

Exploring Young Adults' Level of Vaccine Knowledge and Intent for COVID-19 Vaccination in British Columbia

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Abstract

Background: The 2019 coronavirus (COVID-19) pandemic is still ongoing and continues to have profound economic and social impacts worldwide. Establishing a minimum vaccination in the population is pertinent to curbing the transmission rate. However, barriers exist to achieving this threshold. Young adults represent the cohort with the highest incidence of COVID-19 cases. Assessing young adults' knowledge and intent to vaccinate will assist policy makers in understanding the factors behind health decisions and designing effective strategies.

Methods: An online self-administered survey was posted on Facebook and Reddit for completion by young adults in British Columbia. Questions pertained to their demographic information, immunization intent, and vaccine knowledge level. Chi-squared tests were performed to examine the associations of COVID-19 vaccine intent with demographic factors and with scores from a vaccine knowledge level.

Results: A total of 235 responses revealed that 72% of young adults in British Columbia would get vaccinated right away. Safety and side effects were cited as the predominant reason for vaccine hesitancy. The average grade for the knowledge test was 70% with the lowest scores on the topic about vaccine safety and administration. Higher education, prior influenza vaccination, and high level of vaccine knowledge were statistically associated with greater COVID-19 vaccine uptake ($p = 0.005$, 0.014 , and 0.000 , respectively). In contrast, associations were not detected when vaccine intent was compared with the study program undertaken at a post-secondary institution or the industry sector worked in.

Conclusion: Results suggested that young adults with high levels of vaccine knowledge, higher educational attainment, and prior influenza vaccination experience would be more likely to receive the COVID-19 vaccine. Health officials should consider disseminating more information about vaccine safety, as this was the primary concern expressed by respondents who were vaccine hesitant. Possible interventions for promoting immunizations include hosting educational workshops or immunization clinics for high school students.

Keywords: vaccine hesitancy, vaccine knowledge, COVID-19 vaccine, immunization rates, coronavirus, education, British Columbia

Introduction

The 2019 coronavirus (COVID-19) pandemic continues to threaten the economic, social, and physical health of individuals worldwide. The Canadian government have mandated mask wearing and physical distancing to reduce transmission, but vaccination remains a priority to minimize serious illness and deaths (Public Health Agency of Canada [PHAC], 2021). Researchers predicted that at least 70% of the population need to be vaccinated to build herd immunity (Subbarao, 2020). Reaching this threshold could be a challenge since the vaccine has yet to be made mandatory in Canada (Weichel, 2020). Therefore, COVID-19 vaccine intent will be of interest for policymakers and public health interventions (PHAC, 2020).

Literature Review

Vaccine Legislation

Health Canada (2020) introduced an interim order which enabled vaccine trials to run in parallel and applications to be accepted on a rolling basis. Review of vaccine candidates could begin before receipt of all documentation as long as safety findings are presented when available (Health Canada, 2020). Despite this streamlined approach, vaccines still have to pass stringent testing before approval. The clinical trials examine the immunogenicity, effective dose, and adverse effects of the vaccine in order to extrapolate results to the

population (Chung, 2020). Post-approval vaccine effects will be monitored by Health Canada and PHAC (Chung, 2020). Reports of these adverse events will be published by the Canadian Vigilance Program and Canadian Adverse Events Following Immunization Surveillance System (CAEFISS) (PHAC, 2019).

COVID-19 Vaccine Efficacy and Safety

Health Canada had signed agreements for seven vaccines (Government of Canada, 2021). Pfizer and Moderna were the first mRNA vaccines to be approved, followed by AstraZeneca and Janssen viral vector vaccines (Government of Canada, 2021). Unlike the 40% to 60% efficacy rate of the influenza vaccines, the COVID-19 vaccines offered relatively higher protection with rates between 66% to 95% (Jones, 2021; Ries, 2021a). These four vaccines had also clinically been shown to defend against COVID-19 variants as well (Ries, 2021b).

Adverse reactions depend on the vaccine technology and immunogenicity. For the mRNA vaccines, fewer than 2% of recipients developed severe adverse events, which included fatigue, muscle pain, and headaches (Wadman, 2020). Serious adverse effects were rare for viral vector vaccines. A medical professor asserted that the risk of thrombosis was only one in 50,000 cases (Andersen, 2021). Low risk of adverse events infers that vaccination benefits greatly outweigh the costs.

Vaccine Hesitancy

Vaccine hesitancy poses a global threat due to strong likelihood of re-introducing preventable diseases (WHO, 2020). This refusal or delay in immunization is contextual and shaped by one's confidence, complacency, and convenience (MacDonald, 2015). A survey by Dube et al. (2016) found that over 70% of Canadian parents worried about negative effects from injections. 20% believed in the causation between the MMR (measles, mumps, and rubella) vaccine and autism, but this had been refuted by countless studies (Dube et al., 2016). Insufficient understanding was cited as the primary reason behind vaccine refusal, while greater trust in healthcare workers led to higher immunizations (Dube et al., 2018). These studies underline the importance of building rapport and communication by public health professionals to improve vaccination rates.

Although most healthcare providers advocate for immunizations, 6% of practicing Canadians were hesitant towards the influenza vaccine (Paterson et al., 2016). Meeting the 80% influenza coverage was not observed by provincial acute care (73%) and residential care (69%) staff (BCCDC, 2020b). A study by Hussain et al. (2018) found that hesitancy was higher among nurses than physicians. Low confidence in vaccine safety and efficacy were cited as primary reasons (Paterson et al., 2016). This would be a concern since providers have often

been involved in decisions and serve as role models for their clients. Individual autonomy, minimal health impacts, and low susceptibility to infection were additional reasons (Lorenz et al., 2017). However, infected individuals could be asymptomatic. Healthcare providers could pass this health hazard to vulnerable groups and produce undesirable consequences.

In a study that surveyed 67 countries including Canada, Larson et al. (2016) found that 25- to 34-year-olds were more likely to have less trust in vaccine safety than adults aged 65 years or older when compared with the baseline. Higher education did not correlate with greater acceptance (Larson et al., 2016). Conversely, Ryan et al. (2019) found that undergraduates and unvaccinated students had insufficient influenza and vaccine knowledge than graduates. Public health and pharmacy students had higher immunizations than nursing students (Kalucka et al., 2020). These studies emphasize the importance of vaccine education, especially for healthcare students.

Young adults are the largest consumers of social media, such as Facebook and Instagram (Gruzd & Mai, 2020). Non-credible information could be readily accessible on these sites, especially since vaccine opponents were three times more likely to share conspiracies than advocates (Jamison et al., 2020). Therefore, young adults are the most vulnerable to misinformation about vaccines.

Surveys about COVID-19 Vaccine

There are limited Canadian studies about vaccine intent. In May, researchers from Statistics Canada reported that only 58% of respondents were willing to vaccinate right away (Frank & Arim, 2020). Another survey revealed that vaccine confidence reduced from 46% in July to 39% in September (Angus Reid Institute, 2020). Adults between 18 to 54 years of age or with high school education had lower vaccine acceptance (Angus Reid Institute, 2020). Risk of side effects was a greater concern than vaccine efficacy (Angus Reid Institute, 2020).

Scope and Research Question

Among all age cohorts in British Columbia, young adults between 20 to 29 years of age have the highest number of cases. BCCDC (2020a) found that they were more likely to contract the virus due exposure at multiple settings. Surveying this group will provide health authorities with an understanding of their vaccine intent. These findings can be used in healthcare decisions and development of vaccine campaigns. Vaccination will provide protection for young adults and their contacts, which will reduce transmission rates. Therefore, the research question is “What is the association between the depth of vaccine knowledge and young adults’ intent to become immunized against COVID-19 in British Columbia?”

Materials and Methodology

Description of Materials

This study required internet connection and a computer. Administration utilized Survey Monkey (<http://www.surveymonkey.com>), NCSS 2021 Statistical Software (2021), and Microsoft Excel 365. A \$100 VISA gift card was allocated for the prize draw.

Methods

The online survey was created on Survey Monkey and remained active for self-administration from January 16 to February 2, 2021. A separate email was created to upload the cover letter and survey link. The study invitation was posted on Reddit and Facebook groups according to the relevant topics and geographical sites. An email was sent to a few organizations to include more responses, but only S.U.C.C.E.S.S. replied. This agency was chosen due to the sizeable number of youths in their programs. However, this recruitment carried bias and would be mentioned in the limitations. A reminder was sent two days before deactivating the link.

With an estimated completion time of five minutes, the survey had 17 questions under the three sections: demographic information, immunization intent, and vaccine knowledge level. Scores from the third section were sorted into varying degrees of vaccine knowledge level: low (0 to 3), medium (4 to 5), and high (6

to 7). Chi-squared tests were performed. Participants' emails were assigned a number by the faculty advisor and the winner was selected with an online random number generator.

Inclusion and Exclusion Criteria

Residents who lived in British Columbia for six consecutive months were eligible to participate. Individuals who did not meet this criterion were taken to the end of the survey. Only responses between ages 19 to 30 were analyzed. Friends, family, and peers of the authors were excluded.

Ethical Considerations

The cover letter, consent form, survey questions, and email were approved by the BCIT Research Ethics Board under the code REB 2020-32. Participants' emails were collected on Survey Monkey's Canadian server. Survey responses were stored in a password protected computer, and emails were erased after completion of the study.

Results

Description of Data

Nominal and ordinal data were collected from closed-ended survey questions. Some questions had a comment box for entering more details. Demographic information and COVID-19 vaccine intent questions had multiple options, including a

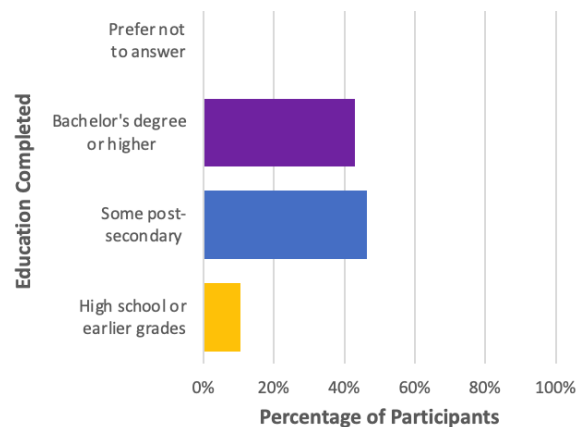
“prefer not to answer”. All knowledge-based questions about vaccines had a true, false, and “I do not know” option. Correct answers were scored one point; other answers were scored zero. Low, medium, or high vaccine knowledge level was assigned to each test score.

Descriptive Statistics

235 of the total 287 responses belonged to participants between 19 to 30 years of age. 54% of participants identified as female, 44% as male, and 1% as other. The descriptive statistics were displayed below.

Figure 1

Education Completed Breakdown

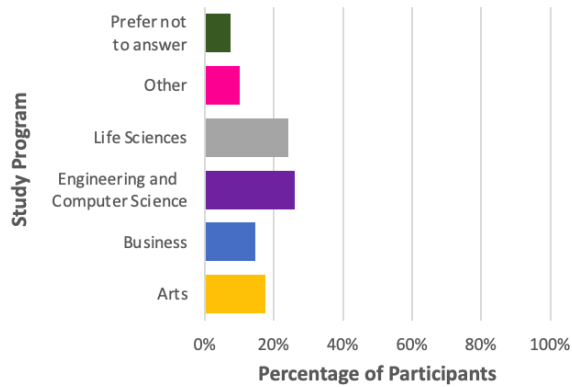


Note. Sample size, n = 235

As shown in Figure 1, majority of participants had some post-secondary experience (46%) or held a bachelor's degree or higher (43%).

Figure 2

Study Program Breakdown

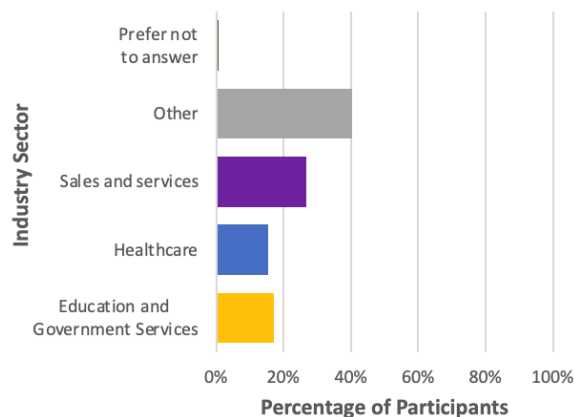


Note. Sample size, n = 149

59% of the respondents were enrolled in post-secondary. As depicted in Figure 2, majority were Engineering and Computer Sciences (26%) and Life Sciences (24%) students. There was a lower representation of students from Arts (17%) and Business (15%).

Figure 3

Industry Sector Breakdown

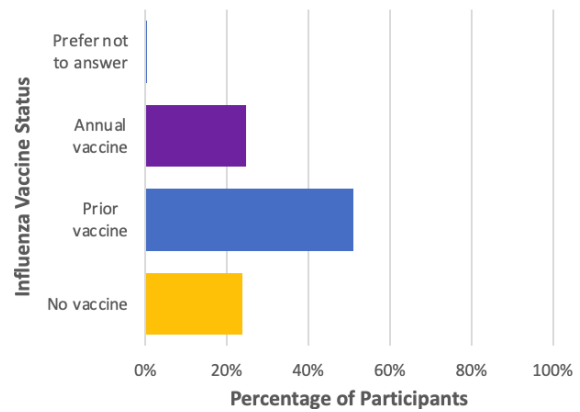


Note. Sample size, n = 176

Roughly 74% of respondents were employed in frontline occupations. The proportion of those in sales and services, healthcare, education and government services, and other were 27%, 15%, 17%, and 40%, respectively (Figure 3).

Figure 4

Influenza Vaccine Status Breakdown

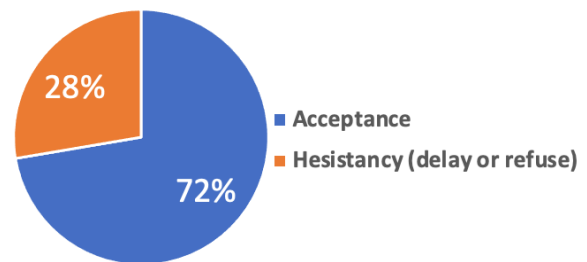


Note. Sample size, n = 235

Figure 4 indicated that more than 75% participants had at least one experience of the influenza vaccination.

Figure 5

COVID-19 Vaccine Intent



Note. Sample size, n = 235

Figure 5 revealed that 72% of young adults would receive the COVID-19 vaccine right away. Safety and side effects (68%) were the predominant concern among vaccine hesitant individuals. The risk of vaccines triggering food allergies were mentioned specifically. 17% of young adults believed that vaccination was unnecessary, and that COVID-19 was not serious nor effective. There were worries about the implication of the COVID-19 vaccine on pregnant mothers and overcrowding at the immunization clinics.

Government websites and peer-reviewed sources was the most popular source for vaccine information among 55% of young adults. Healthcare provider (26%) was the second choice, followed by social media (10%).

Table 1 listed all questions used in the vaccine knowledge test. The average score was 4.9 ± 1.6 out of 7, which translated to 70%. More than four-fifth of young adults answered at least four questions correctly. The first question about vaccines overwhelming the immune system received the lowest score (27%). Participants had difficulty with answering the second question about vaccine safety studies following Phase III trials (52%), and the third question about mercury-containing preservatives in vaccines (65%).

Table 1

Vaccine Knowledge Test Score Results

Question with Correct Answer	Percent Correct
1. Receiving many vaccines at the same time can overwhelm the immune system and cause side effects. (FALSE)	27%
2. Further studies for safety are conducted after completion of Phase III clinical trials and approval of the vaccine. (TRUE)	52%
3. The amount of mercury-containing preservative, e.g., thimerosal, in the influenza vaccine produces harmful health effects. (FALSE)	65%
4. Vaccines are 100% effective in protecting against disease. (FALSE)	82%
5. Scientific studies show that vaccines cause chronic conditions, such as autism, diabetes, and multiple sclerosis. (FALSE)	85%
6. Contracting the disease is more dangerous and causes serious adverse effects than receiving the vaccine. (TRUE)	86%
7. Vaccines are still necessary today because not all diseases can be prevented with better hygiene and sanitation. (TRUE)	94%

Inferential Statistics

All data from Survey Monkey were exported to Microsoft Excel 365 and analyzed with NCSS 2021 Statistical Software (2021). Chi-squared tests were performed to determine associations between COVID-19 vaccine intake level and the multiple variables: education completed, study program, industry sector, influenza vaccine status, and vaccine knowledge level. The five hypotheses and interpretations are summarized in Table 2.

Table 2*Summary of the null and alternate hypotheses and the inferential test results*

H₀ and H_A	Test Used	Results (p-value)	Conclusion
H₀1: There is no association between education level and COVID-19 vaccine intent level. H_A1: There is an association between education level and COVID-19 vaccine intent level.	Chi-squared test	0.005	Reject H ₀ and conclude that there is statistically significant association between education completed and COVID-19 vaccine intent level. Individuals with more education are more likely to take the COVID-19 vaccine.
H₀2: There is no association between study program and COVID-19 vaccine intent level. H_A2: There is an association between study program and COVID-19 vaccine intent level.	Chi-squared test	0.240	Do not reject H ₀ and conclude that there is no statistically significant association between study program and COVID-19 vaccine intent level. The study program has no impact on student's intent to vaccinate against COVID-19.
H₀3: There is no association between industry sector and COVID-19 vaccine intent level. H_A3: There is an association between industry sector and COVID-19 vaccine intent level.	Chi-squared test	0.157	Do not reject H ₀ and conclude that there is no statistically significant association between industry sector and COVID-19 vaccine intent level. Industry sector has no impact on worker's intent to vaccinate against COVID-19.
H₀4: There is no association between influenza vaccine status and COVID-19 vaccine intent level. H_A4: There is an association between influenza vaccine status and COVID-19 vaccine intent level.	Chi-squared test	0.014	Reject H ₀ and conclude that there is a statistically significant association between influenza vaccine status and COVID-19 vaccine intent level. Individuals who had a previous influenza vaccine are more likely to receive the COVID-19 vaccine.
H₀5: There is no association between vaccine knowledge level and COVID-19 vaccine intent level. H_A5: There is an association between vaccine knowledge level and COVID-19 vaccine intent level.	Chi-squared test	0.000	Reject H ₀ and conclude there is a statistically significant association between vaccine knowledge and COVID-19 vaccine intent level. Individuals with high level of vaccine knowledge are more likely to take the COVID-19 vaccine.

Discussion

Understanding young adults' depth of vaccine knowledge and their intent is critical for the successful delivery of public health interventions. The 72% of young adults willing to receive the COVID-19 vaccine right away was substantially higher than Statistics Canada's survey in May. Only 58% of 15-to-24-year-olds

agreed to be vaccinated (Frank & Arim, 2020).

In contrast, 37% was reported by the Angus Reid Institute (2020) in September. These results suggested that young British Columbians had more confidence than their counterparts in other provinces. Possible reasons could be variability in trust and perceived clarity of public

messages from the provincial health officers (Angus Reid Institute, 2020).

Among respondents who were vaccine hesitant, 68% feared side effects and roughly 8% lacked confidence about the effectiveness. These worries were likewise reflected in surveys by Frank & Arim (2020) and Angus Reid Institute (2020). The latter purported that a considerable number of young adults did not regard COVID-19 to be a serious concern (31%) and had low confidence about vaccine effectiveness (25%) (Angus Reid Institute, 2020). Results from Frank & Arim (2020) noted that 26% deemed vaccines unnecessary, and 34% would wait for more safety data. Therefore, more publicly available research would promote favorable perception of vaccine effectiveness and reassurance for young adults to make well-informed decisions.

While all groups preferred government websites as the principal source of information, young adults with more education and vaccine knowledge were attributed with greater COVID-19 vaccine acceptance. Angus Reid Institute (2020) supported this association with 89% of undergraduates planning to vaccinate than the 68% of individuals with high school experience. These results also inferred that post-secondary students have greater exposure to vaccine information. Ryan et al. (2019) identified that knowledge could be attained from the study program, campus campaigns, or physicians onsite. On the contrary, Larson et al. (2016) did

not find a positive relationship between education and vaccine confidence. Discrepancy between results reinforced the fact that vaccine acceptance is contextual and multi-factorial. Confidence, complacency, and convenience were three factors that influence the decision to vaccinate (MacDonald, 2015). This study pertained specifically to the COVID-19 vaccine and British Columbians, whereas Larson et al. (2016)'s study examined vaccines in general and countries with varying socio-economic factors.

Majority of knowledge-based questions were adapted from the WHO's (2015) factsheet of common misconceptions. Scoring 70% on the test inferred that young British Columbians still regarded vaccines to be important; they had some familiarity on this topic and was able to identify the facts. These knowledge scores were similar to Cvjetkovic et al.'s (2017) findings from the questionnaire for undergraduate students. Low scores for questions about thimerosal in the influenza vaccine and post-approval studies signaled insufficient understanding about the monitoring programs, such as CAEFISS. Given that young adults still have safety concerns, it is pertinent to increase public accessibility and transparency of the COVID-19 vaccine facts.

Since knowledge was found to be associated with vaccine intent, there was an expectation for more healthcare students and employees to receive the COVID-19 vaccine. This research did not find any associations.

Likewise, scientific literature yielded mixed results for the influenza vaccine. Kalucka et al. (2020) showed that enrollment in healthcare programs promoted knowledge and influenza vaccine uptake. Meanwhile, Paterson et al. (2016) claimed that some healthcare workers, especially nurses, were vaccine hesitant. Due to the uneven sample sizes for the study program and industry sector categories, the results could not be directly translated to the young adult population; more research would be needed.

Inferential statistics determined that a person with prior influenza vaccination would be more likely to take the COVID-19 vaccine. Ryan et al. (2019) supported that prior vaccination could be a contributor for uptake in their cross-sectional survey of university graduates and the influenza vaccine. The authors found that unvaccinated students were more reluctant to be immunized and likely had vaccine misconceptions (Ryan et al., 2019). Therefore, resources to increase immunization would be more effective if they are diverted for unvaccinated individuals.

Limitations

There were a number of limitations in this study. Despite providing the “I don’t know” option in the knowledge test and a disclaimer to promote honest answers, respondents could still guess correctly or search for answers on another websites. The survey link was only

posted on Reddit and Facebook, limiting access to specific social media users. Survey could only be uploaded on selective groups due to specific restrictions by moderators. Study findings could not be directly applied to rural towns since the link was posted on Reddit or Facebook groups of larger cities.

Forwarding the survey to S.U.C.C.E.S.S. incorporated bias into the results by skewing the sample population to young Asian immigrants compared to the general public. Participant demographics in their youth programs might vary yearly with priority seats given to newcomers. Therefore, these results could not be entirely extrapolated to the public.

Recommendations include posting the survey on other platforms, such as Twitter, to increase participation. The knowledge test can be timed to discourage cheating. Responses outside of the accepted time will be excluded. Extending the data collection period will capture a larger sample size for each category and improve the external validity of this study.

Knowledge Translation

Results from this study could be used to develop policies and targeted public health interventions. From the knowledge test, most young adults were able to provide the correct answers but were unfamiliar with questions regarding vaccine administration and safety. Since knowledge was found to be associated

with vaccine acceptance, hosting an immunization clinic or a workshop on debunking vaccine myths for high school students would be beneficial for their learning. Their capability to discern the facts would likely have an impact on their own and their families' medical choices, which would indirectly have an impact on transmission rates. Since only 72% of young adults expressed interest to vaccinate right away, public campaigns could include disseminating vaccine material and bringing more awareness to the programs related to the adverse effects following immunization, such as CAEFISS. There would be fewer negative sentiments along with better understanding of the public and government's roles in ensuring the safety of approved vaccines for the population. Additionally, findings from this research could serve as a baseline to compare with future studies about vaccine knowledge and intent among young adults.

Future Studies

The following topics can be explored for future research.

- Study on the knowledge level and COVID-19 vaccine uptake between young adults from different provinces
- Study on the knowledge level and COVID-19 vaccine uptake between different age cohorts in British Columbia

- Study on the knowledge retention and vaccine intent after delivery of educational workshops to high school students

Conclusion

This study provided a snapshot of young adults' level of vaccine knowledge and vaccination intent in British Columbia. Factors that encouraged their vaccination included education attainment, vaccine knowledge level, and prior influenza vaccination. Study program and industry sector were not found to be associated with vaccine uptake. Since safety concerns were cited as the primary reason for vaccine hesitancy, healthcare professionals should bring more public attention towards the existing vaccine surveillance systems in Canada. Suggested public interventions could include vaccine campaigns or educational workshops in schools, which are invaluable to promote vaccine confidence and coverage.

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Competing Interests

The authors declare no competing interests.

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