Short Note

Avoidable Intensive Care Resource Use of Unvaccinated COVID-19 Patients: Interpretation and Policy Implications

Ari R Joffe[1]* and Chris Milburn[2]

[1] University of Alberta, Department of Pediatrics, Division of Critical Care Medicine, Edmonton, Alberta, Canada
[2] Dalhousie University, Faculty of Medicine, Halifax, Nova Scotia, Canada
*Corresponding author: ajoffe@ualberta.ca

Abstract: We aim to use a recently published research study as an example in order to demonstrate how data can be misinterpreted and result in deriving misleading policy implications. Bagshaw et al wrote that unvaccinated patients with COVID-19 in Alberta, Canada "had substantially greater rates of ICU admissions, ICU bed days, and ICU related costs than vaccinated patients did. This increased resource use would have been potentially avoidable had these unvaccinated patients been vaccinated." The authors in Bagshaw et al then concluded that their findings "have important implications for discourse on the relative balance of increasingly stringent public health protection (restrictions), including mandatory vaccination policies, and the sustainability and function of health system infrastructure and capacity during the ongoing COVID-19 pandemic." Here we show the following. First, the effect of vaccination on intensive care admissions were grossly over-estimated. Second, an effect of vaccination on access to acute care and on all-cause excess deaths was grossly over-stated. Third, policy implications were overstated and at best unclear. Overall, the data cannot support what Bagshaw et al called "increasingly stringent public health protection (restrictions), including mandatory vaccination policies".

Keywords: COVID-19; intensive care unit; resource use; vaccination

1. Estimating avoidable intensive care unit resource use and costs of unvaccinated patients with COVID-19: interpretation and policy implications

The authors in Bagshaw et al concluded that unvaccinated patients with COVID-19 in Alberta "had substantially greater rates of ICU admissions, ICU bed days, and ICU related costs than vaccinated patients did. This increased resource use would have been potentially avoidable had these unvaccinated patients been vaccinated."[1] Using this publication as an example, we aim to demonstrate how data and policy implications can be misinterpreted.

2. Effect of vaccination on ICU admissions were over-estimated

First, the study by Bagshaw et al used "publicly available age-stratified aggregate data on COVID-19 infections, vaccination status, and health service use provided by Alberta Health."[1] A major error in this data was misattribution of vaccination status. Those single- or double-dose vaccinated within 14 days were considered in the unvaccinated or partially vaccinated group respectively. This violates a cardinal principle of interventional studies, the intention to treat principle. Statisticians have shown that this misattribution error alone can account for an apparent high placebo-vaccine efficacy for adverse outcomes.[2,3] The effect of this error is exacerbated if a vaccine increases the risk of COVID-19 infection via immunosuppression in those first 2 weeks, which occurs with the mRNA COVID-19 vaccines.[4-6] The effect of this error is further exacerbated if there is delay in reporting of ICU admissions; it is unclear if ICU admission data was back-dated for the day of infection, and since this was unlikely, the ICU data was shifted about 1 week from

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infection date.[7,8] The effect of this misattribution error on causing grossly overestimated COVID-19 vaccine efficacy has been shown using real-world data from Israel and the UK.[9,10] The data used in the Bagshaw et al study is no longer publicly available from Alberta Health Services, making correction for these errors impossible.

Second, the study did not report what proportion of ICU admissions with COVID-19 were due to an acute COVID-19 infection. Other reports in North America have found that often 50% of hospitalizations and 25% of ICU admissions with COVID-19 were not due to a COVID-19 infection - the COVID-19 diagnosis was incidental to the reason for admission.[11,12]

Third, there was no adjustment for confounding variables. In RCTs (the best method to balance potential confounding variables) of the mRNA COVID-19 vaccines, no effect on all-cause mortality was found - the vaccines reduced COVID-19 deaths but increased other deaths.[13] Confounders such as co-morbidities, community transmission rates, exposure behaviors, and others, were not available so not adjusted for. More difficult to adjust for are clinician behavior biases; for example, unvaccinated patients may be more likely to be admitted to ICU because clinicians believed they were higher risk to deteriorate.

Fourth, adverse effects of vaccines were not considered for a cost-benefit analysis. Were more vaccinated than unvaccinated patients admitted to hospital or ICU for non-COVID-19 reasons? What was age-stratified population all-cause mortality in those who had been vaccinated compared to unvaccinated? Excess mortality for non-COVID reasons has increased in several highly vaccinated jurisdictions, not clearly due to overwhelmed healthcare capacity.[14,15] Myocarditis in young adult males is caused by mRNA vaccination, much more than from COVID-19 infection itself, and may be why EMS calls in Israel for cardiac arrest and acute coronary syndrome increased by 25% in young adults during vaccination rollout [and not during previous COVID-19 waves].[16-19]

3. Effect of vaccination on access to acute care and all-cause excess deaths unlikely

The authors in Bagshaw et al wrote that "baseline funded ICU bed capacity in Alberta [was] (n=173 beds)," as asserted by Alberta Health Services later in the pandemic.[1] However, previous publications, by some of the same authors, gave different figures, ranging from 351 to 430 funded adult ICU beds in Alberta.[20,21] In 2015 the authors published an estimate of 268 publicly funded adult ICU beds in 2010.[22] Checking publicly available websites for each ICU in Alberta gave a figure for publicly funded adult ICU capacity of 281 beds [Table 1]. It is not clear whether ICU capacity was increased in Alberta during the pandemic; it appears more likely that current ICU resources were simply reallocated in unclear ways. This questions the assertion made in Bagshaw et al that excess mortality may be attributable to "heart disease, diabetes, and nonrespiratory related disease… related to delayed or impeded access to acute care…" for several reasons.[1]

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Table 1. Alberta Intensive Care Unit baseline (pre-pandemic) funded bed capacity.

ICU name	Location	ICU type	Hospital type	Hospital classification (CIHI)[a]	eCritical implementation date	Funded Adult ICU beds	Website where funded beds data obtained
Foothills Medical Center Multi-Systems ICU	Calgary	Mixed (medical, surgical, neurosurgical, trauma)	Academic	Teaching	July 2012	28	https://cumming.ucalgary.ca/departments/critical-care/locations/foothills-medical-centre
Foothills Medical Centre CVICU	Calgary	Cardiovascular surgical	Academic	Teaching	August 2012	22	https://cumming.ucalgary.ca/departments/critical-care/locations/fmc-cardiovascular-intensive-care-unit
University of Alberta Hospital General Systems ICU	Edmonton	Mixed (medical, surgical, trauma, transplant)	Academic	Teaching	April 2013	28	https://www.ualberta.ca/critical-care/about-us/critical-care-units.html
University of Alberta Neuro ICU	Edmonton	Neurosciences	Academic	Teaching	June 2013	15	https://www.ualberta.ca/critical-care/about-us/critical-care-units.html
Mazankowski Alberta Heart Institute CVICU	Edmonton	Cardiovascular surgical	Academic	Teaching	October 2013	24	https://www.ualberta.ca/critical-care/about-us/critical-care-units.html
Peter Lougheed Hospital ICU	Calgary	Mixed (medical, surgical, vascular)	Tertiary	Teaching	August 2012	18 [plus 4 flex]	https://cumming.ucalgary.ca/departments/critical-care/locations/peter-lougheed-centre
Royal Alexandra Hospital ICU	Edmonton	Mixed (medical, surgical, trauma)	Tertiary	Teaching	July 2013	25	https://www.ualberta.ca/critical-care/about-us/critical-care-units.html
Rockyview General Hospital ICU	Calgary	Mixed (medical, surgical)	Community	Teaching	June 2012	17 (7 are CCU)	https://cumming.ucalgary.ca/departments/critical-care/locations/rockyview-general-hospital
South Health Campus ICU	Calgary	Mixed (medical, surgical)	Community	Community large	February 2013	12 (2 are CCU)	https://cumming.ucalgary.ca/departments/critical-care/locations/south-health-campus
Sturgeon Community Hospital ICU	St. Albert	Mixed (medical, surgical)	Community	Community large	January 2014	5 [plus 3 High Intensity beds]	https://www.ualberta.ca/critical-care/about-us/critical-care-units.html
Grey Nuns Community Hospital ICU	Edmonton	Mixed (medical, surgical, vascular)	Community	Teaching	February 2014	8	https://www.ualberta.ca/critical-care/about-us/critical-care-units.html
Misericordia Community Hospital	Edmonton	Mixed (medical, surgical)	Community	Teaching	March 2014	10	https://www.ualberta.ca/critical-

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							care/about-us/critical-care-units.html
Medicine Hat Regional Hospital ICU	Medicine Hat	Mixed (medical, surgical)	Regional	Community large	June 2015	10 (2 are CCU)	https://medicinehatnews.com/news/local-news/2021/09/16/icu-struggles-to-keep-up-with-covid-crisis/
Northern Lights Health Centre ICU	Fort McMurray	Mixed (medical, surgical)	Regional	Community medium	November 2015	6	https://www.fortmcmurraytoday.com/news/not-a-day-we-are-not-busy-icu-doctor-on-fighting-covid-19-at-nlrhc
Chinook Regional Hospital ICU	Lethbridge	Mixed (medical, surgical)	Regional	Community large	December 2015	14 (probably 4 are CCU)	https://www.albertahealthservices.ca/assets/about/scn/ahs-scn-cc-icu-delirium-ls3-poster-chinook-lethbridge.pdf
Grande Prairie QEII Regional Hospital	Grande Prairie	Mixed (medical, surgical)	Regional	Community large	February 2016	6	https://everythinggp.com/2021/09/10/qeii-hospital-continuing-to-experience-pressure-from-covid-19-patients/
Red Deer Regional Hospital ICU	Red Deer	Mixed (medical, surgical)	Regional	Community large	March 2016	18 (6 are CCU)	https://www.albertahealthservices.ca/assets/about/scn/ahs-scn-cc-icu-delirium-ls3-poster-rdrh-icu.pdf
University of Alberta Hospital Burn Unit	Edmonton	Burn	Academic	Teaching	-	4 [plus 4 High Intensity beds]	https://www.ualberta.ca/critical-care/about-us/critical-care-units.html
TOTAL FUNDED ADULT ICU BEDS	Alberta	All	All	Combined	-	**270 [plus 11 flex or high intensity][c]**	-
FUNDED PICU/PCICU BEDS[b]	Alberta	Stollery Children's Hospital PICU and PCICU, Alberta Children's Hospital PICU	Academic	Teaching	-	**15, 16, and 15 respectively = 46**	https://www.ualberta.ca/pediatrics/divisions/critical-care-picu.html; https://cumming.ucalgary.ca/departments/pediatrics/sections/critical-care
TOTAL POTENTIAL FUNDED ADULT ICU BEDS	Alberta	All	All	Combined	-	**327**	Combined

Abbreviations: ICU = intensive care unit; PICU: Pediatric Intensive Care Unit; PCICU: Pediatric Cardiac Intensive Care Unit. The table is modified from Supplemental Table 1 in ref 20, with the last two columns and last four rows added.

a. Hospitals were categorized by Canadian Institute of Health Information (CIHI) by hospital type as follows: teaching (full membership in the Association of Canadian Academic Healthcare Organizations; any size), large (≥200 beds), medium (50-199 beds), and small (1-49 beds) community hospitals.

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b. These PICU and PCICU beds are capable of caring for young adults [i.e., those that are lower risk for adult-specific diseases, particularly lower risk for coronary artery disease and severe COPD].

c. Compared to the number of adult ICU beds pre-pandemic on the Alberta COVID statistics website of 173 [see: https://www.alberta.ca/stats/covid-19-alberta-statistics.htm#healthcare-capacity (Accessed October 13, 2021)]. This seems to include adult and pediatric ICU beds, given that the tables of ICU admissions on the website include pediatric patients in an ICU. The 'surge capacity' had increased on Sept 14 to 297 ICU beds, and by Oct 5 to 374 ICU beds [with 69 unoccupied, leaving 305 beds occupied]. Occupied beds on October 5, 2021, were 305/173 = 176% occupancy; however, if there were 327 beds at baseline, this is 305/327 = 93% occupancy.

First, it is more likely that these excess deaths were related to lockdowns causing loneliness, depression, anxiety, unemployment, lack of exercise, poor diet, weight gain, and increased substance use, factors known to significantly increase mortality from these diseases.[23] This is important for two reasons. Intensive care for complications of "heart disease, diabetes, and nonrespiratory related disease"[1] is often not successful, and the best outcomes involve primary care that emphasizes avoiding the exact risk factors exacerbated by lockdown policies. Moreover, research has found that lockdowns were not effective at reducing COVID-19 cases in the population, yet had these profound adverse effects.[24-26]

Second, it is more likely that these excess deaths, to the extent they may be related to delayed acute care, were due to fear of COVID-19 inculcated in the population and to cruel hospital visitation policies, factors that prevented people from seeking healthcare for any condition. These excess deaths were due to policies, and not the COVID-19 pandemic itself.

Third, it is possible that had ICU capacity been increased in Alberta, some of these excess deaths would have been avoided. Working on increased capacity (without simply cancelling what Bagshaw et al called "non-emergent services including scheduled procedures and surgeries"[1]) was the main priority for public health, Alberta Health Services, and medical experts, or at least it should have been. Making policies such as lockdowns and mandatory vaccination was not their priority, and rather should have been coordinated by Emergency Management Agencies that were trained to consider all costs and benefits of any public policy.[24,27] When the Bagshaw et al study started, on September 6, 2021, there had been 17 months since the start of the pandemic to prepare needed surge capacity at Alberta hospitals.

4. Policy implications at best unclear

The authors in Bagshaw et al concluded that their findings "have important implications for discourse on the relative balance of increasingly stringent public health protection (restrictions), including mandatory vaccination policies, and the sustainability and function of health system infrastructure and capacity during the ongoing COVID-19 pandemic."[1] We are not so sure.

First, "increasingly stringent public health protection (restrictions)"[1] have not translated into better control of COVID-19 cases nor healthcare infrastructure.[23-26] Similarly, "mandatory vaccination policies"[1] in Canada and the United States have not translated into meaningful increases in population vaccination rates (i.e., generally <1% absolute increases).[28,29] Policies should be based on transparent and accurate cost-benefit data, yet, as discussed above, the data in Bagshaw et al was mostly not interpretable, not publicly available (and when publicly available, did not give enough detail to allow an intention to treat analysis), did not consider health costs to mandatory vaccination,[18,30,31] and contained no data regarding effects of restrictions or mandatory vaccinations.

Second, policy must be based on more than healthcare information. Considerations include effects on sectors of society other than healthcare, inequality, human rights, and other determinants of population well-being. This detailed cost-benefit analysis requires diverse stakeholders and coordination by an emergency management agency.[23,25]

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Third, if Bagshaw et al data informs a policy to mandate citizens be vaccinated (because we have concluded that they are using hospital resources due to health decisions we disagree with), then better data suggests this principle should be extended to other disorders. Many health decisions are far more impactful on hospital resource use than is the choice to be unvaccinated. In Canada, there were more hospital admissions due to alcohol use than due to heart attacks – should we enforce no-alcohol mandates?[32] Cigarette smoking was responsible for over 2.2 million days in acute care hospital beds in Canada yearly (at a cost over $2.5 billion in 2002) – should we enforce no-smoking mandates?[33] Poor diets can lead to diabetes, cardiovascular disease, cancer, obesity, and early death; the WHO has estimated that if all people adopted a vegan diet this would avert approximately 13.7 million deaths by 2030 – should we mandate dietary choices?[34] Should we micromanage patients' life decisions aiming for "the sustainability and function of health system infrastructure and capacity"[1]?

Fourth, we suggest that the ICU physician's view can be too skewed to make policy - they daily see rare cases, drawn from a large region and concentrated on their unit. From that point of view, unjustified perceptions of risk can occur. The median infection fatality rate (IFR) from SARS-CoV-2 infection, prior to vaccines, was 0.035% for age 0-59 years, and 0.095% for 0-69 years.[35] The median IFR by age group in Pezzullo et al was a median 0.0003% at 0-19 years, 0.003% at 20-29 years, 0.011% at 30-39 years, 0.035% at 40-49 years, 0.129% at 50-59 years, and 0.501% at 60-69 years.[35] For those <70 years this is 0.33%/0.095%=3.5X lower than the *case* fatality rate in Canada in March, 2021; correcting for this difference between case and infection outcome rates, the infection hospitalization and ICU admission rates for those <70 years in Canada were 3.0%/3.5=0.86% and 0.7%/3.5=0.2% respectively in May, 2021 (and with Omicron variants is now likely 3-5X lower).[24] From a public health lens, serious outcomes from SARS-CoV-2 are rare in those <70 years. Adults over age 70 years are at higher risk, with those living in the community having median IFR (before vaccines and Omicron variants) 2.2%; focused protection, especially in those with multiple co-morbidities, should be offered.[36]

5. Conclusion

Using Bagshaw et al as an example, we have argued the following. First, the effect of vaccination on intensive care admissions can be grossly over-estimated due to misattribution errors, conflating 'with COVID' for 'from COVID', lack of adjustment for confounders, and not fully considering cost-benefit analysis. Second, an effect of vaccination on access to acute care and on all-cause excess deaths can be grossly over-stated if certain factors are not considered, including the adverse effects of lockdowns, induction of fear in the population, and cruel hospital visitation policies, and lack of attention to creating healthcare surge capacity. Third, policy implications can be overstated for several reasons including not considering real-world data on the (lack of) efficacy of increasingly stringent lockdowns and mandatory vaccination policies, full cost-benefit analysis, implications for other medical disorders, and the overall very low risk for serious outcomes from SARS-CoV-2 in people <70 years old.

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