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Was the adult Victorian attack rate for pandemic influenza H1N1 2009 lower than expected?

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In the June issue of the *Australian and New Zealand Journal of Public Health*, Grills and colleagues reported an 'attack rate' for pandemic influenza H1N1 2009 (pH1N1) among Victorian adults of 10%, which they interpreted as lower than expected.[1] Terminology used when discussing infection caused by influenza – pandemic or seasonal – should be clarified. Grills and colleagues used opportunistically collected serum samples from Victorian adults aged 18-64 years to determine presumed seroconversion to pH1N1. If presumptive seroconversion, estimated by an antibody level that is believed to provide protection against further infection, can be said to be equivalent to recent infection, this type of study will estimate infection rate, but cannot distinguish between symptomatic and asymptomatic infection. Although 'rate' is sometimes used in the infectious diseases literature to describe infectious events over specified time periods,[1,2] these 'rates' are actually estimates of cumulative incidence, usually over the influenza season.

Whether the infection rate in adult Victorians should be considered lower than expected is an interesting question. A rate of approximately 10% (an estimated 16% of the sample being antibody positive at the level considered equivalent to infection minus 6% estimated as the proportion that might have had pre-existing antibodies) was unexpected if widespread disease had been anticipated among adults. However, it has been obvious for some time that the biggest source of transmission, and impact of the pandemic, was in younger age-groups not tested in the Victorian serosurvey. For instance, children aged 5-17 years inclusive comprised 67% of the first 977 notified cases of laboratory confirmed pH1N1 in Victoria,[3] a proportion much higher than the proportion of this age-group in the population. The age of the youngest person tested in the Victorian serosurvey was 18 years.

As the authors of the Victorian serosurvey acknowledge, the higher rate of infection in those less than 18 years old must be accounted for in order to estimate meaningful population infection rates. In the absence of published Australian data, we applied the seroconversion rates found in England[2] for those less than 18 years to the Victorian population of that age.[4] Specifically we used a seroconversion rate of 21.3% for children less than five years old, 42.0% for those aged 5-14 years, and 20.6% for those aged 15-17 years. Together with the estimated 10% seroconversion among 18-64 year olds in Victoria,[1] we calculated that approximately 16% of the Victorian population may have seroconverted to pH1N1 in 2009. The infection rate in those over 64 years old was negligible.[3]

Recent estimates of seroconversion by age group from New Zealand support the rates we have used to calculate the proportion of the Victorian population likely to have seroconverted. Subtracting the estimated age-specific seroprevalence for pH1N1 at the end of the pandemic period in New Zealand from the estimated baseline levels pre-pandemic, and adjusting for age and ethnicity, the estimated rates of seroconversion by age group were: 28.2% for children aged 1-4 years; 34.3% for persons aged 5-19 years; 17.6% for persons aged 20-39 years; 14.4% for persons aged 40-59 years and 1.9% for those aged 60 years and above. Considering all ages, seroconversion occurred in 18.3% of the population (Table 10 in reference 5).

Infection rates can be related to the effective reproduction number, R, which is the average number of secondary cases generated by one infected case. A higher age-specific infection rate leads to a higher value for R, while a lower age-specific infection rate will correspond to a lower value. Herd immunity, the level of immunity within the community that effectively protects that community from infection, is established at a value of approximately 1-1/R.[6] When this critical value has been reached, an epidemic declines naturally.

Among other variables, the reproduction number is dependent on the age structure of the population. In populations consisting of predominantly school children, estimates of R as high as 2.0-2.6 have been reported for pH1N1[7] whereas in predominantly adult populations R has been estimated to be as low as 1-1.1 (unpublished data, Katheryn Glass and Geoffry Mercer, National Centre for Epidemiology and Population Health, Australian National University). For populations in which all ages have been included, R has been estimated as approximately 1.2 in Japan,[8] New Zealand[9] and Western Australia.[10] For R = 1.2, herd immunity would occur at approximately 17% of the total population, consistent with our estimate of 16% for Victoria based on the findings of Grills and colleagues in Victoria[1] and using data for younger ages from England.[2] This is also similar to the estimate of 18% seroconversion in New Zealand.[5]

Based on an estimated value of R of 1-1.1 in adults, the adult seroconversion rate would be approximately 0-9%, again consistent with findings in Victoria[1] and England.[2] In New Zealand approximately 13% of a sample of adults aged at least 20 years seroconverted.[5] In Singapore 13% of a cohort of adults aged 21-74 years seroconverted.[11]

Rather than the pH1N1 infection rate of 10% in adult Victorias being lower than expected, we can argue that it is of the magnitude one would expect, based on a current understanding of the epidemiology of pH1N1. In Victoria this estimate is unlikely to have been influenced by any interventions, since the pandemic virus was almost certainly already circulating at the time these interventions were implemented.[10] Many Victorian school aged children and

young adults would have been infected with pH1N1 in 2009 and presumably have developed immunity to further infection. Because of the predilection of pH1N1 for younger age groups, immunity in these age groups provides protection to the wider community.

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Revolving Doors: New Zealand's Health Reforms – The Continuing Saga

By Robin Gauld. Second Edition. Published by Institute of Policy Studies and Health Services Research Centre, Victoria University of Wellington. 2009. ISBN 9781877347313. 233 pages plus index.

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It must be frustrating revising books on health system reforms. No sooner is your revision published, than another round of health sector reforms is embarked upon. Such is the case for this second revision of *Revolving Doors* by Robin Gauld, published in 2009 following the first edition in 2001. After nearly a decade of semi-stability in the New Zealand health system, reform is again occurring in 2009/10. A new National Health Board is being implemented to bring together 'back-office' planning activities, improve information technology co-ordination, and such like – partially echoing the Health Funding Authority of the late 1990s. But this new wave of reforms is young in tooth, and there is much to document and analyse about the 1999–2008 years with the bedding in of District Health Boards (DHBs) that still remain in place, and primary health organisations (PHOs), which also still remain (but are likely to get a major shake up in the next year or so).

Gauld's second edition includes a new final chapter, Chapter 11, *The Saga Continues: The district health board system and beyond.* Otherwise, the book is as per the 2001 edition. Chapters 2 to 10 document the structure of New Zealand health system from 1940 to c.2000, and has been previously reviewed by Ashton in 2002.[1] Ashton found these chapters to be a comprehensive overview of the mechanics and structure of the public health system, but perhaps overlooking the private system. Ashton also notes that the previous edition did not attempt to analyse, either from a theoretical perspective or from empirical evidence, the actual impact of the health system on population health. In sympathy with Gauld, I must note that it is frustratingly difficult to actually determine how any given health system impacts on the population's health in the absence of rich empirical data or cross-national comparisons. That said, given we spend an ever increasing and large fraction of GDP on health, it is a very important question to attempt to answer.

So what is included in Chapter 11 of this latest edition? Basically, a very readable summary of the 1999–2008 Labour-led government's health system agenda and implementation, including its strengths and weaknesses, followed by a thoughtful distillation of the issues to be grappled with by the incoming and current National-led government. A concise summary of the decentralisation to a DHB and PHO system is provided, with its attendant advantages such as a transparency and community participation, and its attendant disadvantages such as duplication and uncertainty about who is accountable for what. The shift during the 2000s towards a population-level, primary care-based, and inequalities reduction focus is described. It would have been ideal to see this changes and any consequent impact of population health and inequalities more tightly analysed, but as stated this is a frustratingly difficult research task.

The concluding analyses and suggested future directions offered up by Gauld at the end of the book are spookily consistent with the analyses and recommendations of the Ministerial Review Group[2] that reported just after Guald's second revision was published, and off which much of the current health sector reforms (or perhaps evolution) are being driven. If triangulation and consistency between authoritative reviews is taken as mutual validation, then it would appear that Gauld is on the money. And for what it is worth, I think he is – at least to the point of capturing much of the common sentiment within the health policy beltway. For example, that there is "widespread, but largely unwritten, agreement across the health