonal and previously unrecognized influenza strains is the ideal approach to prevent a global pandemic. DNA vaccines or recombinant viruses expressing such epitopes represent a possible method of antigen delivery to the host-cell cytoplasm. Recent research has led to numerous possibilities for the development of effective vaccine vectors or antigen delivery systems that will facilitate a heterosubtypic immune response to emerging pandemic influenza.

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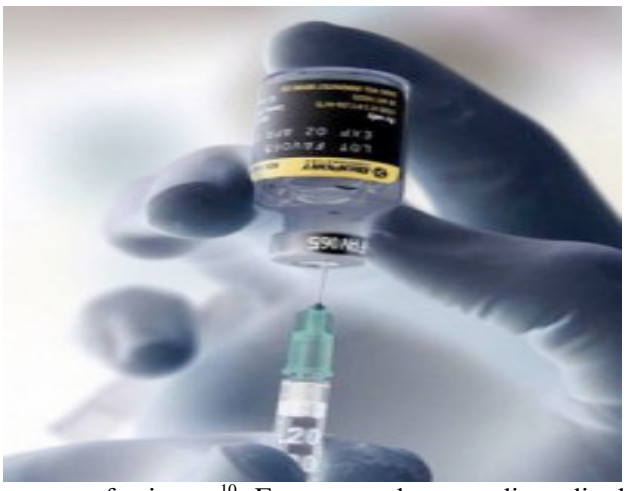
Public Mistrust as a Barrier to Mass Vaccination During Influenza A (H1N1) Pandemic

By Matti Allen

The influenza A (H1N1) pandemic of 2009 was global in scale and deemed menacing enough to lead some nations, including the United States, to declare a national state of emergency[1]. Vaccinations providing individuals with full or partial immunity to prevent the spread of the virus were a key aspect in the health policies of many states[2]. Despite adequate information regarding the threat posed by H1N1 and sufficient supply of vaccine, individuals in jurisdictions across the globe opted to decline vaccination[3,4]. The reasons why so many individuals declined immunization are often rooted in the persistence of misinformation and feelings of uncertainty towards the safety of the vaccine[5].

Mass vaccination is believed to be the most efficacious and cost-effective measure in reducing the number of infections, hospitalizations and deaths during an influenza pandemic[6]. Modelling studies strongly suggest that the mitigating impact of vaccination is dependent on how quickly it is initiated and the extent of the target population that is immunized[6,7]. Thus, the greater the proportion of individuals vaccinated, the greater the effectiveness of the immunization program. While the perception of a low infection risk or low risk imposed by the virus itself is cited by some, for the majority of individuals declining vaccination is based on a belief that the vaccine might not be safe[5]. It is important to note that this fear persists in spite of multiple, large scale, randomized control studies illustrating that the vaccine is both effective and safe[8,9]. Adverse effects were found to be rare and largely mild, most often consisting of soreness localized to the injection site and fatigue lasting one or two days[8,9].

The public's fear stems from the mismanagement of past health crises and lingering suspicions of vaccines in general. Memories of the 1976 U.S. swine flu alert, the subsequent vaccination program and the Guillain-Barre syndrome related deaths that followed are still a



source of mistrust[10]. For many, the now discredited study linking the measles-mumps-rubella (MMR) vaccine with autism is enough to keep them away from any vaccination program [11]. Some myths specific to the H1N1 vaccine discouraging patients from vaccination include: mercury (Thiomersal) in the vaccine is harmful to young children and pregnant women[12], the vaccine's adverse effects are more harmful than the disease itself, receiving the H1N1 weakens the immune system and the vaccine actually causes the flu[13]. These myths have no evidentiary support but they feed into the mistrust of an already wary public. Additionally, the persistence of well-organized and vocal anti-vaccination groups helps to perpetuate these and other common misconceptions, especially with the emergence of new social media such as the internet[14].

The coverage of target populations with H1N1 vaccination programs worldwide was limited due to this common fear of becoming immunized[5]. For example, in the U.S., enough vaccines were distributed to immunize 75% of the population. However, only 33% of the high priority and 20% of the adult population were vaccinated[15]. If the virulence of H1N1 was greater during the 2009 pandemic, the consequences would have been

substantially more pronounced. Thus, it is important to address these concerns to develop a more effective response in future pandemics. To combat these potentially dangerous misconceptions, the public health community must actively pursue strategies of transparency, improved communication and engage in attentive listening to the concerns of individuals[14]. Rather than simply instructing the public to seek vaccination, more efforts should be made to explain the processes used in vaccine development, the evidence supporting the safety and efficacy of the vaccine, and the policies in place to ensure public safety during immunization programs. The public health community should also make greater use of new media, particularly powerful platforms offered on the internet through social networking sites and "blogging", in spreading its message. Finally, health professionals should also make an effort to educate politicians and community representatives on the relative risks and benefits of vaccination, as individuals are at times known to be more influenced by their peers rather than health experts[14]. The H1N1 pandemic has clearly illustrated the need to foster greater levels of trust between the public and the health community. This pandemic should spur adoption of the aforementioned strategies to build faith and ultimately allow for a more effective response to future health challenges.

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Implications of Vaccinations During the 2009 H1N1 Outbreak and Impact on Future Pandemics

By Arthur Dermen & Sevan Evren

Months after the panic of the H1N1 pandemic has subsided, the WHO continues to track the steady spread around the world, keenly aware that H1N1 infections have dwindled for the moment. Reports of patients developing drug resistance to Oseltamivir during the course of treatment have trickled in[1,2], and one case in an Israeli hospital suggested transmission of a drug-resistant strain of H1N1 between patients[3]. Remaining vigilant and prepared for future surges of H1N1 through the implementation of proper vaccination can significantly reduce the number of infections and deaths in the long term.

In the United States, an estimated 70,000 vaccine-preventable deaths occur annually. These cases greatly increase the chances of infecting others and unnecessarily increase health-care costs due to hospitalizations. Despite obvious costs and health benefits, vaccinations have been under attack by anti-vaccination campaigns that rely on the proliferation of misinformation[4]. The Lancet's retraction of Andrew Wakefield's 1998 paper[5] linking Measles-Mumps-Rhubella (MMR) vaccination with autism has undermined the movement, and has come too late for those infected during the latest measles outbreak in the UK[6]. Anti-vaccination movements pose a significant threat to reducing immunization against current and future pandemics, as well as reducing herd immunity against diseases that have largely been eradicated.

Surveys of populations suggest that the decision to decline vaccination is often elicited by a number of factors. Mainly, the populace perceives a low risk of acquiring infection, has a heightened fear of rare or non-existent vaccine side-effects, and an overall mistrust towards government and pharmaceutical companies[4]. Furthermore, individual choices were often influenced by their immediate colleague's own opinions on vaccination. Rectifying these false perceptions would likely be aided by

increasing awareness using advertisements through traditional media outlets, such as television [7]. Encouraging vaccination through healthcare workers and hearing out the concerns of people individually are other avenues of reaching out to the populace in a personal and informative way [7,8,9,10]. Furthermore, encouraging leaders and public role models to receive vaccination is another method of directly increasing the intrinsic value of vaccination and encouraging its acceptance among the general population [7,11]. Nonetheless, efforts to vaccinate the population could have limited effect without adequate vaccination of healthcare workers. Adding a specific focus to the immunization of healthcare workers would most likely be beneficial to long-term success in improving vaccination rates.

While some resistance to vaccination has come to be expected in a given scenario, a worrisome trend among healthcare workers has emerged. One study in two Mexican cities found that hospitals had an 80% vaccination rate during the H1N1 pandemic [12], leaving 1 out of 5 health-care workers at risk of infection. Similar studies have suggested that rates can drop as low as 50% in China[13] and worse, 20% in Greece [14].

Health-care workers have direct exposure to infected patients and as a result, exhibit a high risk of both receiving and transmitting infections. In addition to creating a dangerous route of transmission between high-risk individuals in hospitals, the opinions of health-care workers carry great weight to concerned patients. Addressing the issues that negatively affect vaccination among hospital workers is thus a primary concern.

The lessons from the last decade have been hard learned, but the message for the future is clear. Addressing concerns about vaccine safety and strongly promoting protection against infection can significantly reduce hospitalization and death among the general public and healthcare workers. These benefits extend not only to future epidemics and pandemics, but also diseases that are currently at all-time lows[15]. Furthermore, specific promotion of vaccines among health care workers must also be addressed. Nonetheless, it remains to be seen whether this course of action will be taken before future epidemics and pandemics surface.

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Epidemic Response Archetypes: Negotiating Unknowns in Pandemic Planning

By Tess Laidlaw

From beyond Canada's borders, the disease made a slow but ominous entrance into the country. Early cases progressed quickly and treatments seemed ineffectual. Uncertainty regarding the presence of the disease fueled alarm and rampant speculation, while its unusual epidemiology caused confusion as cases appeared among those normally considered least susceptible to infection. Amid the upheaval, the press reported that "a panic of an almost indescribable nature seems to have taken hold."[1]

The disease described above is not influenza A H1N1 but cholera, and the year is not 2009 but 1832. Yet, the sense of what made one vulnerable or safe and the fear of a rampaging, mysterious infection seems oddly familiar. Societies have responded to epidemic diseases in similar ways through history, yet the manner in which people interpret the risks posed by new diseases remains relatively unexplored by the medical community.[2] Such knowledge would be invaluable in pandemic planning.

Ideas about how diseases are caused or prevented have both intellectual and social counterparts.[3] Medical historian Charles Rosenberg describes epidemics as accompanied by "archetypical" responses: As societies strive to make sense of outbreaks, patterned methods of interpretation recur.[3] To illustrate, many methods of protection from diseases have existed through history and were generally based on medical knowledge of the time. However, some were purely symbolic, such as scapegoating, which emphasizes the perceived high-risk status of an "Other," [4] a person or group that symbolically ensures one's own safety. Scapegoating could, in pandemic situations, lead to victimization of targeted groups.[2] While cholera infection in the 1830s was related to perceived moral failings of immigrants,[1] early media coverage of H1N1 in Canada highlighted the threat posed by Mexico as the source of risk.[5,6]

Contemporary populations have also associated H1N1 flu susceptibility with levels of sexual activity.[2]

The archetypal phenomenon of "symbolic" disease protection could explain why governments were caught off guard by the public's apparent indifference to the availability of a vaccine in the fall and winter following the H1N1 outbreak, despite the earlier panic.[7,8,9] A majority of individuals assessed the level of risk posed by H1N1 through its presence in individual communities,[9] or through the opinions of peer groups, which could either heighten[2] or lessen risk.

Implicit in the development of public health messages during the H1N1 pandemic was the attempt to anticipate the motivations behind human behavior: what messages would create adherence to advised public health measures? A framework tying the application of epidemic response archetypes to human motivation is suggested by Kenneth Burke, whose book *A Grammar of Motives* rests on the central question, "What is involved, when we say what people are doing and why they are doing it?"[10]

Because of his interest in issues of "universal" significance,[11] Burke's theories have impacted numerous disciplines, including medicine.[12,13] Burke argues that aspects of situations can be categorized via the terms "Act, Scene, Agent,

Agency, [and] Purpose," which together form the "dramatist pentad."[10] The pentad can then be studied to reveal human motivation.[10] By identifying these key elements in a situation or projected scenario, an observer can determine which element exerts the most influence, and proceed toward possible consequences. As part of a scenario development process in pandemic planning, the pentad could improve the authenticity of a given scenario[14] and take regional influences on populations into account, such as epidemic threats from additional sources of infection (e.g., avian influenza).[2]

Burke recognized that in catastrophic situations, a "scene-act" ratio would prevail. The scene would govern which acts took place: one could look to the behavior of the participants for expression of "the motivating influence of the crisis."[15] When the primary motivating influence becomes something other than the crisis itself, audiences of public health messages may act in unexpected ways. During the H1N1 outbreak, a contagion of indifference to H1N1, or ambivalence toward the H1N1 vaccine,[7,9] overshadowed literal contagion in public health significance. The pentad could highlight what epidemic response archetypes may play a role in a given situation—such as the H1N1 pandemic "scene" involving a concurrent decline in mortalities and increase in vaccine availability. In short, Burke's pentad enables investigation of a number of perspectives based on examination of the five elements of a situation,[10] while epidemic response archetypes provide variables for consideration in those perspectives.

Epidemic response archetypes are available in the historical record and thus represent tools in pandemic planning. It has been said that "H1N1dsight is a wonderful thing."[8] So too would be a glimpse of the future.

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Designing Mass Immunization Clinics

By Tanya Rac

In an effort to protect the general population from novel influenza A H1N1 virus, health administrators and public health officials emphasized a well-known preventative measure - immunization. According to the World Health Organization, immunization is "undoubtedly one of the most cost-effective health achievements of modern times. It is one of the rare services that costs very little, but offers huge benefits for the health and well-being of populations"[1]. Unlike typical non-pandemic vaccines, the delivery of H1N1 vaccine required unique mass immunization plans[2] Mass immunization clinics are the most effective method of providing immunization to a large number of people over a short period of time[2]. The planning and development of these clinics began long before the H1N1 pandemic had arrived. This report describes strategies that may be used to design pandemic immunization clinics.

Choosing a clinic location well suited to the needs of the public and the health officials is imperative for the success of the clinics. The team must consider whether the clinics are set up in rural or urban areas, the number of clinics to be set up, and whether the clinic locations will alternate over the immunization period. Examples of clinic sites are schools, leisure centers, church halls, malls, and universities. Some of these sites are already equipped with chairs, tables, Internet, and other objects/services required to set up a clinic site. Information technology is necessary for proper risk communication and record updates with various buildings, sites, cities, and with colleagues in other health jurisdictions.

A thorough transportation plan may be useful in preventing potential traffic dilemmas. For instance, the site should ensure adequate parking space for those driving personal vehicles. Public transportation plans should include looking into bus fare fees, re-routing of buses, and enhanced bus service.

The vaccine cold chain is essential to maintain vaccine potency. It refers to the process used to maintain optimal conditions during the transport, storage, and handling of vaccines, starting at the manufacturer and ending with the administration of the vaccine to the client[3]. Vaccine should be stored between 2 to 8 degrees Celcius. Security of the vaccine during transportation, storage and distribution should include double-count vaccine sheets, locked storage facilities, and specific transport personnel.

During pandemics, there may be an overwhelming demand for certain immunization supplies. To ensure adequate stock, health regions may stockpile prior to the pandemic. Stockpiling may bring about its own complexities with storage space and designating staff responsible for keeping the inventory up-to-date and properly rotated. Ongoing use of immunization supplies generates large quantities of biomedical waste especially at mass immunization sites. Waste management sectors should have special protocols to carefully dispose this waste during the pandemic. Thorough

cleaning in the clinics is important, as the "accumulation of dust, soil, and microbial contaminants on environmental surfaces is both aesthetically displeasing and a potential source of nosocomial infections"[4]. Clinic custodians should be given biomedical housekeeping training manuals.

During the pandemic, the need for health services could exceed the available human resources[2]. The disease impact and increased demand of health services can be projected by epidemiological analysis. Human resource should plan a schedule for health care professionals who will administer the vaccine based on the expected rates of vaccination, and provide adequate training courses.. Due to staff shortage and insufficient financial resources, the clinics may rely heavily upon volunteers. Volunteers should be given training sessions and orientation packages. This provides an ideal opportunity to involve a broad range of stakeholders especially from the community to maximize awareness. A strong communication plan among these participants is used to relay messages from the various levels of government and to share epidemiological findings.

Planning ahead in preparation for influenza pandemics, with its potentially high morbidity and mortality rates, is essential for hospital administrators and public health officials[2]. Adequate immunization decreases the incidence of the clinically ill, hospitalized, and the dead[2]. However, pandemics can present unexpected challenges. As a result, the mass immunization contingency plans must be flexible enough to adapt to the demands of the pandemic.

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Author Profile

Tanya Rac received her MPH degree from the School of Public Health at the University of Saskatchewan, and is currently working for the Public Health Observatory, Saskatoon Health Region. She had also previously received a BSc degree from The University of Saskatchewan.

Post-analysis of the Swine Flu Pandemic: Overreaction or Necessary Precaution?

By Inderjeet Sahota

In April 2009 news reports began to surface of an influenza-like outbreak in Mexico. Mexican officials did whatever they could to curb its spread but the world watched anxiously as their efforts seemed insufficient in preventing further outbreaks[1]. Cases of swine flu, as it was now being referred to, were emerging in cities all across North America, Europe and Asia. Just two months after the initial reports in Mexico the World Health Organization (WHO) would declare this swine flu a pandemic and issue protocols in the hope that it would stop further spread. One after another, countries began declaring this virus a national priority and pharmaceutical companies dedicated themselves to finding a vaccination. News reports tirelessly warned us of the immediate threat this virus posed to health and a genuine sense of paranoia ensued as people became too scared to be in public places.

Just over a year later the situation is very different.

You'd be hard pressed to find a news report on the swine flu now. So, what happened? As the dust begins to settle, health officials are beginning to ask themselves whether the global reaction to swine flu was necessarily precautionary or simply an overreaction. Around 12,700 people worldwide died from H1N1, an unfortunately sizable number[2]. However, this value needs to be taken into context. According to the Centre for Disease Control in the United States, about 36,000 people die from seasonal flu-related causes each year in the United States alone[3]. This does not necessarily mean the flu was the primary cause of death but even so, the numbers indicate how relatively small the deaths from H1N1 were in comparison to the number of people that die from the seasonal flu each year. Also, even before mass vaccination programs were introduced most people infected with H1N1 were able to recover within weeks with no long-term complications. Although the physical loss from H1N1 remains fortunately small, the economic cost

may not be so minute. The final global cost of the pandemic has yet to be determined. However, analysts believe it will likely amount to billions of dollars[2]. Wealthier countries have already confirmed to have spent that much on medicines and vaccinations alone and many governments are now trying to resell their stockpiles of the swine flu vaccine.

The WHO is now under scrutiny following accusations that they may have exaggerated the pandemic to bring economic benefits to the pharmaceutical industry. Although this is unlikely, the allegations were serious enough to warrant the WHO to release an official statement on January 22, 2010 addressing the matter[4]. As months go by, it will be interesting to witness the results of an independent investigation of the management of the H1N1 pandemic and this might elucidate whether the global response was appropriate or grossly disproportionate.

The swine flu vaccinations themselves offer another potential problem. In Canada, and much of the rest of the world, there have been serious questions regarding the safety of the H1N1 vaccinations that were administered. As the need for deployment was paramount, pharmaceutical companies had a limited time to administer these

vaccinations around the world. As such, appropriate long-term testing was deferred as vaccinations were fast-tracked through the process in an effort to curb this influenza pandemic. It remains to be seen whether there are any long-term effects of these vaccinations. Unfortunately, as many people have already undergone the treatment, the first results we have may be from case reports, not laboratory reports.

So, was the global response an over-reaction or a necessary precaution? I believe that the overall response was in the right direction. Many health officials echo the concerns listed above but ultimately understand that the risk of this viral strain killing millions was worth the swift response[5]. However, I feel that although the response was in the right direction it wasn't the right magnitude. If health officials were able to determine early on that this influenza strain was of relatively moderate virulence, then an action plan that better suited the situation, rather than a seemingly all-or-nothing reaction, may have been more efficient. A tiered response where global protocols are issued according to an accurate level of severity would probably be best when dealing with future pandemics. In the next year it will be interesting to see what the WHO and other governmental organizations determine from their analysis of the response and the changes that can be applied for similar emergencies in the future.

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Author Profile

Inderjeet Sahota is currently a MSc candidate from the Department of Biomedical Physiology and Kinesiology at Simon Fraser University. His main interests in research involve understanding cardiovascular and cerebrovascular alterations that occur in spinal cord injury (SCI). The purpose of my project is to determine the changes in cerebrovascular blood flow velocity (CBFV), as well as other cardiovascular parameters, that occur in people with spinal cord injury during changes in hypo- and hyper-tensive situations (during orthostatic hypotension and autonomic dysreflexia respectively). We hope that by understanding the changes that occur in CBFV we may help confer better treatment protocols for the future. Inderjeet is also currently serving as Health Science Inquiry's Managing Editor.

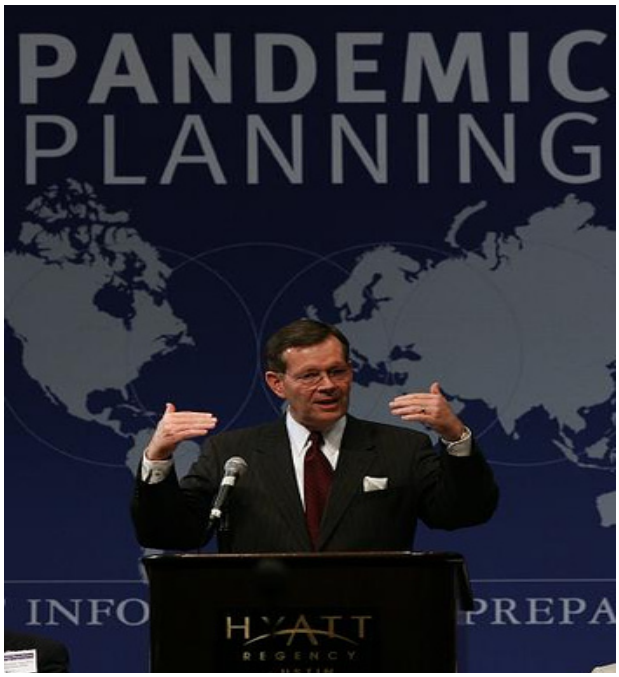
H1N1 Pandemic Planning – Correlation Between Human Behaviour and Pandemic Planning

By Farhan Asrar

In Canada, H1N1 pandemic planning was well underway before H1N1's first wave came into effect. The planning also included a well proposed outline of vaccinating Canadians against H1N1. The public were initially skeptical about the vaccine with polls indicating only one-third of Canadians intended to get vaccinated[1]. The public attitude varied from some who were anxious to get vaccinated to those who did not consider H1N1 to be a threat. However, this changed the day reports of children getting sick and/or dying first appeared[2,3]. Line-ups then began stretching long distances, largely comprised of concerned parents and their children[2]. This shift was a result of the ever-changing public perception and norms. Looking back, healthcare professionals can realize the significant impact human behaviour and perception has on the implementation of public health programs.

There are several health behaviour models and theories that aim to study human behaviour and intentions in order to predict health outcomes. One such model is the theory of reasoned action that suggests behavioural intentions are a result of one's attitude towards the behaviour and subjective norms surrounding that behaviour[4].

The attitude towards the behaviour refers to the individual's positive or negative feelings about that behaviour, while subjective norms are defined as the perceived expectations of relevant people or groups that influence the individual in carrying out that behaviour[4]. Thus, the attitude towards H1N1 vaccination depended upon the individual's perception of whether the H1N1 pandemic would affect him/her as well as the perception on the benefits of vaccination. The subjective norms during H1N1 referred to influences one had on the notion of being vaccinated, i.e. if one was influenced by people or groups who thought it was helpful to be vaccinated or if those people or groups were amongst the majority that were initially undecided.



The dramatic shift seen in the attitudes and subjective norms of the public following reports covering the deaths of children due to H1N1 indicates that both factors can be influenced by changing trends, public opinion and media coverage[2,3]. The perceived susceptibility towards H1N1 changed with the public realizing that they and their families were vulnerable to the illness and the subjective norm at the time became such that many wanted themselves and their children to be vaccinated[1]. This led to an increased pace in the demand for vaccines and resulted in vaccine shortages, queue jumping by those not at high risk, and individuals being turned away after lining up for hours to get vaccinated[1].

Attitude and subjective norms also influenced decision-making during other aspects of H1N1. One may recall that this pandemic was initially known as 'Swine Flu', but public perception led to the assumption that it was associated with

pork consumption, resulting in increased consumer fears, decreased demand and 15 countries imposed restrictions on pork products from Canada and USA[5,6]. This provoked a successful push for a name change in the hopes of altering behavioural intentions[7,8].

Such reflections emphasize the need for exploring public perception and social/behavioural factors during pandemic planning in order to better plan, predict and prepare for changes in attitudes and subjective norms of society once the pandemic comes into effect.

On the other hand, one could argue that predicting such behavioural changes to aid in pandemic planning is similar to playing the lottery. Former U.S. Secretary of Defense Donald Rumsfeld once said

"There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we now know we don't know. But there are also unknown unknowns. These are things we do not know we don't know"

At first, I found this to be amusing. However, looking back at Rumsfeld's quote from the perspective of H1N1 planning and the changes in behavioural intentions, one can't help but wonder if every pandemic will simply have 'known unknowns' and 'unknown unknowns' which may remain unaccounted for no matter how extensively we plan for it. In other words, the complexity of pandemic planning becomes further evident when even the miscued comments of politicians begin to make sense.

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Naturopathic Medicine is a Viable Therapy in the Prevention and Treatment of H1N1

By Jacob Scheer

Vaccination and anti-virals are the current standard of care in the prevention and treatment of H1N1 influenza virus. Concerns have surfaced as to their safety, efficacy, and necessity. Evidence and ongoing studies indicate, however, that Naturopathic therapeutics, which includes Homeopathy and Herbal medicine, may offer a safe and effective adjunct or alternative to vaccination and anti-virals.

Immunization is widely thought to provide the most effective tool against a pandemic virus. The occurrence of a rare but serious adverse event, Guillain-Barre syndrome is associated with influenza immunization. It was first documented following the 1976 program against the swine influenza in the United States and is important to address in the context of the recent spread of the novel influenza A (H1N1) in humans. Minimizing the risk of severe adverse events is an important goal when developing immunization policies for interpandemic use of novel influenza vaccines and implementing mass immunization programs[2].

On September 28, 2009, the Globe and Mail, reported a "perplexing" Canadian study linking H1N1 outbreaks to seasonal flu shots which has thrown the national influenza plans into disarray and is testing public faith in the government agencies responsible for protecting the nation's health. Distributed for peer review, the study confounded infectious disease experts in suggesting that people vaccinated against seasonal flu are twice as likely to catch swine flu.

According to the World Health Organization, alternative medicine has been the standard of care for billions of people world wide. There are a host of herbs that enhance and support the function of the immune system. Herbs such as Boneset and Vervain have been used traditionally in the treatment of influenza and influenza like symptoms[1]. Immune enhancing herbs such as Echinacea, Andrographis and Picrorrhiza support the body's defence against the virus. Additionally,

studies have shown that many herbs exhibit anti-viral, anti-bacterial and anthelmintic properties[6]. Finally, the Physician's Desk Reference (PDR) for Herbal Medicines lists the following herbs for the treatment and symptomatic relief of influenza: Buttercup; Cinnamon; Colt's Foot; Dog Rose; Chamomile; Eucalyptus; Elder; Horseradish; Oats; Quinine; and Wild Indigo[7].

Homeopathy, a highly systematic method of medical therapeutics and clinical evaluation, has been effective in the treatment of influenza and influenza-like symptoms for hundreds of years. The medicines used in this form of alternative medicine are chosen according to the Law of Similars (the concept of like curing like), a fundamental Homeopathic principle. It is based upon the observed relationship between a medicine's ability to produce a specific constellation of signs and symptoms in a healthy individual and the same medicine's ability to cure a sick patient with similar signs and symptoms[8]. References to the Homeopathic treatment of influenza or *grip* date

back to the 1880's[3]. Dr. James Kent in his book "Repertory of the Homeopathic Materia Medica" first published in 1881 refers to the treatment of influenza in the rubric: extremities, pain, influenza, etc. The Homeopathic remedies in this rubric that were used to successfully treat influenza include; aconite, bryonia, euphrasia, eupatorium perforliatum, and gelsemium. These medicines are still used successfully throughout the world to treat influenza and influenza-like symptoms.

In 1989, the following controlled clinical trial was conducted to assess the effectiveness of a Homoeopathic preparation in the treatment of influenza-like syndromes. The Homeopathic drug was Oscillococcinum, manufactured by Boiron Laboratories, made from Anas Barbariae Hepatis and Cordis Extractum HPUS 200 C. In the trial, 237 volunteers received the test drug and 241 were assigned to placebo. The A HlNl influenza virus was isolated in the study region 7 days after the study managers issued the instruction to start including patients in the experiment. 17.1% of the participants from the active drug group recovered within 48 hours of treatment compared to 10.3% from the placebo group (p value 0.03). Volunteers with an influenza-like syndrome who received the homoeopathic preparation showed a greater early recovery rate, within 48 hours of treatment, than those who received placebo[4]. To date it is the only known clinical trial for H1N1. I would recommend further studies to substantiate the benefits of Naturopathic therapeutics in the the treatment of H1N1.

Is Naturopathic or alternative medicine a viable therapy in the prevention and treatment of H1N1? My professional expertise and anecdotal evidence would cry out, "Absolutely!" I am, however, able to constrain emotional exuberance knowing that the experiences and results of the past along with the current clinical evidence support my professional conviction.

Acknowledgements

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Author Profile

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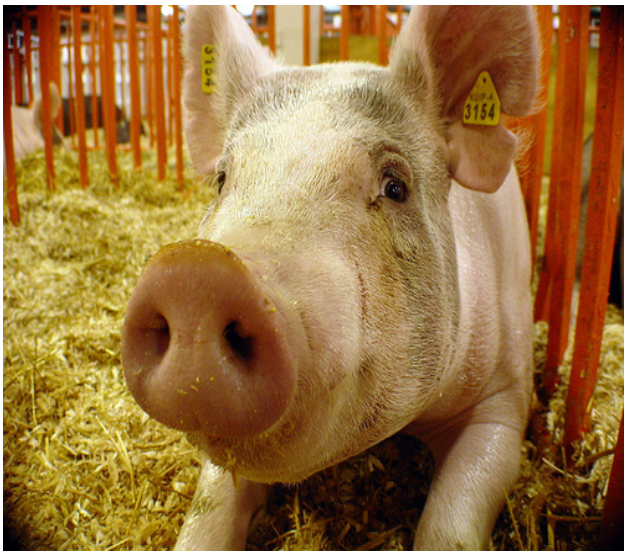
If a Pig Coughs in Mexico the Whole World Should Hear It

By Chelsea Himsworth

We should not be breathing a sigh of relief because the H1N1 pandemic appears to be abating.[1] Rather, we should be alarmed by the specter of future, potentially more disastrous, outbreaks of zoonotic diseases (diseases transmissible from animals to humans) that 'swine flu' portends. Such consternation is warranted given that (a) over 60% of *all* pathogens currently known to cause disease in humans have an animal origin,[2] (b) over 75% of emerging human pathogens are zoonotic,[2] and (c) zoonoses are twice as likely to be associated with emerging disease in humans compared to non-zoonotic pathogens.[2] Since emergence is precipitated by population growth, global trade and travel, urbanization, agriculture, and climate change,[3,4] the threat posed by zoonotic diseases is only going to increase.

Our vulnerability to outbreaks of zoonotic diseases is aggravated by traditional anthropocentric clinical- and laboratory-based disease surveillance systems that are capable of detecting zoonotic threats only *after* a disease has already emerged (and potentially become established) in human populations.[4] This shortcoming is illustrated by the fact that H1N1 was only identified in people two months after the initial human outbreak,[5] and several years after the virus likely became entrenched in swine.[6,7] Similarly, while human-focused management (e.g., vaccination and antiviral treatment) may lessen the health impact of emerging zoonoses, it does not address the underlying animal and environmental factors that drive emergence, and thus cannot decrease the potential for future emergence of events.

National zoonotic disease research, surveillance, and management efforts are further crippled by being divided along disciplinary and institutional boundaries,[4,8] resulting in a 'scientifically fragmented'[4] approach. This problem is compounded by a lack of *international* communication with regard to diseases that clearly



ignore political borders.[8,9] For example, the 2009 H1N1 virus is thought to have originated from a recombination of Eurasian and North American swine viruses (likely through international trade of live pigs),[7] before emerging in Mexico, and proceeding to spread to 41 countries within 4 months.[5]

Clearly the world is in need of an integrated, interdisciplinary, and international system for zoonotic disease surveillance and management. The closest approximation to such a system may be the Program for Monitoring Emerging Infectious Disease;[10] a non-governmental, freely accessible, internet-based program for reporting disease outbreaks in humans and animals. The Achilles' heel of this program is that it relies upon engaged and astute health professionals and scientists to voluntarily post information and to make use of the information posted by others, which may be the reason it is used inconsistently both within and among countries.

A more unified, scientifically-informed and policy-driven *hierarchical* approach to zoonotic disease is imperative. Ideally, such a system would

consist of three levels: (1) an international body (e.g., a combination of World Health Organization and World Organisation for Animal Health) that would assume the task of designing a *global* surveillance and management system for emerging zoonotic diseases in humans *and* animals, (2) government-appointed national task forces (one per country) that would implement the system by creating networks with (3) new and/or pre-existing academic and governmental institutions throughout each country. This structure would allow fluid transfer of information between agencies, maximize proactive strategies, and foster a coordinated response to emerging zoonotic diseases. A similar approach was suggested in 2005 by Kuiken et al.,[8] who estimated that the start up-costs for such an endeavor would be approximately $4-5 million annually for the first three years[8] — a fraction of the $400 million spent on the purchase of H1N1 vaccine in Canada alone.[11]

Despite the obvious need for a unified approach to zoonotic disease, such an approach has yet to be implemented. If nothing else, the H1N1 pandemic, by the very fact that it was a pandemic, should teach us that the world is not prepared to deal with emerging zoonoses. It should also teach us that we cannot afford to wait any longer before developing an integrated, interdisciplinary, and international system for zoonotic disease surveillance and management. Had such a system been in place in February, 2008, perhaps it would have "heard pigs coughing in Mexico," and been in a position to prevent, rather than merely respond to, a global pandemic.

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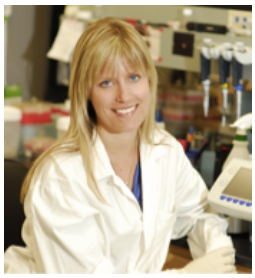

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H1N1 Influenza: Global Pandemic, Global Vulnerabilities

By Diego S. Silva

Although the media glare has subsided, the H1N1 pandemic continues to have disproportionately higher rates of morbidity in persons of lower socioeconomic status (SES) relative to those of higher SES, requiring a global response rooted in solidarity. Decision-makers and the public, in both economically rich and poor countries, need to address the material and social inequalities that make certain populations particularly susceptible to severe cases of H1N1. Although the global prevalence of H1N1 is higher in young and healthy individuals, the morbidity and mortality caused by the virus disproportionately affects persons who suffer from chronic lung and cardiac diseases, diabetes, and obesity all risk factors more commonly found in persons of lower SES than in the general population.[1]

In middle-income countries such as Argentina and Peru, the risk factors associated with severe cases of H1N1 were comparable to those identified globally by the WHO.[2,3] In South Africa, additional risk factors for severe cases of H1N1 included compromised immunity because of HIV/AIDS (53% of influenza associated deaths)[4] and active tuberculosis (10% of influenza associated deaths), both diseases that are more prevalent in lower SES populations. However, these are merely three examples from middle-income countries; it is difficult to ascertain epidemiological data from low-income countries due to a lack of surveillance capabilities. In the WHO African Region, for example, 12 of 46 (26%) member countries had no official data to report from the H1N1 pandemic.[5]

The risk factors for severe illness due to H1N1 in high-income countries are also commonly found in persons of lower SES. In Canada and New Zealand for example, indigenous communities, which normally have a higher burden of disease than non-indigenous communities and are generally of lower SES, suffered the most severe effects of H1N1[6]. In Canada, Kumar and colleagues found

that 25.6% of confirmed or probable cases of critical illness caused by H1N1 occurred in Aboriginal persons.[7] Campbell and colleagues found the incidence of ICU admission in Aboriginals to be 4.08 per 100,000 persons, compared to 0.07 per 100,000 in the general Canadian population.[8] Despite these rates of severe H1N1, Aboriginals only account for 3% of Canada's total population.[9] Correlations may exist between the risk factors associated with severe H1N1 and the higher prevalence of cardiopulmonary diseases, diabetes, and obesity in indigenous populations.

The plight of persons of lower SES during the H1N1 pandemic requires the global community to acknowledge peoples' shared vulnerabilities. Practically, and perhaps selfishly, everyone should be concerned about a virus that can mutate easily and does not respect the jurisdiction of states. Not only do infectious diseases, like influenza, not respect borders, but we also need to recognize that inequalities in wealth and health lead to adverse social conditions (e.g. poor sanitation) that can breed resilient microorganisms (e.g. multi- and extensive-drug resistant tuberculosis).[10]

Addressing the morbidity and mortality caused by the H1N1 pandemic and future pandemics will require a spirit of solidarity between countries and persons of different SES. What does global solidarity entail in practice? First, we need to acknowledge that material (e.g. a lack of clean water) and political (e.g. a lack of education for women) disadvantages are at least as important as biological factors in determining the likelihood of becoming ill and the severity of a person's illness vis-à-vis infectious diseases.[11,12] Second, we must develop healthcare policies that respond to emergencies in a manner that do not exacerbate existing inequities. For example, scarce resources (e.g. ventilated beds in intensive care units) should not be allocated solely on the basis of the likelihood of survival, since the ability of people to survive an infectious disease, like H1N1, is often positively correlated to contextual factors associated to SES (i.e. people of higher SES, who are more likely to survive ventilation, will be at an advantage if ventilators are allocated only on the basis of survivability).[13] Finally, decision-makers need to dialogue with the general public, and in particular vulnerable persons, in order to make informed policy and practice decisions that are sensitive to contextual factors.[14] Not only might dialogue ensure that decisions are sensitive to the varying realities of different populations, but it is also in keeping with the democratic spirit of most of the world's governments.

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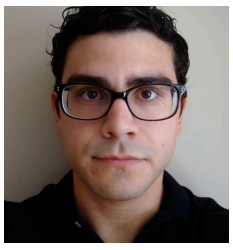

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H1N1 Brand Power: Marketing a Disaster

By Janis Huntington & Amanda Jones

In 2009, the emergence of the H1N1 virus captured the attention of everyone from the general public to multi-lateral organizations. Around the globe, governments and organizations diverted resources to implement influenza preparedness plans in response to this international "disaster". As new infectious diseases emerge and existing ones continue to spread, how is it possible that countries chose to spend billions of dollars on this particular disease? We don't need to look very far for the answer. In fact, no further than our favorite coffee shops or the markings on our shoes. It's all in the brand.

What is a brand? Simply put, a brand is "a collection of emotional and functional attributes [of a product] that strongly influences purchase".[1] In the case of H1N1, the brand is that H1N1, with its potential for causing widespread disease, is an international health disaster that could recreate the devastation caused by the 1918 Spanish flu (estimated 20-40 million deaths) or the 1968 Hong Kong flu (1-4 million deaths).[2] The devastation of past pandemics is hard to ignore. The frequent comparisons between these historic pandemics and H1N1 left the impression that anything less than a complete response would be negligent and a threat to the world's health, thus contributing to H1N1's brand value.[3] What resulted from this line of thinking was the "purchase" of strategic planning for pandemic preparedness and the funneling of health care resources to prevent H1N1.

In order for a brand to be successful, it needs to be consistently used over time. Evidence of the H1N1 brand's consistency can be seen in how it was labeled "pandemic" in the WHO Pandemic Influenza classification system even before a single person was infected. By the time the public heard the announcement of the "potential" pandemic, it was already classified as Stage 4 (which signifies confirmed human to human transmission of a virus with no consideration to the number of individuals

or regions affected).[4] While influenza experts are aware that Phase 1 of a pandemic indicates that the recombinant virus is circulating only in animals,[5] this distinction was rarely clarified in mainstream media. News items on the emerging H1N1 outbreak frequently mentioned past pandemics with devastating death tolls, building the public's association of H1N1 "pandemic" with immense loss of life.[6] While the term "pandemic" is intended to refer to *all* diseases that are geographically widespread, it has become restricted primarily to influenza. When looking up "pandemic" with the definition feature of Google, seven out of ten related phrases directly refer to flu.[a] The H1N1 "pandemic" brand is also consistent in the scientific literature. For example, in 2009, there were 1,637 articles indexed on Medline with the keyword "H1N1"; 34% of those also used "pandemic." This is a striking percentage when compared to publications on other pandemic diseases such as HIV and tuberculosis. Of

[a]Google search results were obtained on April 28th, 2010, and contained the following related phrases: pandemic influenza, 2009 flu pandemic summary, pandemic flu, pandemic disease, influenza pandemic, flu pandemic, pandemic studios, pandemic alert level, 2009 flu pandemic in mexico, 1918–1919 flu pandemic

the articles published in 2009 that had the keywords "HIV" or "AIDS," (12,044) or "tuberculosis" (4,282), only 0.88% of HIV/AIDS articles and only 0.70% of TB articles also contained the term "pandemic".

Why is it that influenza dominates the "pandemic" brand? The answer can be found in another well-established marketing strategy: know your target audience. The idea of a "pandemic" had to be appealing to the western culture before it could be globally marketable. Once international agencies decided influenza was a threat that demanded special attention, wealthy nations immediately launched into creating and implementing influenza preparedness strategies. However, before these countries could access the necessary resources, they needed to justify the spending to their constituents. If constituents were going to support influenza preparedness, they needed to feel at risk. For a disease, the brand is only as good as its potential impact – the number of people that it could infect – and everyone is considered at risk for H1N1.

For a brand to have staying power it needs to deliver on its promise, and the H1N1 brand had promised a substantial health impact. In January 2010 the WHO issued an online press release in response to mass criticisms regarding how H1N1 had been defined by the WHO as a pandemic. The WHO stated that the evidence supporting these allegations was "scientifically wrong and historically inaccurate."[7] The document was worded defensively, and upheld the promise that was built into the pandemic brand.[7] The aim was to convince the H1N1 brand buyers that they had received their money's worth because that based on the WHO's definition of a pandemic, H1N1 certainly was one. While defending their position, they neglected to realize what the criticisms actually signified: despite the WHO's technical definitions, the world had been expecting a particular type of pandemic due to how H1N1 was branded and that pandemic was not delivered. Many critics are speculating about financial interests motivating recommendations regarding the purchase of H1N1 "products" (such as vaccines),[8] but the point here is this: regardless of intent, H1N1 was marketed as a brand and that brand has failed. Unless the brand image is altered to reflect the product, the next time the world is faced with a new strain of influenza, the public may not be buying "pandemic" again.[9]

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