
**Contrast of Prophylactically Protecting Canadian Health Care
Workers and Emergency Service Providers:
A Moderate Canadian Pandemic Mathematical Assessment**

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Abstract

BACKGROUND: The spread of the avian strain of H5N1 influenza and the current worldwide outbreak of influenza A (H1N1) highlights an urgent need for preparedness and coordinated health system strategies to effectively combat a potential influenza pandemic. Canada acknowledges the benefits of antivirals (both therapeutically and prophylactically) in reducing the impact of a pandemic. A Canadian Pandemic Influenza Plan (CPIP) exists and Canadian governments have stockpiled antivirals. The use of antivirals as treatment and prophylaxis within the CPIP Annex E are based on the recommendations put forth by the Task Group on Antiviral Prophylaxis (TGAP). The strategy does not recommend use of antiviral prophylaxis for emergency service providers and limited post exposure prophylaxis for health care workers.

OBJECTIVE: The purpose of this study was to contrast different antiviral policy scenarios under the conditions of a first wave of a moderate pandemic, with the assumption that an additional antiviral stockpile is used as prophylaxis for all Canadian health care workers (HCWs) and emergency service providers (ESPs).

METHODS: A deterministic mathematical model of the transmission dynamics of influenza was used to track the Canadian population during an assumed moderate pandemic. The Canadian population was stratified into thirty seven non-overlapping geographical regions, age and gender groups. The population was further subdivided into risk of infection, risk of mortality given infection, epidemiological states (e.g., susceptible, exposed, infectious, recovered) and economic states (e.g. employed, unemployed, non labour force participating, age dependent wage, absenteeism profiles). The model was parameterized using available Canadian data as well as key estimates from available literature on United States and Canadian data from the 1957/58 pandemic. The model was run under current Canadian policy based on two interpretations of the TGAP recommendations as well as a policy in which antiviral drugs were used for treatment only. Subsequently, a series of nine additional simulations were conducted under modified antiviral use policies in which HCWs and ESPs were to receive antiviral drugs as pre and post exposure prophylaxis. The nine policies were to be adopted under the inherent assumption that an additional stockpile was to be purchased in order to satisfy each simulation. The burden associated with an infectious disease pandemic as well as the benefits due to the implementation of various antiviral use scenarios were assessed with respect to eight contrast measures: (1) reduced population deaths; (2) reduced hospitalizations; (3) reduced general practitioner visits; (4) HCW reduced deaths; (5) ESP reduced deaths; (6) HCW reduced absences; (7) ESP reduced absences; (8) net present value added from the intervention.

RESULTS: While there are significant life and economic benefits associated with the use of the current Canadian stockpile, the current model indicated that it is insufficient to support the Canadian population under the current TGAP recommendations. Depending upon the TGAP interpretation in use, the model indicated that the current stockpile begins to run out prior to the passing of the first wave of the pandemic.

When compared against all combinations of the contrast measures, all additional stockpile scenarios outperformed the respective TGAP interpretations. Those that involved the purchase of additional stockpiles for either an 84 day pre-exposure prophylaxis for HCWs and ESPs or post-exposure prophylaxis for HCWs and ESPs ranked the highest. These scenarios would require the purchase of 51 to 83 million additional doses of antivirals. Measured against a current stockpile utilization of treatment only, for HCW and ESP populations, such an investment would incrementally reduce infections by 51-61%, reduce deaths by 40-48%, reduce expected peak absenteeism by 57,600 - 59,704; and provide an incremental net present value gain for society in the range of \$421-\$521 million.

CONCLUSION: Under the assumptions, the results of this study suggest that the purchase of an additional antiviral stockpile for the purposes of either an 84 day pre-exposure prophylaxis or post-exposure prophylaxis for all HCWs and ESPs is a worthwhile investment. Either investment represents a risk reduction strategy that would increase the protection of health care workers and emergency service providers with complementary benefits for the population as a whole (less infections, deaths, hospitalizations and general practitioner visits).