# 100 years since the 1918 influenza pandemic—progress made, yet questions remain. A synopsis of the 4th New Zealand Influenza Symposium, February 2018

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## ABSTRACT

The year 2018 marks 100 years since the 1918 influenza pandemic that caused devastating social and economic destruction worldwide. Despite substantial progress made with influenza research and strategies to control disease outbreaks, influenza continues to be a global public health problem. This paper presents a synopsis of the 4th New Zealand Influenza Symposium hosted by the Immunisation Advisory Centre in February 2018. During this symposium, international and national experts and service providers convened to discuss strategies to mitigate the effects of seasonal influenza and prepare for the next influenza pandemic.


The Immunisation Advisory Centre (IMAC) hosted the 4th New Zealand Influenza Symposium (NZiS) with the support of the Ministry of Health in February 2018 in Wellington. IMAC, a national organisation based at the University of Auckland, is a hub for researching vaccines and vaccine-preventable diseases, training healthcare professionals and coordinating national immunisation service delivery. Similar to previous years, the event attracted international and national experts to discuss current influenza-related policy, immunisation practice and research. Building upon the three previous symposiums, discussions continued about strategies for improving policy and vaccine delivery mechanisms to better protect people, particularly vulnerable groups, against influenza.[1–3] Recognising that it has been 100 years since the devastating 1918 influenza pandemic, this event also offered an opportunity to reflect on previous experiences and look forward with new energy to tackle the remaining unanswered questions—knowing that the next influenza pandemic is not a matter of if, but when. This paper presents a synopsis of the key topics discussed; the full programme and links to the speakers' presentations are available online.[4]

## Pandemic influenza: past reflections and future preparations

### Looking back: four previous influenza pandemics

An influenza pandemic is a global disease outbreak caused by a novel influenza A virus that has sufficient virulence to cause human disease and can be efficiently transmitted from human-to-human.[5,6] Influenza pandemics are unpredictable and irregular,

but have occurred three to four times each century. There were three influenza pandemics in the 20th century, some informally named after their presumed site of origin, which differed in terms of the virus subtype, epidemiology and disease severity.[7] The influenza pandemic of 1918–1919 was caused by a H1N1 virus subtype and quickly spread worldwide in multiple waves resulting in approximately one third of the population being infected and 50 million deaths.[8] Although the virus was particularly virulent, the majority of individuals died during this pandemic due to secondary bacterial pneumonia since antibiotics were not available at the time.[9] From 1957–1963, the "Asian" influenza pandemic was caused by a H2N2 subtype and resulted in approximately 1.5 million deaths worldwide.[10] From 1968–1970, the "Hong Kong" influenza pandemic, caused by a H3N2 subtype, resulted in approximately one million deaths worldwide.[10] Most recently, an outbreak of a severe acute respiratory infection occurred in Mexico causing the first pandemic of 21st century.[11] The 2009 H1N1 influenza pandemic spread to more than 214 countries worldwide and resulted in at least 18,449 laboratory-confirmed deaths reported to the World Health Organisation (WHO) for the period up to August 2010.[12] Global estimates later reported that the mortality rate was 15 times higher than laboratory-confirmed deaths with an estimated 201,200 respiratory and 83,300 cardiovascular deaths associated with the 2009 H1N1 pandemic.[13]

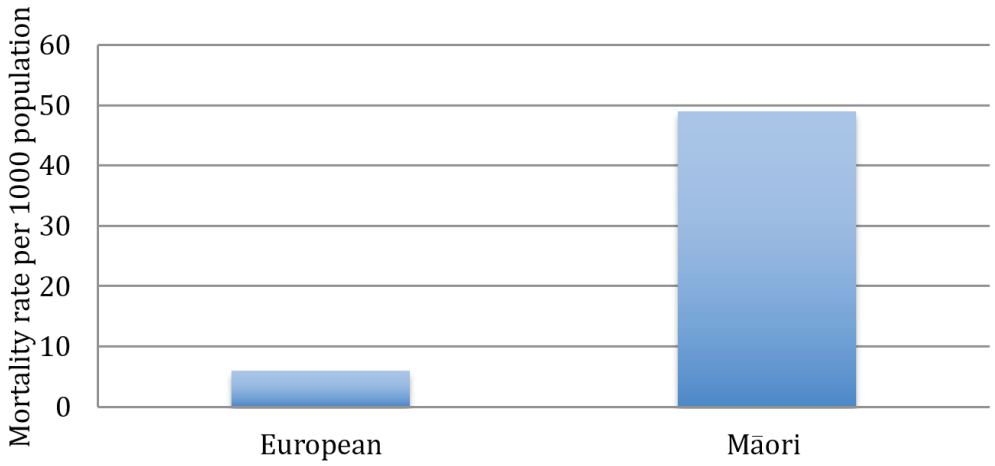
The 1918 pandemic has been coined as the "mother of all pandemics" due to the vast devastation it caused, and because descendants of the 1918 virus caused subsequent pandemics.[8] A defining feature of the 1918 pandemic was that it uncharacteristically impacted young adults rather than the very young and the elderly, resulting in an atypical age pattern of influenza-related deaths.[8] Indigenous populations were especially vulnerable during the 1918 pandemic; reports indicate that these groups were disproportionately impacted due to socio-economic, geographical and community factors.[14–16] The worldwide devastation caused by the 1918 pandemic was echoed in New Zealand. At the symposium, Professor Geoffrey W Rice shared compelling stories and pictures that represented an in-depth account of how families in New Zealand were impacted by the 1918 influenza pandemic.[4,17] In a short period, there were approximately 9,000 deaths with Māori, the indigenous population of New Zealand, experiencing the greatest burden with a mortality rate at least seven times that of Europeans (Figure 1).[17–20]

Despite various scientific breakthroughs, notably the successful genome sequencing of the causative influenza virus, many questions about the 1918 pandemic remain that warrant future research. The origin of the 1918 virus is still highly debated, along with questions about why the outbreak was so fatal, the atypical epidemiologic features, and importantly, could a pandemic of this severity happen again and how do we best prepare ourselves for this possibility.[8]

## Moving forward: preparing for the next pandemic

While it is impossible to predict the next influenza pandemic, robust global surveillance and coordination is required to monitor emerging and re-emerging viruses with pandemic potential. Among the many ongoing efforts worldwide, the WHO's Research and Development (R&D) Blueprint identifies priority diseases and enables rapid activation of R&D activities during epidemics, including vaccine and medicine development.[21] Moreover, progress has been made with strengthening countries' response capacities to infectious disease threats as part of the Global Health Security Agenda (GHSA).[22] All of these activities are vital as researchers estimate that 62 million people would die if a pandemic similar to that of 1918 occurred in today's population.[23] Inequities between countries would be appalling, with 96% of the deaths predicted to occur in the developing world where health services and resources are already strained.[23] These alarming figures emphasise the importance of rapid and coordinated global responses to disease outbreaks; however, it is arguably even more important to prevent outbreaks from occurring in the first place. Dr Tedros Adhanom Ghebreyesus, the Director-General of the WHO, stresses that the quest for a pandemic-free world will require addressing the root causes of health insecurity, namely lack of access to healthcare and absence of universal health coverage for the most vulnerable.[24]

**Figure 1:** Mortality rate during the 1918 influenza pandemic in New Zealand.[17]




To prepare for the next pandemic and minimise the associated societal and economic impacts, the WHO, which acts as the global lead agency during health emergencies, provides various guidance reports and checklists to assist nations in creating pandemic plans.[25] As recommended by the WHO, New Zealand's pandemic planning is embedded in the Civil Defence and Emergency Management framework.[26] Mr Charles Blanch, Director of Emergency Management at the Ministry of Health, informed participants about the all-hazards and all-of-government approach to pandemic preparation and response outlined in the New Zealand Influenza Pandemic Action Plan (NZIPAP).[4,27] In addition to a detailed national pandemic plan, recently updated from the 2009 H1N1 pandemic experience and extensive consultation, various inter-agency training, testing and simulation exercises are underway to review and revise plans with lead officials.[27] Experts suggest many recommendations to further strengthen New Zealand's plans, such as incorporating activities for a broad range of infectious diseases beyond notifiable diseases and influenza, and providing support to nearby Pacific Island countries.[26] Given the impending threat of a future public health emergency, it is imperative that all nations continually review and refine their preparedness and response plans to contribute to a comprehensive and robust global effort.

## Seasonal (epidemic) influenza: reducing inequities of disease burden

Seasonal (epidemic) influenza occurs every winter since viruses constantly evolve via antigenic variation to escape host human immune responses.[28] Antigenic drift refers to frequent, gradual changes in the two genes that encode hemagglutinin (HA) and neuraminidase (NA), the key antigens that elicit an immune response in humans.[6,10] These point mutations result in minor changes to these surface proteins and produces new virus strains that may not be recognised by pre-existing antibodies, thereby reducing the effectiveness of previous seasonal vaccines.[28] Given this, surveillance is required to achieve a close antigenic match between circulating influenza virus strains and the seasonal influenza vaccine to provide optimal protection.

To collect data to better understand national influenza disease burden and guide vaccine strain selection, the Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance study has been underway in New Zealand.[29] Dr Sue Huang, Director of the WHO National Influenza Centre at the Institute of Environmental Science and Research, updated participants on recent SHIVERS data, noting that the 2017 seasonal influenza epidemic was relatively mild and H3N2 was the predominant circulating subtype.[4] A sero-epidemiologic population cohort study that

tested for hemagglutination inhibition (HAI) and neuraminidase inhibition (NAI) defined serological infection among an unvaccinated cohort (N=911) indicated that 35% (321/911) had either HAI or NAI seroconversion.[4] Of those infected, 14% (46/321) were HAI-alone seroconverters and 31% (100/321) were NAI-alone seroconverters, inferring that measuring anti-NA and anti-HA antibodies is important in understanding the true influenza infection burden.[4]

Annual seasonal influenza vaccination remains a key strategy to prevent influenza illness and related complications. Policy-makers and healthcare professionals shared their experiences with the 2017 seasonal influenza vaccination campaign in New Zealand. Similar to previous years since 2013, the Ministry of Health achieved its target of delivering 1.2 million doses.[4] In 2017, efforts focused on increasing vaccine accessibility, particularly for the elderly and pregnant women, extending availability of the funded vaccine, introducing district health board (DHB) performance measures and improving infrastructure to collect data about vaccine distribution.[4] The focus for the 2018 campaign will be on changing the vaccine strains, funding quadrivalent vaccines, managing the introduction of the funded zoster vaccine, and improving coverage among the elderly, particularly those of Māori, Pacific and Asian ethnicities, and healthcare workers.[4] Representatives from DHBs with high vaccination coverage rates shared some helpful strategies to improve staff vaccination rates; they emphasised diligent preparation before the campaign, frequent communication and building relationships during the campaign, comprehensive weekly reporting to guide decision-making, and collaboration with internal stakeholders and union members.[4]

More information and resources about the New Zealand vaccination campaign can be found at IMAC's website.[30] The importance of reducing inequities of influenza disease burden and protecting vulnerable groups (eg, young children, the elderly, pregnant women) by ensuring they are appropriately vaccinated was highlighted. Conversations continued from last year's symposium about novel vaccine technology, particularly for young children (eg, adjuvanted trivalent inactivated influenza vaccine [ATIV]) and the elderly (eg, ATIV and high-dose vaccines), and paradigms for influenza vaccination strategies (eg, individual protection, herd immunity).[3,4]

# Conclusion

The 4th New Zealand Influenza Symposium (NZiS) brought together various international and national experts and front-line service providers to discuss key areas of influenza prevention, findings from recent research studies and priority areas for future work. The event marked 100 years since the devastating influenza pandemic of 1918, thereby highlighting the continued need to prevent disease outbreaks and improve pandemic response plans in case a pandemic of that scale happened again. Seasonal influenza epidemics provide an annual opportunity to collect data to better understand the true influenza disease burden and inform disease control and management efforts. A key emerging theme was that vulnerable populations are disproportionately impacted by both pandemic and seasonal influenza. To reduce the inequitable influenza disease burden, efforts to improve accessibility and availability of influenza vaccines, along with developing more effective vaccines, for vulnerable populations should be a priority.

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