

Covid-19 vaccine boosters for young adults: A risk-benefit assessment and five ethical arguments against mandates at universities

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Abstract

Students at North American universities risk disenrollment due to third dose Covid-19 vaccine mandates. We present a risk-benefit assessment of boosters in this age group and provide five ethical arguments against mandates. We estimate that 22,000 - 30,000 previously uninfected adults aged 18-29 must be boosted with an mRNA vaccine to prevent one Covid-19 hospitalisation. Using CDC and sponsor-reported adverse event data, we find that booster mandates may cause a net expected harm: per Covid-19 hospitalisation prevented in previously uninfected young adults, we anticipate 18 to 98 serious adverse events, including 1.7 to 3.0 booster-associated myocarditis cases in males, and 1,373 to 3,234 cases of grade ≥ 3 reactogenicity which interferes with daily activities. Given the high prevalence of post-infection immunity, this risk-benefit profile is even less favourable. University booster mandates are unethical because: 1) no formal risk-benefit assessment exists for this age group; 2) vaccine mandates may result in a net expected harm to young people; 3) mandates are not proportionate: expected harms are not outweighed by public health benefits given the modest and transient effectiveness of vaccines against transmission; 4) US mandates violate the reciprocity principle because rare serious vaccine-related harms will not be reliably compensated due to gaps in current vaccine injury schemes; and 5) mandates create wider social harms. We consider counter-arguments such as a desire for socialisation and safety and show that such arguments lack scientific and/or ethical support. Finally, we discuss the relevance of our analysis for current 2-dose Covid-19 vaccine mandates in North America.

45 **1. Introduction**

46 Covid-19 vaccine booster mandates have been controversial, especially in younger age groups.
47 Two main factors are driving scientific controversy: a lack of evidence that booster doses
48 provide meaningful reduction in hospitalisation risk among young people and mounting
49 evidence that (widespread) prior infection confers significant protection against hospitalisation
50 due to (re-)infection. Further, mandates have deleterious societal consequences and are eroding
51 trust in scientific and government institutions.¹ In North America, as of May 2022 at least 1,000
52 colleges and university campuses required Covid-19 vaccination, and over 300 required
53 boosters.² More than fifty petitions have been written opposing these vaccine mandates³,
54 raising specific legal and ethical complaints.⁴ In many cases, young people, parents, and faculty
55 have been ignored by administrators and mandate proponents.

56
57 Policymakers, public health scholars and bioethicists have argued both for and against Covid-
58 19 vaccine mandates. The strongest argument made by mandate proponents is based on the
59 harm principle: insofar as vaccines prevent transmission and thereby reduce harm to others,
60 restrictions on individual freedom are viewed as more ethically justifiable.⁵ Of course, a
61 reduction in risk to others (especially if this is a small or temporary effect) might not alone be
62 sufficient to justify a booster mandate in young people. Savulescu⁶ and colleagues⁷ have argued
63 that, to be ethical, mandates require four conditions: that the disease be a grave public health
64 threat; that there is a safe and effective vaccine; that mandatory vaccination has a superior
65 cost/benefit profile in comparison to other alternatives; and that the level of coercion is
66 proportionate.

67
68 Proportionality is a key principle in public health ethics.¹ To be proportionate, a policy must
69 be expected to produce public health benefits that outweigh relevant harms, including harms

70 related to coercion, undue pressure, and other forms of liberty restriction. Williams⁸ has argued
71 that Covid-19 vaccine mandates may be justified for older but not younger people, among
72 whom such policies are not proportionate given a lack of clarity that benefits outweighs harms.
73 Such ethical assessments should rely on empirical data: thorough risk-benefit assessment
74 requires quantification (where possible) of relevant risks and benefits *for the group affected by*
75 *the policy*. With respect to poor outcomes due to Covid-19, the most consistent predictors are
76 age⁹ and comorbidities.¹⁰ Similarly, age and sex are prominent risk factors for vaccine-
77 associated reactogenicity¹¹ and serious adverse events such as myocarditis, which is more
78 common in males.¹² Vaccine requirements must therefore be predicated on an age- and sex-
79 stratified risk-benefit analysis and consider the protective effects of prior infection.

80
81 In this paper, we provide (to our knowledge) the first risk-benefit assessment of SARS-CoV-2
82 boosters for young previously *uninfected* adults under 40 years old. Our estimate suggests an
83 expected net *harm* from boosters in this young adult age group, whereby the negative outcomes
84 of all severe adverse events and hospitalizations may on average outweigh the expected
85 benefits in terms of Covid-19 hospitalizations averted. We also examine the specific harms to
86 males from myo/pericarditis. Our analysis is conservative given the fact that we did not account
87 for the protective effects of prior infection, which is estimated to be substantive.¹³ We then
88 outline a five-part ethical argument against booster mandates for young people informed by
89 our empirical assessment. First, we argue that there has been a lack of transparent risk-benefit
90 assessment; second, that vaccine mandates may result in a net expected harm to individual
91 young adults; third, that vaccine mandates are not proportionate; fourth, that US mandates
92 violate the reciprocity principle because of current gaps in vaccine injury compensation
93 schemes; fifth, that mandates are even less proportionate than the foregoing analyses suggest
94 because current high levels of coercion or pressure create wider societal harms. We consider

95 possible counterarguments including potential rationales for mandates based on a desire for
96 social cohesion or safety and summarise why such arguments cannot justify current Covid-19
97 vaccine mandates. We suggest that general mandates for young people ignore key data, entail
98 wider social harms and/or abuses of power, and are arguably undermining rather than
99 contributing to social trust and solidarity.

100

101 **2. Background**

102 To provide background for our risk-benefit assessment and ethical arguments, we outline recent
103 controversies among experts regarding vaccine boosters and summarise current data on Covid-
104 19 vaccines, specifically: vaccine effectiveness against transmission, effectiveness in those
105 with prior infection, and the age-stratified risk of severe COVID-19.

106

107 **2.1. Controversy Among Experts**

108 The rapidly shifting policy response to the pandemic has exacerbated a crisis in the
109 *trustworthiness* of scientific institutions, health agencies and regulatory bodies. Transparency
110 in policy making has been threatened in part by political expediency, sometimes even to the
111 point of government agencies over-ruling appointed scientific expert groups without clear
112 explanation of the reasons for such reversals. For example, in July 2021, the CDC released a
113 joint statement with the FDA¹⁴ reassuring the public that boosters were not necessary. Just two
114 months later, in September 2021, a US FDA advisory committee overwhelmingly voted 16-2
115 against boosting healthy young adults.¹⁵ Yet, this recommendation was overruled by the White
116 House and CDC leading to the resignation of two high-level FDA vaccine experts. These
117 experts wrote in *The Lancet* about the "...need to identify specific circumstances in which the
118 direct and indirect benefits of doing so are, on balance, clearly beneficial."¹⁶ To date, no such
119 favourable risk-benefit assessment has been made public.¹⁷

120 Because the mRNA vaccine 3rd dose booster trials were too small to measure important clinical
121 endpoints, additional doses have been granted Emergency Use Authorisation (EUA) based on
122 observational data suggesting benefits in older populations.¹⁸ Prior to the emergence of the
123 Omicron variant, the US CDC estimated¹⁸ that administering a booster dose to 9,000 (Pfizer)
124 or 12,000 (Moderna) 18–29-year-olds would prevent one Covid-19 hospitalisation over six
125 months. As of August 2022, this estimate has not been updated to reflect increasing natural
126 immunity or waning vaccine effectiveness. Data on vaccine effectiveness specific to young
127 adults is scarce, but reports from the UK¹⁹ and Israel²⁰ failed to identify additional protective
128 effects of boosters against severe disease for people younger than 40. In a recent CDC
129 publication, which stratified for ages 18-49, a booster dose increased effectiveness against
130 emergency department encounters and hospitalizations among immunocompetent adults
131 during the Omicron wave, but the analysis did not adjust for comorbidities and excluded those
132 with a history of prior infection “to reduce the influence of protection from previous
133 infection.”²¹

134
135 Risk-benefit calculations for the primary series among younger children and adolescents are
136 similarly scant. A cohort study conducted in Hong Kong estimated the number needed to harm
137 (NNH) from myo/pericarditis for dose two of BNT162b2 was 2563 among adolescent males²²
138 yet the CDC never published a U.S.-specific NNH, nor recommended shifting to a one-dose
139 policy for adolescents as did the UK, Norway, Taiwan and Hong Kong.²² The most recent
140 Covid-19 number needed to vaccinate (NNV) calculation conducted by the CDC in June 2022
141 estimated that 1660 to 3320 children ages 6 months to 4 years would need to be vaccinated to
142 prevent one hospitalisation; no NNH was offered for comparison.²³ Moreover, the CDC’s
143 outdated risk-benefit analysis for adolescents and young adults does not distinguish important
144 subgroups such as or those who have recovered from previous infection or healthy young

145 people (as opposed to those with comorbidities or immunocompromised status). Finally, many
146 countries have not required or mandated booster doses for young healthy adults at
147 universities²⁴, suggesting that, at a minimum, there is a diversity of expert views on whether
148 the expected benefits of such policies outweigh their potential harms.

149

150 **2.2. Current Data Regarding Covid-19 vaccines**

151 A thorough *ethical* evaluation of risks and benefits requires relevant *empirical* data, especially
152 where risks and benefits can be quantified to a reasonable degree of certainty. Relevant data
153 include not only those regarding average individual vaccine safety and effectiveness but also
154 age-stratification of these data as well as the protective effect of prior infection and the
155 effectiveness of vaccines against transmission.

156

157 Proponents of mandates have argued that current vaccines “prevent transmission,” which
158 would support a standard ethical reason in favour of mandates: the protection of others. Yet it
159 is increasingly clear that current vaccines provide, at most, partial and transient protection
160 against infection, which decreases precipitously after a few months^{25,26}, with secondary
161 transmission largely unaffected (in other words: an infected vaccinated person poses similar
162 risks to others as an infected unvaccinated person).^{27,28} The CDC states: “anyone with Omicron
163 infection, regardless of vaccination status or whether or not they have symptoms, can spread
164 the virus to others.”²⁹ It is therefore inaccurate to infer a sustained or long-term reduction in
165 transmission from a short-term reduction in infection.³⁰

166

167 A second limitation is ignoring the protective effects of prior infection. In February 2022, the
168 CDC estimated that 67% of adults 18-49 had infection-induced SARS-CoV-2 antibodies, up
169 from 30% in September 2021.¹³ By now (August 2022), the majority of young adults, both

170 vaccinated and unvaccinated, have most likely already been infected with Covid-19. Evidence
171 increasingly shows that prior SARS-CoV-2 infection provides at least similar clinical
172 protection to current vaccines³¹⁻³³, something that is not acknowledged in current university
173 policies. It is not clear whether vaccination of previously infected individuals provides any
174 meaningful benefits with respect to severe disease, especially for healthy young people.³⁴

175

176 Mass vaccination had been proposed as a way to “end the pandemic.”³⁵ However, elimination
177 or eradication of the virus is not a tenable goal with vaccines that provide only temporary and
178 incomplete reduction in infection risk, and the presence of multiple animal reservoirs. Because
179 of this, nearly all human beings will eventually be infected with SARS-CoV-2, as with other
180 endemic coronaviruses (and every pandemic influenza virus on record), many times in their
181 lifetime.³⁶ Denmark has, for example, acknowledged vaccinating children was not effective at
182 curbing spread of the virus and is thus no longer recommending vaccination against Covid-19
183 for most children.^{37,38}

184

185 A final point relates to the burden of Covid-19 in young adults under 40. Using pre-vaccine era
186 mortality data from 190 countries, an adjusted infection fatality ratio (IFR) for 18 to 29 year-
187 olds ranges from 100 per million (18 year-olds) to 500 per million (29 year-olds) with
188 significant variation by country within each age stratum.³⁹ During the Omicron surge, and
189 stratified by vaccination status, the CDC’s maximum reported crude mortality incidence rate
190 (IR) for 18-29 year-olds was 1 per million among the vaccinated and 5 per million among the
191 unvaccinated.⁴⁰ Taking population immunity into account with variant severity and projected
192 coincident surges of influenza, SARS-CoV-2, and respiratory syncytial virus in the winter of
193 2022-2023, the UK’s Joint Committee on Vaccination and Immunisation (JCVI) currently
194 recommends for its fall booster campaign that the following groups at high risk for severe

195 outcomes be *offered* a booster: residents and staff in care homes for older adults; frontline
196 healthcare and social care workers; adults over 50 years; people aged 5 to 49 years in a clinical
197 risk group or living with someone who has immunosuppression; and persons age 16 to 49 who
198 are care givers.⁴¹ Both vaccination and prior infection can substantially reduce the likelihood
199 of mortality^{32,33,41} but the protection against hospitalisation afforded by a booster wanes at 15
200 weeks to an estimated 80% during BA.1 and 56.5% during for BA.2.⁴² Using a national
201 population-wide dataset in Qatar, both previous infection alone and vaccination alone were
202 found to provide >70% protection against severe, critical or fatal Omicron (BA.1 or BA.2).⁴³
203 Prior infection alone was 91% effective whereas protection from two or three doses of vaccine
204 alone was 66% and 83%, respectively. Covid-19 does cause acute illness, and may have long-
205 term effects for some, particularly those who develop critical illness, but vaccination appears
206 to confer at best modest protection against longer-term sequelae⁴⁴ and the existing data are non-
207 randomized, from variants that predate Omicron and with unclear relevance for current adults
208 under age 40. The existence of effective treatments for clinical management⁴⁵ is also an
209 argument against vaccine mandates, especially for groups not considered at risk for severe
210 illness.

211

212 **3. Risk-Benefit Assessment**

213 In a recent editorial, vaccine developer and paediatrician Paul Offit³⁴ argued that “because
214 boosters are not risk-free, we need to clarify which groups most benefit....It is now incumbent
215 on the CDC to determine who most benefits from booster dosing and to educate the public
216 about the limits of mucosal vaccines.”¹ Below, we provide an Omicron-specific risk-benefit
217 assessment of booster vaccination for young adults ages 18 to 29 years for both Pfizer

¹ Offit recommended that his own son not receive a booster dose due to concerns that benefits would not outweigh risks [<https://www.theatlantic.com/health/archive/2022/01/should-teens-get-booster-omicron/621222/>].

218 (BNT162b2) and Moderna (mRNA-1273) vaccines. This analysis builds on the first stratified
219 risk-benefit analysis of vaccination among adolescents 12-17 years of age which considered
220 age, sex, health status, virulence of the dominant variant, and population prevalence of post-
221 infection immunity.⁴⁶ For the booster among young adults ages 18-29, the calculations leverage
222 the CDC's pre-Omicron number needed to vaccinate, the estimated reduction in severity of
223 Omicron vs Delta⁴⁷, and current estimated seroprevalence.¹³ While harms from Covid-19
224 vaccines are rare⁴⁸ they should be factored into policy recommendations. This risk-benefit
225 analysis considers the overall rate of reported SAEs and grade ≥ 3 reactogenicity (Figure 1) and
226 myo/pericarditis among males (Figure 2). Rates and definitions are consolidated in Table 1.

227

228 Serious adverse events are defined by the FDA and the National Institutes of Health⁴⁹ as an
229 adverse event that results in any of the following conditions: death; life-threatening at the time
230 of the event; inpatient hospitalisation or prolongation of existing hospitalisation; persistent or
231 significant disability/incapacity; a congenital anomaly/birth defect; or a medically important
232 event, based on medical judgement. Grade 3 or 4 reactogenicity is defined as local/systemic
233 events that prevent daily routine activity or require use of a pain reliever (grade 3) or requiring
234 an emergency room visit or hospitalisation (grade 4).^{49,50}

235

236 To estimate the expected harms (SAEs including myocarditis and grade ≥ 3 reactogenicity) and
237 benefits (Covid hospitalizations prevented) specific to boosting 18–29-year-old young adults,
238 we used data reported by CDC from phase 2/3 clinical trials^{18,50-52}, peer-reviewed observational
239 data from large integrated health systems⁵³⁻⁵⁷, post-marketing surveillance collected via V-Safe
240 by the CDC⁵⁸, and an international estimate in a young adult population.⁵⁴

241

242

243 **3.1. Serious adverse event (SAE) rates reported from manufacturer-provided data**

244

245 Of the 12 SAEs reported by Pfizer in the booster trial (n=5055), three were found by blinded
246 investigators to be attributable to the vaccine, providing a rate of 1 in 1685 (3/5055)¹⁸ as the
247 lower bound while the upper bound is drawn from the CDC's Grading of Recommendations,
248 Assessment, Development, and Evaluation (GRADE) review which reported a rate of 1 in
249 306.⁵⁰ For a campus of 30,000 boosted with the Pfizer product, the expected SAE rate is
250 therefore 18 (3/5055*30,000) to 98 (1/306*30,000). Surprisingly, Moderna found that none of
251 the 5 SAEs experienced by 4 out of 344 participants⁵⁰ in its open-label booster trial
252 (4/344=1.2%)² were attributable to the vaccine, thus our SAE estimates are for Pfizer only.

253

254 **3.2. Reactogenicity rates**

255

256 According to self-report data, side effects from the booster dose prevent up to a third of
257 recipients from being able to carry out normal daily activities in the days following
258 vaccination.⁵⁵ Sponsor-reported rates for grade ≥ 3 reactogenicity are 1 in 22 (14/306)⁵⁰ for the
259 Pfizer booster to 1 in 9 (18/167)⁵⁰ for the Moderna booster. For a campus of 30,000 boosted
260 previously uninfected young adults, the expected number of grade ≥ 3 reactogenicity cases is
261 therefore 1373 (14/306*30,000) to 3234 (18/167*30,000), respectively. In those with a prior
262 SARS-CoV-2 infection, post-vaccination symptoms causing missed work or daily activities are
263 reported two- to three-fold more often than those without a history of infection^{56,57}, a major
264 concern given that seroprevalence among adults aged 18-49 is now well above the February
265 2022 estimate of 67%.¹³ Conservatively assuming 67% as the proportion with a history of

² [Table 3e footnote h](#): Overall, 4/344 (1.2%) participants experienced 5 SAEs during a median follow-up of 5.7 months after booster dose (administered at least 6 months after a 50 mcg (n=173) or 100 mcg (n=171) 2-dose primary series); the sponsor deemed these unrelated to mRNA-1273. Data on an equivalent primary series comparison group was not available at the time of the GRADE assessment.

266 Covid-19 infection, and a two- to threefold increased likelihood of systemic effects, expected
267 grade ≥ 3 reactogenicity cases would be at least 1839 to 4333 for Pfizer and Moderna boosters,
268 respectively. Even without taking into account prior infection, the proportion reporting to V-
269 Safe being “unable to perform daily activities” was between 20-40% depending on booster
270 product, and higher among those receiving a heterologous booster.⁵⁸

271

272 **3.3. Booster vaccine-associated myocarditis rates in university-age males 18-29 years**

273

274 The CDC estimated the rate of post-booster myocarditis during days 0 to 7 following
275 BNT162b2 vaccine administration in 16–17 year-old males to be 1 in 41,500⁵¹ using passive
276 surveillance through the Vaccine Adverse Event Reporting System (VAERS), and 1 in 5000⁵¹
277 using active surveillance with the Vaccine Safety Datalink (VSD). In 18–29 year-old males,
278 the post-booster myocarditis rate for both products combined using VAERS was reported to be
279 1 in 101,000⁵² (ages 18–24) to 1 in 208,000⁵² (ages 25–29) while the VSD rate was much higher
280 at 1 in 14,200⁵² (mRNA-1273) to 1 in 21,000⁵² (BNT162b2). Two other population-based
281 studies from the US and Israel in 18–24-year-old males found the rate to be 1 in 7000⁵³ to
282 9000.⁵⁴ In both of these studies, BNT162b2 was the vaccine administered prior to diagnosis.
283 For our estimates, and assuming a precautionary stance, we have used active surveillance rates
284 or population-based rates. For 16–17 year old males we use the VSD rate of 1 in 5000⁵¹; for
285 18–29 year olds we consider the rate 1 in 7000⁵³ to be the most reliable because the same
286 method was used to estimate the dose-two myocarditis rate for adolescents ages 12–17⁵⁹, based
287 on CDC definitions and databases, and was consistent with international estimates for this age
288 group.⁴⁶ We provide a 16–17 year-old rate given that academic acceleration allows younger
289 adults to attend college along with the freshman cohort. In our figures, we provide a range of
290 myopericarditis estimates for consideration.

291 3.4. Hospitalizations prevented

292

293 To estimate the benefits of hospitalizations prevented by boosters, we updated the CDC's
294 estimated number needed to vaccinate (NNV)¹⁸ for a strain such as Omicron which was found
295 to be approximately 59% less virulent⁴⁷ than Delta. Scaling the CDC's NNV estimates of 9,000
296 for BNT162b2 and 12,000 for mRNA-1273 by this reduced severity, we estimate that 22,000
297 (9000/0.41) to 30,000 (12,000/0.41) young adults would need to be boosted with BNT162b2
298 or mRNA-1273, respectively, to prevent one Covid-19 hospitalisation over six months.

299

300 3.5. Risk-benefit estimates

301

302 At this scale, and as shown in Figure 1, a hypothetical campus with 30,000 young adults
303 receiving the BNT162b2 booster could expect *more* SAEs (18 to 98) than Covid-19
304 hospitalizations averted (1.0-1.4). Our hypothetical campus may also expect 1373 to 3234
305 young adults (rate of 1 in 9-22⁵⁰) to experience Grade ≥ 3 reactogenicity disrupting daily
306 activities or requiring medical care when vaccinated with BNT162b2 or mRNA-1273,
307 respectively. Given that prior SARS-CoV-2 infection increases the rate of systemic reactions
308 by two- to three-fold^{56,57}, the number of young adults expected to experience disruptions in
309 their school and daily activities is likely to exceed 1839 with BNT162b2 and 4333 with mRNA-
310 1273.

311

312 If the 15,000 males and 15,000 females ages 18-29 years on the hypothetical campus were all
313 boosted under a universal mandate, we estimate between 1.7 to 3.0 occurrences of myocarditis
314 (rates of 1 in 7,000⁵³ to 1 in 5000⁵¹) among males and 0.7 cases among females.⁵¹ Boosting the

315 entire campus could thus cause approximately 3-4 myo/pericarditis cases, among males
316 predominantly, per single hospitalisation averted. (Figure 2)

317

318 Most media reports, as well as a recent systematic review⁶⁰ and expert opinion from the
319 American College of Cardiology⁶¹ present vaccination-associated myo/pericarditis as rare,
320 (typically) “mild” and followed by rapid recovery with anti-inflammatory treatment. The
321 reviews have not framed vaccine-associated risks versus infection-associated risks using
322 compatible denominators based on exposure (vaccination) and infection (seroprevalence), thus
323 the infection-associated risks may have been overstated by at least a factor of four according
324 to CDC estimates of the burden of Covid-19 illness.⁶² However, it has been found to occur in
325 as many as 1 in 2652 males aged 12–17 years old and 1 in 1862 males aged 18–24 years old
326 after the second dose⁵⁹ (and as high as 1/1300 after the second dose in a Pfizer-Moderna
327 combination).⁶³ An Israeli study described 1 in 5 cases among 16–29 year-olds to be of
328 intermediate severity, meaning these cases had persistent new/worsening abnormalities in left
329 ventricular (LV) function, or persistent ECG anomalies, or frequent non-sustained ventricular
330 arrhythmias without syncope.⁶⁴ The CDC reported that 1200 of the 1314 verified myocarditis
331 cases with known hospitalisation status following primary series or booster had been
332 hospitalized.⁶⁵ Among adolescents, 69%⁶⁶-80%⁶⁷ of those diagnosed with vaccine associated
333 myopericarditis had findings consistent with cardiac scarring on MRI testing three to eight
334 months after the second dose. The potential long-term impact of scar tissue on heart conduction
335 remains unknown.^{66,67} Post-vaccination myocarditis has been found to be equivalent to or
336 exceed the risk of post-Covid myocarditis in males less than 40 years old despite the lack of
337 seroprevalence-based estimates of Covid-associated myocarditis.⁶⁸ Rare incidences of death in
338 young males attributed to mRNA vaccine induced myocarditis have also been reported.^{69,70}

339

340 **Table 1. Risk-benefit analysis inputs: definitions and rates for serious adverse events (SAEs), reactogenicity, and myo/pericarditis**

341

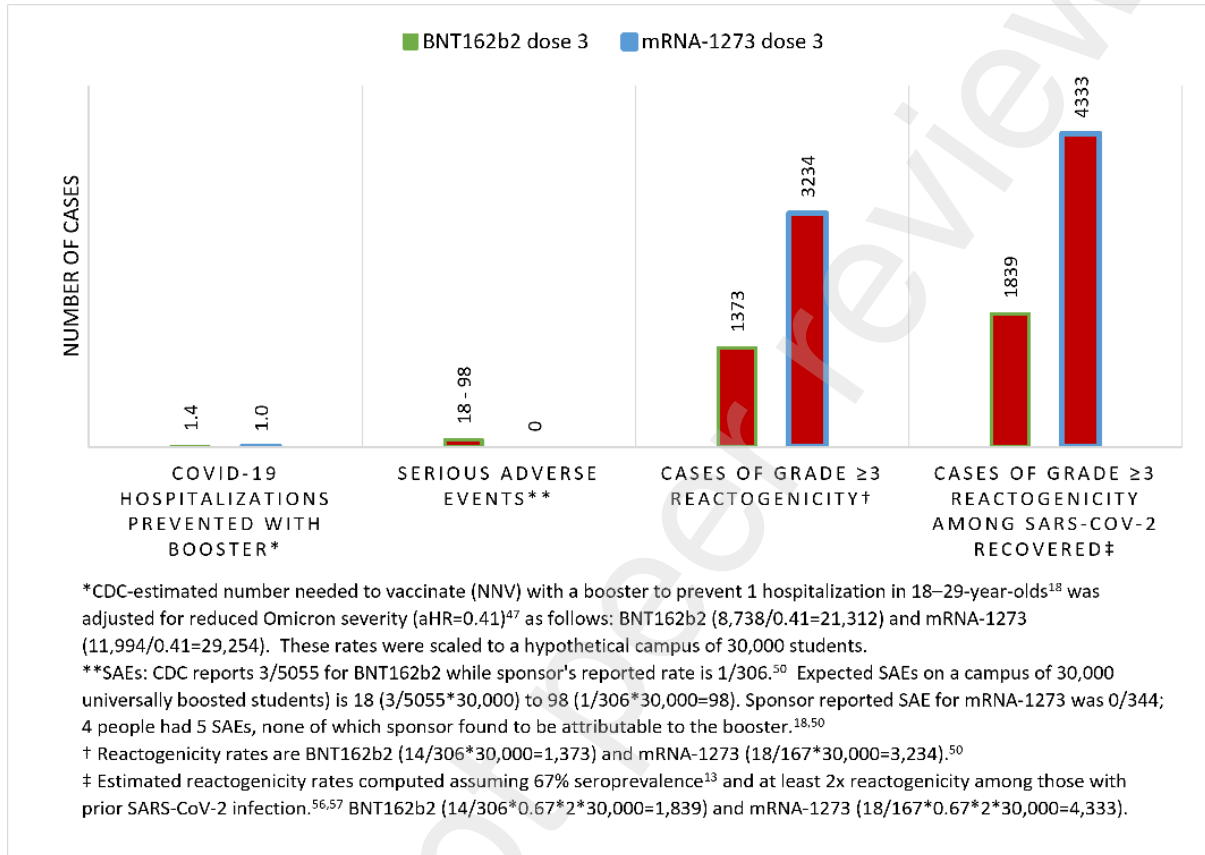
Rate	Definition	Numerator/Denominator		Risk	
Serious Adverse Events (SAEs)	An adverse event that results in any of the following conditions: death; life-threatening at the time of the event; inpatient hospitalisation or prolongation of existing hospitalisation; persistent or significant disability/incapacity; a congenital anomaly/birth defect; or a medically important event, based on medical judgement.	Pfizer: 3 / 5055 ¹⁸ Slide 26 Pfizer: 1 / 306 ⁵⁰ Table 4a Moderna: 0 / 171 ^{*50} Table 4b		1 in 1685 1 in 306	
Reactogenicity	Grade 3 or 4 reactogenicity is defined as local/systemic events that prevent daily routine activity or require use of a pain reliever (grade 3) or requiring an emergency room visit or hospitalisation (grade 4).	Pfizer: 14 / 306 ⁵⁰ Table 3f Pfizer: 19 / 289 ⁵⁰ Table 4a Moderna: 18 / 167 ⁵⁰ Table 3f, 4b		1 in 22 1 in 15 1 in 9	
Myo/pericarditis	<p>CDC case definitions¹⁷</p> <p>Myocarditis</p> <p><u>Probable</u></p> <p>1. Presence of ≥1 new or worsening of the following clinical symptoms:*</p> <ul style="list-style-type: none"> -Chest pain/pressure/discomfort -Dyspnea/shortness of breath -Palpitations <p>2. Abnormal testing</p> <ul style="list-style-type: none"> -Elevated troponin -ECG or EKG findings 	<p><u>Confirmed</u></p> <p>1. Symptoms</p> <ul style="list-style-type: none"> -Chest pain/pressure/discomfort -Dyspnea/shortness of breath -Palpitations <p>2. Abnormal testing</p> <ul style="list-style-type: none"> -Biopsy 	<p>Males Booster</p> <p>Ages 18-29</p> <p>147/mill⁵³ Sharff et al 112.5/mill⁵⁴ Friedensohn et al (IDF)</p> <p>Pfizer (VAERS): 18-24 9.9/mill⁵² 25-29 4.8/mill⁵²</p>	<p>Females Booster</p> <p>Ages 18-29</p> <p>n/a n/a</p> <p>Pfizer (VAERS): 18-24 0.6/mill⁵² 25-29 2.0/mill⁵²</p>	<p>Male: 1 in 6800</p> <p>Male: 1 in 8900</p> <p>Male: 1 in 101k Female: 1 in 1.7 mill Male: 1 in 208k</p>

Rate	Definition	Numerator/Denominator	Risk		
	<p>-Decreased function on ECHO or MRI -cMRI findings consistent with myocarditis 3. No other identified cause</p> <p>Pericarditis Presence of ≥ 2 new or worsening of the following clinical features: -acute chest pain -pericardial rub on exam -new ST-elevation or PR-depression on EKG -new or worsening pericardial effusion on ECHO or cMRI</p>	<p>-Elevated troponin AND MRI findings consistent with myocarditis 3. No other identified cause</p>	<p>slide 11</p> <p>Pfizer (VSD): 47.6/mill⁵² slide 23</p> <p>Moderna (VSD): 70.3/mill⁵² slide 23</p> <p>Ages 16-17</p> <p>Pfizer (VAERS): 24.1/mill⁵¹ slide 10</p> <p>Pfizer (VSD): 200.3/mill⁵¹ slide 25</p>	<p>slide 11</p> <p>Pfizer (VSD): 4.7/mill⁵² slide 23</p> <p>Moderna (VSD): 13.9/mill⁵² slide 23</p> <p>Ages 16-17</p> <p>Pfizer (VAERS): 0.0/mill⁵¹ slide 10</p> <p>Pfizer (VSD): 44.0/mill⁵¹ slide 25</p>	<p>Female: 1 in 500k Male: 1 in 21k Female: 1 in 213k</p> <p>Male: 1 in 14k Female: 1 in 72k</p> <p>Male: 1 in 41.5k Female: 0</p> <p>Male: 1 in 5000 Female: 1 in 23k</p>

342 *Footnote from GRADE: Overall, 4/344 (1.2%) participants experienced 5 SAEs during a median follow-up of 5.7 months after booster dose (administered at least 6 months
343 after a 50 mcg (n=173) or 100 mcg (n=171) 2-dose primary series); the sponsor deemed these unrelated to mRNA-1273. Data on an equivalent primary series comparison
344 group was not available at the time of the GRADE assessment.
345

346 **Fig 1: Expected Serious Adverse Events (SAEs) and Grade ≥ 3 Reactogenicity Per Single**
 347 **Hospitalisation Prevented with Universal Booster Vaccination on a Large University**
 348 **Campus of 30,000 Students**

349



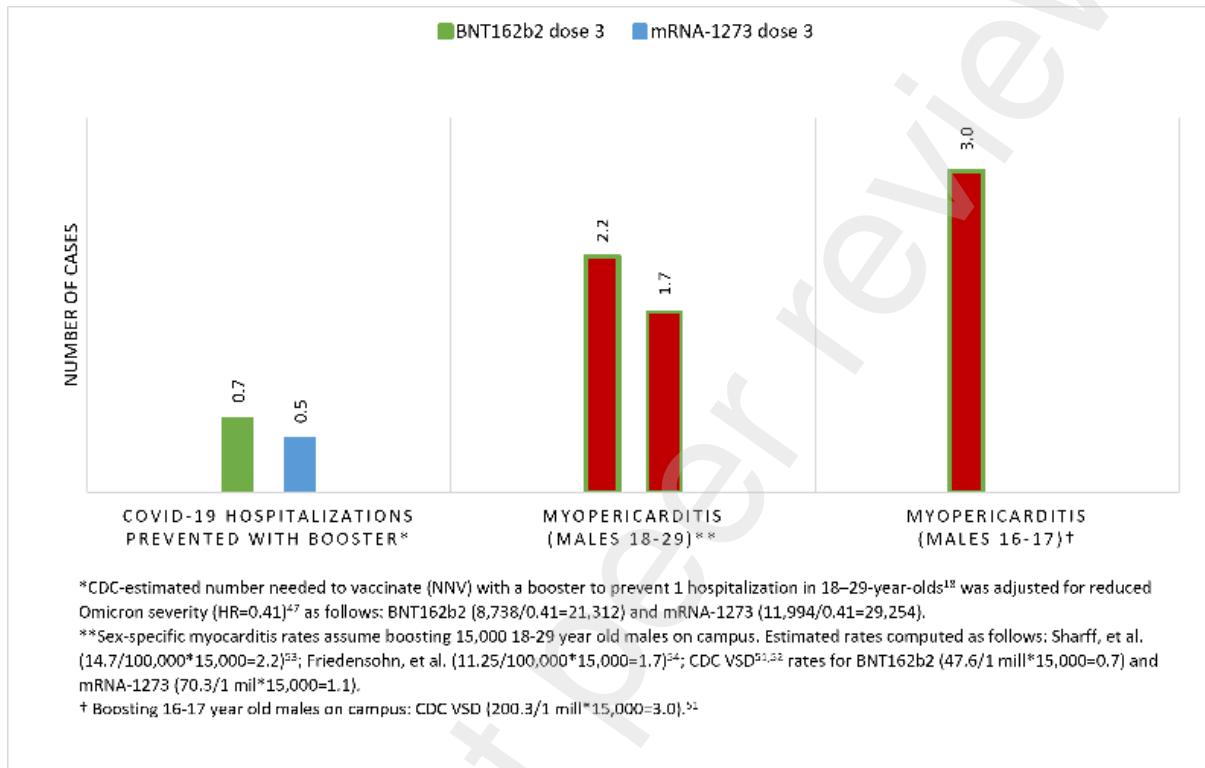
350

351

352

353 **Fig 2: Expected Myopericarditis Cases per Single Hospitalisation Prevented with**
 354 **Universal Booster Vaccination on a Large University Campus with 30,000 Students**
 355 **(15,000 Males)**

356



357

358

359 3.6. Limitations of analysis

360

361 These estimates have a number of limitations. First, our estimates rely on sponsor-reported and
 362 CDC summaries of adverse events; we cannot account for failures to report or loss to follow-
 363 up during the clinical trials. Second, we do not distinguish between specific types or clinical
 364 significance of SAEs because of scarce data, including the small sample size of the original
 365 booster clinical trials and the inability to verify reasons for participant loss to follow-up, which
 366 may have been due to unreported SAEs. The Pfizer trial, for example, included only 78
 367 individuals 16–17 years of age randomised to receive booster or placebo.⁷¹ Nevertheless one

368 male in this age group was diagnosed with myocarditis. It is also possible that multiple severe
369 side-effects were reported by the same participant and that the number of people impacted by
370 such reactions is lower than our estimate. We are extrapolating SAE data to young adults (18–
371 29 years old) that were originally generated in clinical trials involving all age groups. However,
372 studies have shown that younger people have a greater likelihood of vaccine-related adverse
373 events.⁷² The three vaccine-associated SAEs reported by Pfizer were moderate persistent
374 tachycardia, moderate transient elevated hepatic enzymes, and mild elevated hepatic
375 enzymes.¹⁸ Hence, the causal relationship between our estimated SAEs and the Covid-19
376 vaccines needs to be approached with caution. Haas et al.⁷³ suggested that many systemic AEs
377 in the RCTs (76% of systemic and 24% of local reactogenicity) may have been due to a nocebo
378 effect—*anxiety, expectations and background symptoms*. It is very likely, however, that real-
379 world severe or serious AEs may be greater than those reported in the RCT data because
380 standard trials are underpowered to detect rare AEs and there may also be selection bias: those
381 with greater expectation of harmful side effects are less likely to enrol in a trial. In fact, these
382 data are usually collected after a drug has been approved and is on the market (phase IV clinical
383 trial data). Such limitations show the need for more robust post-marketing data and ideally
384 large, controlled trials to determine costs and benefits for any future booster doses, especially
385 in younger age groups. Universities have not recorded cumulative adverse event rates on their
386 Covid-19 dashboards, thus there is no way to validate our estimates with real-world data. Even
387 with the residual uncertainties, our risk-benefit assessment shows that it is at least plausible
388 that expected individual harms outweigh benefits for young healthy people (i.e., most young
389 adults), and it is implausible that individual benefits significantly outweigh risks. Pfizer’s
390 public data supports this inference.⁷² In requesting the EUA for boosting adolescent males, the
391 Pfizer’s risk-benefit analysis estimated 23-69 cases of myocarditis per one million booster
392 doses administered and 29-69 hospitalizations averted, yet this estimate of 23-69 cases of

393 myocarditis per million third doses administered is now known to be an order of magnitude
394 below the 200.3 per million reported by the US CDC among adolescents aged 16–17 years.⁵¹

395

396 **4. Five ethical arguments against university booster mandates**

397

398 Below, we present five ethical arguments against university booster mandates informed by our
399 risk-benefit assessment and ethical analysis of mandatory policies to date. These arguments
400 relate to (1) the importance of transparency in policy (which has been lacking), (2) the potential
401 for net individual harm, (3) the lack of a proportionate public health benefit, (4) the lack of
402 reciprocity in terms of compensation for vaccine-related harms, and (5) the wider social harms
403 of vaccine mandates.

404

405 **4.1. Transparency**

406 Risk-benefit assessment is essential to the ethical acceptability of public health policy, and
407 transparent assessments help maintain trust in public health, especially in the context of
408 controversial policies. There is an even stronger rationale for thorough and transparent risk-
409 benefit assessment when interventions are mandated or when (given uncertainty or relevant
410 population differences) some people might face harms not outweighed by individual benefits.

411 In such cases, risk-benefit assessments should be stratified by demographic factors and updated
412 as new data become available to reduce uncertainty. At a minimum, if an intervention is
413 implemented despite significant uncertainty (especially if it is mandated), there is a strong
414 ethical rationale to collect (controlled) data to resolve relevant uncertainties.

415

416 It is arguably negligent that key institutions such as the CDC and FDA have not conducted a
417 risk-benefit assessment either before or after recommending that all adults *should* receive a

418 booster dose. Without such a formal analysis, professional associations (such as the American
419 College of Cardiology (ACC) expert panel⁶¹) have been forced to infer from the literature and
420 CDC's own analyses. For example, the ACC expert panel produced a graphic displaying a
421 favourable harms vs. benefits ratio for young adults ages 12-29.⁶¹ The ACC's widely promoted
422 graphic is tied to data presented by the CDC⁷⁴ and relies on four key assumptions which
423 necessarily bias the findings in favour of vaccination: 1) vaccine effectiveness of 95% over 120
424 days to prevent Covid-19 cases and hospitalizations; 2) myocarditis rates were derived from
425 passive surveillance in VAERS instead of active surveillance available to the CDC (VSD)
426 resulting in harms being underestimated by a factor of 10^{51,52}; 3) harms and benefits were
427 averaged across ages 12–29 when the risk may be highest among those aged 16–19^{51,52}; and 4)
428 hospitalisation rates were tied to May 2021 data, more than a year prior to the ACC's review
429 and pre-Omicron. Nevertheless, for adolescent males ages 12–17, the CDC estimated 56-69
430 myocarditis cases would be expected while 71 ICU admissions could be averted.⁷⁴

431
432 It was foreseeable that the decision to approve boosters (against the advice of the FDA panel)
433 would be followed by booster mandates since pandemic vaccine mandates were already in
434 place in many universities and colleges throughout the United States at the time.¹³ Universities
435 rely upon public health agencies such as the CDC for guidance. Thus, we maintain that if
436 mandates remain then there is an ethical obligation for the agency (and independent scientists)
437 to update public NNV estimates for boosters among adults younger than 40, stratified by sex,
438 comorbidity status and history of infection to provide evidence that the intervention confers an
439 expected net benefit to individuals younger than 40 years in the context of the prevailing SARS-
440 CoV-2 variants and pre-existing immunity. Without this, it is problematic to simply claim that
441 Covid-19 vaccines are “safe and effective” without specific risk-benefit analyses for different
442 age categories and with consideration for individual health status, including evidence of prior

443 infection, because risks of both disease and vaccination are highly variable according to these
444 factors.^{9,10}

445

446 Since there has not been any RCT specific to evaluating boosters in young adults, the CDC
447 relied on data from an older cohort with a median age of 51.^{71,75} and perhaps assumed that the
448 benefits would also outweigh risks for younger age groups. As we have shown, it is likely that
449 this assumption is incorrect. Under such uncertainties, ethical vaccine policymaking arguably
450 requires radical transparency about scientific knowledge and uncertainties regarding vaccine
451 risks and benefits (i.e., even more transparency than where certainty is high).

452

453 Transparent policymaking can encounter a “trust paradox” in providing information about
454 vaccine risks to the public. As noted by Petersen, et al.⁷⁶ governments have a perverse incentive
455 to withhold negative information about vaccines since they are actively promoting such
456 products and negative information about vaccines reduces vaccination uptake. And yet
457 transparent disclosure about negative information (e.g., side effects) helps to sustain trust in
458 health officials and reduces the politicisation of vaccines.⁷⁷ Transparency may reduce the
459 uptake of vaccination in the short-term but will uphold trust in health authorities and vaccines
460 in the longer-term—just as open disclosure regarding clinical harms promotes trust in
461 medicine.⁷⁸ Conversely, efforts by the FDA to prevent the release of internal documents and
462 communications with Pfizer when requested by a civil society group (<https://phmpt.org>)
463 through a Freedom of Information Act (FOIA) reinforce the view that regulatory agencies are
464 not being transparent with the public. To address the “trust paradox” in regulatory politics, and
465 to maintain trust in government and scientific institutions, greater data accountability (in this
466 case, a risk-benefit analysis) should precede mandates. Given concerns about pharmaceutical

467 influence on the political process^{78,79} this should be facilitated by new mechanisms for
468 independent scrutiny of regulatory science during emergencies.⁷⁹

469

470 **4.2. Potential Net Expected Individual Harm**

471 The reasonable possibility of a net harm to individuals (as presented in our risk-benefit
472 assessment) should provide a strong basis to argue for the ethical case against booster mandates
473 for young adults. Mandates at institutions of higher education serve the age group with one of
474 the lowest public health burdens from Covid-19. Hence boosters provide a low impact on
475 hospitalisation and a low impact on transmission for an age group with a low prospect of
476 benefit. Arguably, this has been considered by most universities and colleges and is the reason
477 why most do *not* have booster mandates for the fall of 2022. In fact, this is likely why European
478 countries, including the UK, France, Germany and Norway, Sweden and Denmark (to our
479 knowledge) never had university-implemented mandates.²⁴ When the European Centre for
480 Disease Control and Prevention (ECDC) recommended boosters for all adults in November
481 2021, priority was focused on those over age 40.⁸⁰ Taking a different view of the data, the US
482 CDC recommended boosters for all adults and currently recommends a *second* booster for all
483 Americans aged 50 years or more.⁸¹ The ECDC, in contrast, recommended that first boosters
484 be “offered” with prioritisation for those over 40 years, and second boosters only for those over
485 age 60 and those with an immunocompromised status or high risk medical conditions.⁸²

486

487 The UK’s *Joint Committee on Vaccination and Immunisation* (JCVI) provides an interesting
488 example of using the potential for net harm to advise *against* the primary vaccination series for
489 12–15-year-olds.⁸³ The JCVI argued that the potential benefit of vaccination in this age group
490 was only “marginally greater than the potential known harms,” since healthy 12–15-year-olds
491 are at very low risk of serious outcomes from Covid-19. Although it may (or may not) be the

492 case that the JCVI adopted worst-case estimates⁸⁴, such an approach reinforces the need to act
493 judiciously under conditions of uncertainty where the clear benefits of an intervention are not
494 confidently above the potential harms. Note also that they mention “potential known harms”
495 without taking into consideration potential long-term effects. The UK Health Ministers
496 subsequently voted to offer a single dose of vaccination to adolescents ages 12-15 in
497 consideration of: “...the health and wider social benefits to this cohort.”⁸⁵ A second dose was
498 offered to those with underlying health conditions. There are important parallels between the
499 JCVI decision and the outcome of the FDA panel that recommended against universal booster
500 recommendations for adults in the US in the fall of 2021: in both cases, the US and UK
501 governments went against these recommendations. A key ethical difference is that the UK has
502 not implemented any Covid-19 vaccine mandates at schools or universities, and the mandate
503 proposed for care home and healthcare workers was withdrawn.⁸⁶

504
505 As noted above, blanket mandates ignore critical data, such as the benefits of prior infection
506 and data on adverse effects. These factors make an expected net harm now even more likely
507 than when mandates began and make it even more urgent to update Covid-19 vaccine policy.
508 Policies for other vaccines have been updated following the accumulation of new data. For
509 example, adult boosters for tetanus and diphtheria vaccines (though previously widely
510 administered) have been shown to provide no benefit.⁸⁷ Vaccines for influenza, dengue, and
511 rotavirus have been withdrawn or had strict limitations placed on their use in children due to
512 unexpected harms.⁸⁸ Adenovirus-vectored Covid-19 vaccines have been limited in their use
513 due to thrombosis (especially in younger women).⁸⁹ Uncertainties remain regarding mRNA
514 vaccines, for example related to their effects on menstruation⁹⁰, shingles⁹¹, or the overall safety
515 of current formulations in younger adults and children as well as evidence in support of booster
516 vaccination.⁹²

517 There are two other theoretical problems that could be factored into mandatory programs from
518 a precautionary standpoint: original antigenic sin and the non-specific effects of vaccines.
519 Original antigenic sin refers to the decreased ability of an individual to respond to a new viral
520 variant because the immune system has been “locked” onto the original immunogen.⁹³ While
521 data has not shown this to be true with certainty for Covid-19 it cannot yet be ruled out as an
522 important side effect of repeat vaccination including with the new bivalent booster. Non-
523 specific effects of vaccination refers to the effects of a vaccine on overall health and all-cause
524 mortality, which have been shown to differ based on the type of vaccine (live vs. non-live) and
525 age/sex.^{94,95} Both of these theoretical issues are at the frontiers of our current knowledge of
526 vaccinology and are rarely considered in the media and by the lay public. We cite these
527 examples to prove our main point: proportionality of mandates should account for the
528 precautionary principle in the context of uncertain evidence that benefits outweigh risks and
529 harms. The net effect of these uncertainties, combined with other factors such as the rising
530 prevalence of post-infection immunity¹³, is that future risk-benefit assessments of mRNA
531 vaccines may be even less favourable. Further, with vaccination mandates, young males in
532 particular are being coerced into assuming a documented, albeit very small, risk of death related
533 to vaccination^{69,70} for, in most cases of booster vaccination, an uncertain individual and societal
534 benefit.

535

536 **4.3. Lack of proportionate public health benefit**

537 Proportionality, a key principle in public health ethics, requires that the benefits of a public
538 health policy must be expected to outweigh harms, including harms arising from the restriction
539 of individual liberty.^{1,5-8,86} Where mass vaccination involves harm to a minority of individuals
540 or coercion or undue inducements are used to increase vaccine uptake, proportionality requires

541 that these considerations be outweighed by public health benefits, typically in the form of
542 reduced transmission from vaccinated individuals to others.⁹⁶

543

544 Covid-19 booster mandates often involve a degree of coercion, including the threat of loss of
545 access to education and free choice of occupation.⁹⁶ Contrary to those who restrict the concept
546 of coercion to situations of a direct threat to something people should have access to as a matter
547 of right⁹⁷, we endorse here a broader concept of coercion that includes situations of structural
548 pressure that deprive people of reasonable options.⁹⁸ To be ethically acceptable, such severe
549 restrictions of individual liberty need to be justified not only by an individual benefit but by
550 the expectation that vaccination reduces harm to others. Booster doses of Covid-19 vaccines
551 provide no lasting reduction in the probability of infection or transmission²⁷⁻²⁹ and extremely
552 low expected benefits to young healthy individuals, especially those who have already been
553 infected.^{31-33,100-102} The net expected harms to individuals and the harms of coercive mandates
554 themselves are not counterbalanced by a large public health benefit; such harms and restrictions
555 of liberty are therefore disproportionate and ethically unjustifiable.

556

557 **4.4. Failure of Reciprocity**

558 The use of booster mandates raises an additional ethical problem of *reciprocity* for institutions
559 of higher education and public health authorities.^{103,104} Most vaccines are covered in the US¹⁰⁵,
560 the Canadian province of Quebec¹⁰⁶, and 18 other countries¹⁰⁶ by an injury compensation
561 program based on fair (reciprocal) compensation for those who experience a vaccine-related
562 harm. Mandatory vaccines arguably require even stronger protections for individuals who
563 experience harmful consequences that lead to permanent harm¹⁰⁷ because their free choice
564 regarding vaccination has been limited. While institutions of higher education are mandating
565 boosters, the US and Canadian compensation programs have failed to uphold their social justice

566 responsibility to injured individuals. In the US, Covid-19 vaccines and therapeutics are
567 processed by the Countermeasures Injury Compensation Program (CICP) which is designed to
568 cover epidemics, pandemics and security threats as designated by the Secretary of Health and
569 Human Services and as authorised by the PREP Act.¹⁰⁵ As of August 1, 2022, 37 claims have
570 been denied compensation because “the standard of proof for causation was not met” or “a
571 covered injury was not sustained.”¹⁰⁸ No claims have been paid out by the US CICP but one
572 claim for anaphylaxis has been approved for compensation and pay-out is currently pending
573 assessment of eligible expenses.¹⁰⁸

574

575 It is highly problematic that young adults are being mandated to take a third dose—especially
576 given the risk-benefit assessment—while the federal US vaccine injury program has failed to
577 compensate but one Covid-19 vaccine-injured individual.¹⁰⁸ It is also important to note that
578 boosters have been granted an EUA by the FDA, but are still not fully approved.¹⁰⁹ Universities
579 and colleges that mandate Covid-19 boosters are pressuring young adults to receive a vaccine
580 that, in case of injury, has no transparent legal route to adequate compensation. In sum, one
581 core precondition for vaccine mandates is a functioning and fair compensation program, which
582 has not been achieved for Covid-19 vaccines.

583

584 **4.5. Wider Social Harms**

585 Strong coercion creates significant social harms. Covid-19 vaccine mandates have often
586 involved a high degree of coercion, effectively ostracising unvaccinated individuals from
587 society. University mandates involve significant coercion in that they exclude unvaccinated
588 people from the benefits of university education (or employment) and thereby entail major
589 infringements to free choice of occupation and freedom of association. When such mandates
590 are not supported by a *compelling* public health justification and where exemptions are not

591 easily available, the likelihood of reactance and negative social effects are increased.¹ The
592 social harms of university Covid-19 mandates have not been formally studied, but there is
593 reason to think that they may be significant.¹ Policies can have wide-ranging consequences for
594 non-compliance, such as loss of employment, loss of internet use, restriction to off-campus vs.
595 on-campus housing, delays or refusal to process student housing requests, loss of enrolment, a
596 hold placed on grades, inability to use recreational facilities to train for competitive sports or
597 register for class, and delays in ability to repay student loans post-graduation. A number of
598 young adults and professors affected by mandates have outlined publicly their perspectives and
599 the social harms of these policies, such as loss of access to schooling and social services¹¹⁰,
600 psychosocial stress, reputational damage and lost income, and threats of being disenrolled or
601 deported.¹¹¹ This punitive public health approach may also provoke reactance in young adults¹,
602 with long-term negative consequences on trust in society and institutions and vaccine
603 confidence in general, including vaccine hesitancy for routine paediatric and adult vaccines, a
604 problem which predated the pandemic and is considered one of the World Health
605 Organization's top ten "threats to global health."¹¹²

606

607 **5. Objections: possible rationales for mandates**

608 Despite the considerations above, proponents of university Covid-19 booster mandates might
609 argue that such policies are justified (even if some individuals experience uncompensated
610 harms) because they: (i) help *normalize* compliance with vaccination as a social duty (thereby
611 promoting solidarity or pro-vaccine attitudes that undermine anti-vaccination sentiment) and/or
612 (ii) help to increase the safety of the university environment or wider society. Mandates may
613 help some people "feel better," knowing that everyone in a crowd, dorm, or classroom is
614 vaccinated, that they are among peers that have "done the right thing" and "care about the
615 safety of others." For instance, some faculty and staff may "feel protected" by the new booster

616 mandate introduced at Western University in Ontario, Canada, on August 22, 2022.¹¹³ From
617 this perspective, if a majority of university policymakers (whether clinical advisory group
618 members, administrators and/or professors) or students *believe* that vaccination should be
619 socialised to promote solidarity, counteract anti-vaccination sentiment, or create a safe
620 environment, then such beliefs (and values) should guide policy.

621

622 However, even if many people hold such beliefs and even if such goals are valuable, policy
623 must be responsive to facts. Risk-benefit assessments should remain objective and avoid the
624 use of some people feeling better or safer to justify behavioural rules with sanctions for non-
625 compliance in the absence of rational justification. While many vaccines do improve group
626 safety by reducing transmission, the current generation of Covid-19 vaccines do not provide
627 significant lasting effects of this kind, and repeated doses appear to provide diminishing
628 benefits (in terms of reduced infection) per dose, especially among young adults.¹¹⁴ It therefore
629 makes little sense to claim that Covid-19 vaccination is a pro-social act (or that the
630 unvaccinated are a disproportionate threat to others). Moreover, it is unclear whether
631 *mandating* Covid-19 boosters will produce a net positive effect on pro-vaccine sentiment in
632 society—in fact, booster mandates appear to be associated with an increase in anti-vaccination
633 beliefs and reduced uptake of other (non-coronavirus) vaccines.^{1,86,96} As highlighted above,
634 there are also wider social harms of policies that purport to reduce transmission of a ubiquitous
635 virus: such policies may create a fear of infection among young healthy people (out of
636 proportion to the actual risks) and contribute to worsening mental health which predated the
637 pandemic.¹¹⁵

638

639 Moreover, the claim that the *socialisation* of compliance with public health measures can
640 justify those measures is problematic for three other reasons. First, such an argument is circular:

641 compliance is not an end itself; policy must be justified by the expectation of public health
642 benefit. Second, people may have different attitudes to compliance depending on their values
643 (e.g., the views regarding the importance of individual liberty) and experiences (e.g., those with
644 low baseline levels of trust in public health due to negative experiences of health professionals
645 or government agencies). Policies that require people to comply against their values and
646 preferences require ethical justification, especially where voluntary compliance is likely to be
647 lower among those who are disempowered (e.g., students) or marginalised for other
648 reasons^{5,116}, for example those from social groups which have been mistreated by government
649 agencies or by the medical system in the past, including in the context of research.¹¹⁷ Third, the
650 socialisation argument is based, in part, on concepts of civic duty and responsibility to others.
651 Pushing for boosters even when these will not contribute to overall risk reduction runs counter
652 to the responsible use of public resources. Policies that encourage waste of valuable health care
653 resources, to make some feel better, are sending a distorted message about important societal
654 obligations.

655

656 The proclivity for university vaccine mandates may also reflect harmful trends toward
657 intolerance in university bureaucracies that value compliance over individual freedoms.
658 Mandates, by their nature, encourage conformity and acquiescence to authority, and exclude
659 those with different views or values. Though universities might take pride in being places that
660 permit the free exchange of ideas, mandates reduce the scope for reasoned debate regarding
661 scientific uncertainties or conflicts of ethical values.¹¹⁸ For example, how many universities
662 have held public debates about mandatory Covid-19 vaccination? To our knowledge, very few
663 such debates have taken place in North American institutions. We are aware of only one
664 academic event¹¹⁹ which some of us organised, in which booster mandates were critically
665 debated. Sanctions for lack of full vaccination imposed on university professors who publicly

666 voiced their opposition against mandates could arguably also have been intended to suppress
667 public debate or be interpreted as such.

668

669 **6. Implications for Broader Covid-19 Vaccine Mandates for Youth in** 670 **Schools, and Other Institutions**

671

672 The arguments presented above are relevant not only to 3rd, 4th, or 5th dose booster mandates
673 but also to university or school policies that maintain primary two-dose Covid-19 vaccine
674 mandates in 2022 in the face of high rates of previous SARS-CoV-2 infection. Two dose
675 mandates are being upheld in at least 1000 universities and colleges across the United States,
676 far more than the 300 or so maintaining booster mandates², and also some primary and
677 secondary schools¹²⁰ which instituted mandates then extended the deadline when it was
678 apparent that serious inequities in access to education would result.¹²¹ It is even harder to justify
679 a two-dose primary vaccine mandate in late 2022 than when such policies began in mid-2021.⁴⁶
680 Consistent with our argument above, the now high prevalence of prior infection, data regarding
681 the lack of sustained transmission reduction by current vaccines, and the age at peak risk for
682 myo/pericarditis being college-bound students ages 17–19 all undermine the case for two-dose
683 vaccine mandates. We would therefore urge universities and schools to rescind all Covid-19
684 vaccine mandates. Strong statements in support of mandates made in 2021 by organisations
685 such as the Association of Bioethics Program Directors in North America¹²², the American
686 Civil Liberties Union¹²³, and the Ontario Human Rights Commission¹²⁴ should be updated.
687 Such organisations have an ethical obligation to revise these public statements and consider
688 whether they are valid in light of current data.

689

690 The continued policy of two-dose mandates may represent status quo bias: when a rule is
691 normalised it remains even when it has no (current) rational basis. The more rules, the more

692 paperwork and cumbersome “busy work” that administrators and young students and
693 professionals need to jump through. Yet rules come with consequences: how much are
694 universities, corporations, consulting firms and the military paying in staff time to monitor and
695 maintain vaccine mandates? How much time and energy are young adults using to comply with
696 these policies? How much frustration and psychosocial stress is this causing? What about
697 attrition from institutions and the military at times when the labour market and recruitment is
698 difficult? When vaccine mandates are unethical, individuals may have an ethical duty to oppose
699 them, in part to promote tolerance and prevent further bureaucratic encroachment and
700 disenfranchisement of individuals with reasoned arguments against such mandates. Finally, we
701 argue that institutions have an ethical duty to evaluate the effectiveness of such programs if the
702 status quo is to be maintained.

703

704 **7. Conclusion**

705 Based on public data provided by the CDC¹⁸, we estimate that approximately 22,000 to 30,000
706 previous *uninfected* young adults ages 18–29 years must be boosted with an mRNA vaccine to
707 prevent one Covid-19 hospitalisation. Given the fact that this estimate does not take into
708 account the protection conferred by prior infection nor a risk-adjustment for comorbidity status,
709 this should be considered a conservative and optimistic assessment of benefit. Our estimate
710 shows that university Covid-19 vaccine mandates are likely to cause net expected harms to
711 young healthy adults—between 18 and 98 serious adverse events requiring hospitalisation and
712 1373 to 3234 disruptions of daily activities—that is not outweighed by a proportionate public
713 health benefit. Serious Covid-19 vaccine-associated harms are not adequately compensated for
714 by current US vaccine injury systems. As such, these severe infringements of individual liberty
715 are ethically unjustifiable.

716

717 Worse still, mandates are associated with wider social harms. The fact that such policies were
718 implemented despite controversy among experts and without updating the sole publicly
719 available risk-benefit analysis to the current Omicron variants suggests a profound lack of
720 transparency in scientific and regulatory policy making. These findings have implications for
721 mandates in other settings such as schools, corporations, healthcare systems and the military.
722 Policymakers should repeal booster mandates for young adults immediately, ensure pathways
723 to compensation to those who have suffered negative consequences from these policies,
724 provide open access to participant-level clinical trial data to allow risk- and age-stratified harm-
725 benefit analyses of any new vaccines prior to issuing recommendations¹²⁵, and begin what will
726 be a long process of rebuilding trust in public health.

727

728

729 **Conflicts of Interest**

730 We have no interests to declare.

731

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736 local youth ice hockey team's ability to play through the pandemic.

737

738

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