

Title: Accommodating Substantial Covid-19 Risk Factors within Maine’s Age-Based Approach to Vaccine Prioritization

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1 Executive Summary

- A 10-year increase in age is associated with a 3-fold increase in covid-19 mortality
- A handful of risk factors, including Down syndrome (on the US CDC list of risk factors¹ but not included in the Maine CDC’s public presentation²) are associated with a 3-fold, or possibly 10-fold, increase in covid-19 mortality.
- Within Maine’s age-based framework for vaccine prioritization, any condition associated with a 3-fold increase in covid-19 mortality could give a person with that condition a 10-year “boost” in access to vaccine. Any condition with a 9-fold increase in covid-19 mortality could give a person with that condition a 20-year “boost” in access to vaccine.

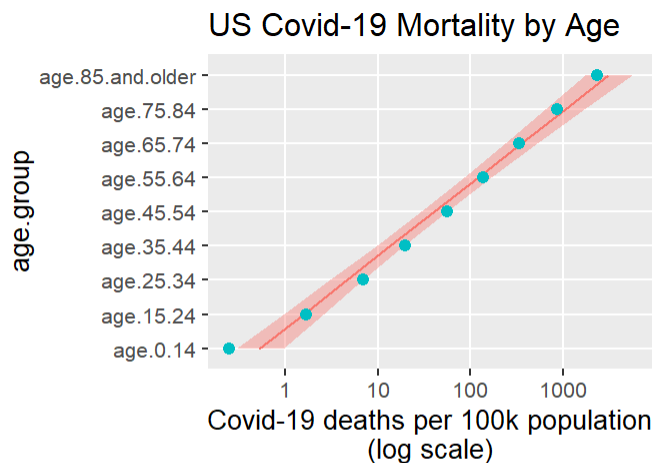
2 Introduction

Maine has recently moved to age-based prioritization for covid-19 vaccines (modified shortly afterwards to also prioritize teachers and child care providers). The justification was that age is very strongly associated with covid hospitalization and death, more so than many risk factors, as discussed at the briefing delivered February 26.²

3 Analysis

3.1 Age

I have analyzed US covid-19 mortality by age group, with each age group except the youngest (0-14) and oldest (85+) covering a 10-year span. The figure at right shows the data, including a best-fitting line. The fit is excellent (adjusted $R^2 > 0.98$) and indicates that covid-19 mortality increases **3-fold with every increase in age group**. This is consistent with the analysis on page 3 of the Maine CDC slide presentation (630-fold gain shown on Maine CDC’s slide from 18-29 to 85+ years is 2.9-fold gain per 10-year age group, compounded across 6 group transitions).²



Source: US Census and <https://data.cdc.gov/resource/9bhg-hcku.json>
Downloaded 2021mar08

Best-fit line has mortality increasing by factor of 3.0 [95% confidence interval: (2.7, 3.3)] per age group.

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¹ <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>

² Maine DHHS (2021, February 26). *Indicators of Severe COVID-19 Illness*. Presentation by Nirav Shah. Slides accessed 03/08/2021 from https://www.maine.gov/dhhs/sites/maine.gov.dhhs/files/2021-02/Indicators%20of%20Severe%20COVID19%20Illness%20%2026%202021.pptx_.pdf

3.2 Risk Factors in Maine CDC Presentation

Most risk factors considered in the Maine CDC powerpoint² have a modest elevation in mortality. However, a handful of medical conditions have a larger elevation. In particular, as indicated in slide 8 (reproducing a figure from Williamson et al., 2020³), haematological malignancy diagnosed less than 1 year ago has about a **3-fold elevation in covid mortality**. In addition, as indicated in slide 8 and slide 9 (the latter reproducing a figure from Tartof et al., 2020⁴), organ transplant has a **3.6- to 6.5-fold elevation in covid mortality**.

3.3 A Risk Factor Not in Maine CDC Presentation: Down Syndrome

Finally, there are other substantial risk factors associated with covid mortality that are not found in the powerpoint. In particular, it has been reported that Down syndrome may be associated with a roughly 10-fold increase in covid mortality.⁵ A more recent report suggests that the 10-fold estimate may be biased high because the earlier study was conducted early in the pandemic when access to medical care may have been limited for people with less severe disease (so the earlier paper may have disproportionately missed survivors). However, even the more recent paper estimates that Down syndrome puts people at a roughly 3-fold increase in risk of covid mortality.⁶ The elevated risk motivates the inclusion of Down syndrome on US CDC's list of medical conditions with sufficient evidence to conclude they put people at increased risk of severe illness from covid.¹ Importantly for the logistics of speeding vaccine delivery in real-world settings, Down syndrome is easy to verify.

4 Recommendation

From a quantitative point of view, driven by science and data, a condition associated with a 3-fold increase in covid mortality is equivalent to the increase in risk associated with a 10-year increase in age, and a condition associated with a 9-fold increase in covid mortality is equivalent to the increase in risk associated with a 20-year increase in age. For this reason, safety and equity for people with a risk factors associated with a 3-fold increase in covid mortality could be addressed by giving them access to the vaccine along with people who are 10 years older—and giving people with conditions that elevate their risk by 9-fold access to the vaccine along with people who are 20 years older. For example, a 40-year-old with haematological malignancy diagnosed less than 1 year ago might be given access to vaccine when 50-year-olds from the general population gain access, and a 40-year-old with Down syndrome or organ transplantation might be given access to vaccine when 50- or 60-year-olds from the general population gain access. Other conditions listed on the US CDC web page¹ should also be evaluated against this standard for purposes of vaccine prioritization within Maine's age-based framework as US CDC updates the list.

³ Williamson EJ et al. (2020). Factors associated with COVID-19-related death using OpenSAFELY. *Nature*, 584, 430-436. <https://doi.org/10.1038/s41586-020-2521-4>

⁴ Tartof SY et al. (2020). Obesity and mortality among patients diagnosed with COVID-19: Results from an integrated health care organization. *Annals of Internal Medicine*. <https://doi.org/10.7326/M20-3742>

⁵ Clift AK et al. (2020). COVID-19 mortality risk in Down syndrome: Results from a cohort study of 8 million adults. *Annals of Internal Medicine*. <https://doi.org/10.7326/M20-4986>

⁶ Hüls et al. (2021). Medical vulnerability of individuals with Down syndrome to severe COVID-19—data from the Trisomy 21 Research Society and the UK ISARIC4C survey. *EClinicalMedicine*. <https://doi.org/10.1016/j.eclinm.2021.100769>