## THE IMPACT OF INFLUENZA ON CANADA AND ADULTS 65 YEARS OF AGE AND OLDER.







# SECTION 1 AN AGING POPULATION: CONCERNS & PRIORITIES

## **Canada's aging population**

**MILLION 65 AND** 

OLDER IN 2015

The number of individuals 65 years of age and older is projected to double in the next 20 years from...

**MILLION 65 AND** 

OLDER IN 2036<sup>1</sup>



## **Canada's aging population**

Government health spending on an aging population is outpacing health spending due to growth of the population.<sup>2</sup>



Adapted from CIHI Health Care Cost Drivers: The Facts. 2011.

The aging of Canada's population is expected to have a major impact on Canada's health care system over the next 25 to 30 years.<sup>3</sup>

#### Adults over 65 years of age generally have:

- More family physician visits
- More hospital admissions
- Longer hospital stays... than younger Canadians<sup>3</sup>

#### References:

Contribution of population growth and aging to growth in provincial/territorial government health spending, 1998–2008

<sup>2.</sup> Canadian Institute for Health Information (CIHI). Health Care Cost Drivers: The Facts. October 2011.

<sup>3.</sup> Canadian Medical Association. Health and Health Care for an Aging Population. A Policy Summary. December 2013.

# Older Canadians suffer disproportionately from influenza-related morbidity and mortality.<sup>4</sup>



Adults 65+ only represent **15%** of the Canadian population<sup>5</sup>, but in the 2014–15 influenza season, they accounted for:<sup>4,5</sup>



... due to influenza.

References:

4. Public Health Agency of Canada (PHAC). FluWatch. May 3 to May 9, 2015.

5. Statistics Canada Population Projections: Canada, the Provinces and Territories, 2013 to 2063.

SECTION 2 EPIDEMIOLOGY

## **Epidemiology of influenza**



- In Canada, influenza generally occurs every year in the late fall and winter months<sup>6</sup>
- It is estimated that between 10–20% of the population becomes infected with influenza each year<sup>6</sup>
- Rates of influenza infection are highest in:<sup>6</sup>
  - Children aged 5–9 years
  - ADULTS 65+ YEARS
  - Those with underlying medical conditions

Reference: 6. CCDR. An Advisory Committee Statement (ACS). National Advisory Committee on Immunization (NACI). Statement on Seasonal Influenza Vaccine for 2013–2014.

# Influenza remains a serious public health concern in Canada.

Annually, influenza is estimated to cause:







References:

7. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). A Review of the Literature of High Dose Seasonal Influenza Vaccine for Adults 65 Years and Older.

8. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Statement on Seasonal Influenza Vaccine for 2015–2016.

9. Symposium on Influenza Immunization in the Healthcare Workplace. University of Calgary Faculty of Medicine. A Report of Conference Proceedings. June 11, 2014.

### Influenza remains under-reported despite its seriousness.

Global surveillance is an essential foundation for monitoring and managing pandemics.<sup>10</sup>

• The H1N1 pandemic of 2009 was under-reported by many countries<sup>10</sup>

To this day, there remains significant shortcomings in influenza surveillance and reporting, including:

- 1) A lack of standards for reporting illness, risk factors and mortality data<sup>10</sup>
- 2) A mechanism for systematic reporting of epidemiological data<sup>10</sup>
- 3) Data sources may capture only a very small proportion of influenza infections<sup>6</sup>

References:

<sup>6.</sup> CCDR. An Advisory Committee Statement (ACS). National Advisory Committee on Immunization (NACI). Statement on Seasonal Influenza Vaccine for 2013–2014. 10. Briand S, *et al.* Challenges of global surveillance during an influenza pandemic. Global Influenza Programme, World Health Organization. December 2010.

### Epidemiology

### **Potential Complications of Influenza**



6. CCDR.ACS, NACI. Statement on Seasonal Influenza Vaccine for 2013-2014.

11. ACS, (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016-2017.

12. Canadian Lung Association. Chronic Obstructive Pulmonary Disease (COPD).

13. Norhayati MN, et al. 2015.

14. CDC: Flu Symptoms & Complications.

15. CDC: The Pink Book: Course Textbook - 13th Edition (2015). Chapter 12 Influenza.

17. Udell JA. et al. 2015. 18. Siriwardena AN, et al. 2010. 19. CDC Morbidity and Mortality Weekly Report. August 26, 2016. 20. Grau AJ, et al. 2005. 21. Chen C-I, et al. 2016. 22. Husein N, et al. 2013.

### Influenza In 65+ Year-Olds in Taiwan

Influenza Vaccination Was Strongly Associated With Lowering the Risk of Major Cause-Specific Mortality<sup>23</sup>

- Study in Taiwan in >100,000 residents ≥65 years of age
- Six of 8 major causes of mortality evaluated were not directly related to lung disease
- >10-month follow-up of 35,637
   vaccinated and 67,061 unvaccinated seniors in 2001
- HIGH-RISK was defined as having
  - A chronic disease
  - Residence in long-term care, or
  - A history of recent (prior 3 years) hospital admission

80% of the full study population were not classified as high-risk

#### **Conclusion**

Influenza has been demonstrated to have a broad impact on other co-morbidities including stroke, diabetes and renal disease in a Taiwanese study.<sup>23</sup>

### Influenza In 65+ Year-Olds in Taiwan

Wang Study: Effect of Influenza and Risk Status on Cumulative Mortality<sup>23</sup>



(A) Cumulative all-cause mortality in HIGH-RISK study participants, stratified by influenza vaccination status prior to the study<sup>23</sup>

(B) Cumulative all-cause mortality in LOW-RISK study participants, stratified by influenza vaccination status prior to the study<sup>23</sup> Influenza Has Been Demonstrated to Increase the Risk of Major Cause-Specific Mortality in a Taiwanese Study<sup>23</sup>



### Study concluded that influenza was strongly associated with a higher mortality risk, not only for pneumonia and COPD, but also for other major cause-specific mortalities.<sup>23</sup>

Disclaimer: Influenza vaccines are not indicated to decrease the risk of major cause-specific mortalities, including but not limited to pneumonia and COPD.

# SECTION 3 INFLUENZA & CHRONIC CONDITIONS

### Influenza & Chronic Conditions

### Influenza: high-risk groups

NACI identified people at high risk for developing flu-related complications:<sup>11</sup>

- Residents of nursing homes or chronic care facilities
- People ≥65 years of age ٠
- All children 6 to 59 months ٠ of age
- Adults and children with the  $\circ$  Cancer. other following chronic health conditions:
- Cardiac or pulmonary disorders (bronchopulmonary dysplasia, cystic fibrosis and asthma)
- Diabetes mellitus and other metabolic diseases

- immune-compromising conditions
- Renal disease
- Anemia or hemoglobinopathy
- Neurologic or neurodevelopment conditions

- Morbid obesity (BMI ≥40)
- Children and adolescents (age 6 months to 18 years) undergoing prolonged acetylsalicylic acid treatment, because of potential increase of Reye's syndrome associated with influenza
- Aboriginal peoples
- Pregnant women

The following is a selective presentation of some of the high-risk factors for influenza-related complications identified by NACI and the CDC:11,24



#### References:

11. An Advisory Committee Statement (ACS), National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016-2017.

24. Centers for Disease Control and Prevention: People at High Risk of Developing Flu–Related Complications. https://www.cdc.gov/flu/about/disease/high\_risk.htm. Accessed March 27, 2017.

### Influenza in the 65+

### 74% of Canadians reported having at least 1 chronic condition<sup>25\*</sup>



\*The following chronic conditions are included: arthritis, asthma, cancer, chronic pain, depression, diabetes, emphysema or chronic obstructive pulmonary disease, heart disease, high blood pressure, a mood disorder other than depression and stroke.

Adapted from CIHI. Seniors and the Health Care System. January 2011.

# Influenza contributes to mortality among patients with underlying lung or chronic heart diseases

For persons aged 65 years and over, the risk for influenza-attributed death was:<sup>26</sup>



greater among those with chronic heart diseases

greater among those with chronic lung diseases



**20**x

greater among those with **both** chronic heart and lung conditions

### It is imperative to take measures to prevent influenza in adults 65 years of age and older.<sup>7,11</sup>

References:

7. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). A Review of the Literature of High Dose Seasonal Influenza Vaccine for Adults 65 Years and Older.

11. National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016–2017. Public Health Agency Of Canada. (October 18, 2016). Retrieved October 31, 2016 from : http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-eng.php.

26. Schanzer DL, et al. Co-morbidities associated with influenza-attributed mortality, 1994–2000, Canada. Vaccine. 2008;26:4697–4703.

# Impact of influenza and infections on functional status among older adults



- Pneumonia and influenza are leading causes of catastrophic disability, behind stroke and congestive heart failure<sup>27,28</sup>
- Influenza has been found to negatively affect functional status in seniors and be associated with declines in the ability to perform activities of daily living (ADL)<sup>29</sup>
- Influenza mortality was strongly associated with high (≥4 points) ADL decline (β = 0.32, p<0.001) as shown in the results of a multi-variate analysis.<sup>29</sup>
  - Results are from a US retrospective nursing home study

## **The study concludes:** "Our results suggest a substantial and potentially costly impact of influenza on NH residents."<sup>29</sup>

References:

- 27. Ferrucci L, et al. Hospital diagnoses, Medicare charges, and nursing home admissions in the year when older persons become severely disabled. JAMA. 1997;277(9):728-734.
- 28. McElhaney JE, et al. T-cell immunity to influenza in older adults: a pathophysiological framework for development of more effective vaccines. Front. Immunol. February 25, 2016. 29. Gonzalo PL, et al. The impact of influenza on functional decline. J Am Geriatr Soc. 2012 July;60(7):1260–1267.

## SECTION 4 IMPACT OF INFLUENZA IMMUNIZATION IN ADULTS 65+

### Immunosenescence in people 65+

### What is Immunosenescence?

Immunosenescence is a heightened susceptibility to influenza-related complications in older adults due to the natural and progressive weakening of the immune system over time.<sup>28,30</sup>

Immunosenescence is characterized by lower immune responses and can result in:

- An increased incidence and severity of infectious diseases<sup>28,30</sup>
- A reduction in the strength and persistence of antibody responses to vaccines<sup>28,30,31</sup>

### In the elderly, vaccine effectiveness is roughly half of that in healthy adults.<sup>11</sup>

References:

<sup>11.</sup> National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016-2017. Public Health Agency Of Canada. (October 18, 2016). Retrieved October 31, 2016 from: http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-eng.php.

<sup>28.</sup> McElhaney JE, et al. T-cell immunity to influenza in older adults: a pathophysiological framework for development of more effective vaccines. Front. Immunol. February 25, 2016.

<sup>30.</sup> Doherty M, et al. Vaccination of special populations: Protecting the vulnerable. Vaccine. 2016;34:6681–6690.

<sup>31.</sup> Public Health Agency of Canada (PHAC). Canadian Immunization Guide. General Guidelines. Updated November 2013.

### Influenza Immunization in Adults 65+

### Impact of Immunosenescence: Influenza vaccine effectiveness in adults 65+

Vaccination is the NACI-recommended option to protect against influenza.<sup>11</sup>

However, a study spanning multiple influenza seasons found that vaccine effectiveness in adults 65+ is consistently lower, ranging *from* 62%–76% *for younger adults and* 26%–52% *for adults* 65+.<sup>32</sup>



Adapted from Legrand J, et al. 2006.

#### References:

<sup>11.</sup> National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016-2017. Public Health Agency Of Canada. (October 18, 2016). Retrieved October 31, 2016 from : http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-eng.php.

<sup>32.</sup> Legrand J, et al. A. Real-time monitoring of the influenza vaccine field effectiveness. Vaccine. 2006;24:6605–6611.

### Influenza Immunization in Adults 65+

## Hospitalizations caused by influenza were highest among adults over 65...<sup>33,34</sup>



Adapted from Public Health Agency of Canada (PHAC). FluWatch 2014–2015.



References:

33. Public Health Agency of Canada (PHAC). FluWatch. August 16 to August 29, 2015.

34. Public Health Agency of Canada (PHAC). FluWatch. July 17 to August 13, 2016.

# Deaths caused by influenza were highest among adults over 65...<sup>33,34</sup>

In 2014-2015, adults 65 years of age and older accounted for 15% of the Canadian population:<sup>4</sup>

However, they are disproportionately represented when it comes to hospitalizations and deaths directly related to influenza.<sup>11\*</sup>



References:

4. Public Health Agency of Canada (PHAC). FluWatch. May 3 to May 9, 2015.

11. An Advisory Committee Statement (ACS)/National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016-2017. 33. Public Health Agency of Canada (PHAC). FluWatch. August 16 to August 29, 2015.

34. Public Health Agency of Canada (PHAC). FluWatch. July 17 to August 13, 2016.

# SECTION 5 NACI ON INFLUENZA PREVENTION

## NACI statement 2016–2017 Recommended recipients of influenza vaccine

"Recommended for everyone 6 months and older without contraindications."

"To reduce the morbidity and mortality associated with influenza, immunization programs should focus on those at high risk of influenza-related complications..."<sup>11</sup>

### NACI recognizes age (65 and older) as a risk factor<sup>7,11</sup>

References:

7. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). A Review of the Literature of High Dose Seasonal Influenza Vaccine for Adults 65 Years and Older. http://www.phac-aspc.gc.ca/naci-ccni/influenza-vaccine-65-plus-vaccin-contre-la-grippe-65-plus-eng.php. Last updated April 11, 2016. Accessed March 7, 2017.

11. An Advisory Committee Statement (ACS), National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016–2017.

### NACI on Influenza Prevention



Reference:

11. An Advisory Committee Statement (ACS), National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016–2017.

### NACI on Influenza Prevention

### NACI Recommendations on Influenza Vaccines for 65+ years of age<sup>7,11</sup>

### NACI statement 2016–2017

Four types of vaccine are available for use in adults ≥65 years of age:<sup>11</sup>

Recipient by age group	Vaccine types available for use
Adults 65+ years of age	<ul> <li>TIV</li> <li>QIV</li> <li>ATIV</li> <li>High dose TIV</li> </ul>
TIV (. Twicks lower incontinuate of influence we asing	

TIV: Trivalent inactivated influenza vaccine QIV: Quadrivalent inactivated influenza vaccine ATIV: Adjuvanted trivalent inactivated influenza vaccine

http://www.phac-aspc.gc.ca/naci-ccni/assets/pdf/flu-2016-2017-grippe-eng.pdf

"In choosing a vaccine product, it is important to consider the relative burden of influenza disease caused by the various influenza subtypes (i.e., influenza A(H1N1), influenza A(H3N2) and influenza B) in this age group, as well as the efficacy, immunogenicity and safety profile of the available vaccines."<sup>11</sup>

References:

7. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). A Review of the Literature of High Dose Seasonal Influenza Vaccine for Adults 65 Years and Older. http://www.phac-aspc.gc.ca/naci-ccni/influenza-vaccine-65-plus-vaccin-contre-la-grippe-65-plus-eng.php. Last updated April 11, 2016. Accessed March 7, 2017.

11. An Advisory Committee Statement (ACS), National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016–2017.

In the elderly, vaccine effectiveness is about half of that in healthy adults and varies depending on the outcome measures and the study population.<sup>11</sup>

Reducing the rates of influenza and its complications in individuals 65 years of age and over remains a public health priority.<sup>35</sup>

References:

11. An Advisory Committee Statement (ACS), National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016–2017.

35. Public Health Agency of Canada (PHAC). Canadian Immunization Guide. General Guidelines. 2014–2015. http://www.phac-aspc.gc.ca/naci-ccni/flu-grippe-eng.php. Accessed December 4, 2015.

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- 2. Canadian Institute for Health Information (CIHI). Health Care Cost Drivers: The Facts. October 2011.
- 3. Canadian Medical Association. Health and Health Care for an Aging Population. A Policy Summary. December 2013.
- 4. Public Health Agency of Canada (PHAC). FluWatch. May 3 to May 9, 2015.
- 5. Statistics Canada Population Projections: Canada, the Provinces and Territories, 2013 to 2063. Available at: https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-311-x/98-311-x2011001eng.cfm. Accessed November 28, 2016.
- 6. CCDR. An Advisory Committee Statement (ACS). National Advisory Committee on Immunization (NACI). Statement on Seasonal Influenza Vaccine for 2013–2014.
- 7. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). A Review of the Literature of High Dose Seasonal Influenza Vaccine for Adults 65 Years and Older. http://www.phac-aspc.gc.ca/naci-ccni/influenza-vaccine-65-plus-vaccin-contre-la-grippe-65-plus-eng.php. Last updated April 11, 2016. Accessed March 7, 2017.
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- 9. Symposium on Influenza Immunization in the Healthcare Workplace. University of Calgary Faculty of Medicine. A Report of Conference Proceedings. June 11, 2014.
- 10. Briand S, et al. Challenges of global surveillance during an influenza pandemic. Global Influenza Programme, World Health Organization. December 2010.
- 11. An Advisory Committee Statement (ACS), National Advisory Committee on Immunization (NACI): Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2016– 2017. Public Health Agency Of Canada. (October 18, 2016). Retrieved October 31, 2016 from: http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-eng.php.
- 12. Canadian Lung Association. Chronic Obstructive Pulmonary Disease (COPD). https://www.lung.ca/lung-health/lung-disease/copd/flare-ups. Last updated October 17, 2014. Accessed March 7, 2017.
- 13. Norhayati MN, et al. Influenza vaccines for preventing acute otitis media in infants and children (Review). Cochrane Database of Systematic Reviews. 2015;(3):CD010089.
- 14. Centers for Disease Control and Prevention: Flu Symptoms & Complications. https://www.cdc.gov/flu/about/disease/complications.htm. Accessed March 15, 2017.
- 15. CDC: The Pink Book: Course Textbook 13th Edition (2015). Chapter 12 Influenza.. https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/flu.pdf. Last updated November 15, 2016. Accessed March 7, 2017.
- 16. Udell JA, et al. Association between influenza vaccination and cardiovascular outcomes in high-risk patients: a meta-analysis. JAMA. 2013 Oct 23;310(16):1711–1720.
- 17. Udell JA, et al. Does influenza vaccination influence cardiovascular complications? Expert Rev Cardiovasc Ther. 2015;13(6):593–596.
- 18. Siriwardena AN, et al. Influenza vaccination, pneumococcal vaccination and risk of acute myocardial infarction: matched case-control study. CMAJ. 2010;182(15):1617–1623.
- 19. CDC Morbidity and Mortality Weekly Report. August 26, 2016;65(5). Prevention and Control of Seasonal Influenza with Vaccines Recommendations of the Advisory Committee on Immunization Practices United States, 2016–17 Influenza Season. https://www.cdc.gov/mmwr/volumes/65/rr/rr6505a1.htm. Last updated August 25. 2016. Accessed March 7, 2017.
- 20. Grau AJ, et al. Influenza vaccination is associated with a reduced risk of stroke. Stroke. 2005 Jul;36(7):1501–1506.
- 21. Chen C-I, et al. Influenza vaccination is associated with lower risk of acute coronary syndrome in elderly patients with chronic kidney disease. Medicine (Baltimore). 2016 Feb;95(5):1–9.
- 22. Husein N, et al. Influenza and pneumococcal immunization Canadian Diabetes Association clinical practice guidelines expert committee. Canadian Journal of Diabetes. 2013 Apr;37 Supplement 93.
- 23. Wang CS, et al. Impact of influenza vaccination on major cause-specific mortality. Vaccine. 2007;25(7):1196–1203.
- 24. Centers for Disease Control and Prevention: People at High Risk of Developing Flu–Related Complications. https://www.cdc.gov/flu/about/disease/high\_risk.htm. Accessed March 27, 2017.
- 25. CIHI: Seniors and the Health Care System: What Is the Impact of Multiple Chronic Conditions? 2011. https://secure.cihi.ca/free\_products/air-chronic\_disease\_aib\_en.pdf.
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- 32. Legrand J, et al. Real-time monitoring of the influenza vaccine field effectiveness. Vaccine. 2006;24: 6605–6611.
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