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Preventive behaviors and perceptions of influenza vaccination among a university student population

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ABSTRACT

Background Every year during influenza season, preventable illnesses occur due to lack of vaccination and failure to adopt the preventive behaviors known as non-pharmaceutical interventions (NPIs). In an effort to study the impact of preventive strategies and policies on behavioral changes during the spread of the H1N1 pandemic in 2009, we examined a sample of undergraduate, graduate and business students at the Massachusetts Institute of Technology (MIT).

Methods An online survey was completed by 653 students to assess NPI use, perceptions of influenza vaccinations and effectiveness of preventive health policy strategies during the 2009 H1N1 outbreak. Strategies included e-mails and text messages, posters in corridors and restrooms, and videos. These strategies were implemented during both the first and second waves of the 2009 H1N1 pandemic.

Results Despite the widespread campaign, fewer than half of the respondents reported modifying their behaviors. We discovered that >70% of the respondents did not practice any NPIs, and more than half showed lack of knowledge of flu vaccinations.

Conclusions Our study results indicate a need for more effective strategies to encourage NPI practices in student populations during outbreaks of infection.

Keywords communicable diseases, management and policy, population-based and preventive services

Introduction

In 2009, a new swine-origin influenza A (H1N1) virus (S-OIV) spread rapidly by human-to-human transmission to 30 countries in <2 months.[1] The virus was thought to have started in La Gloria, Mexico,[2,3] and caused severe illnesses, including pneumonia and acute respiratory distress syndrome, and resulted in hospitalizations and deaths.[4,5] Identifying the virus in different countries and across continents showed that it could easily be spread by air and land travel, community networks and gatherings.[6] Vaccinations and non-pharmaceutical interventions (NPIs) were key strategies for mitigating the spread of influenza in the 2009 H1N1 pandemic. The combination of vaccinations and NPIs is not only a potentially effective strategy, but is also more cost-effective than vaccinations alone.[7]

Despite the effectiveness of vaccinations, the general public does not completely trust them. Research has shown that university students also have negative perceptions about vaccines, mostly because of concerns about usefulness, safety and side effects.[8,9] In addition to vaccinations, public health agencies such as the Centers for Disease Control and Prevention (CDC) strongly recommended encouraging NPIs such as personal hygiene measures, social distancing and self-isolation.[10] NPIs are readily available and can act as primary prevention until other strategies like vaccination become available.[11,12]

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However, not all NPI strategies were successfully implemented in university populations during the 2009 pandemic. The objective of the current study was to study NPI practices and students' perceptions of vaccination during the 2009 H1N1 influenza pandemic.

NPIs in universities

The effectiveness of NPIs has mostly been studied among households[13–16] or school-age children.[17–22] The effectiveness of simple NPIs such as hand washing has been well proven worldwide.[23–27] Research has also shown that social distancing and self-isolation are effective strategies.[28–30] University populations have also been considered potentially at risk of propagating contagious disease due to the high-density living environment on campuses. However, a number of studies have shown that university students do not practice isolation or social distancing.

The first reported university outbreak of H1N1 exhibited rapid spread of the virus at the University of Delaware.[31,32] Initial cases appeared to be associated with travel to Mexico, but students' participation in 'Greek Week' (20–25 April 2009) activities facilitated a rapid increase. In another study, Katz *et al.*[12] showed that almost no students at George Washington University self-isolated for the entire duration of their illness. Mitchell *et al.*[25] also studied the effects of NPIs at a large public university in the USA and reported that nearly half of the students, most with acute respiratory infections, attended social events. Another study showed that, despite public health and university health education campaigns at New Mexico State University, ~25% of students living on campus were not aware of the virus and 60% did not perceive dormitory living to be a potential health risk.[27] Van *et al.*[33] also studied the attitudes and behavior of students at the University of New South Wales in Sydney, Australia. Most subjects in their study had not adopted any specific behavior changes.

Students' perceptions of vaccinations

Even though there is a general assumption that vaccinations are more accepted among educated populations, studies of the 2009 H1N1 outbreak did not support that assumption. Students at a large public university in New York did not know basic facts about the H1N1 vaccine.[9] Most students at Northern Kentucky University perceived themselves as at low risk for the flu because they were young, and only 16% of students planned on getting vaccinations.[8] Surprisingly, most of the medical students at two Czech universities did not perceive flu vaccination as important, and their opinion did not change even during the 2009 pandemic (only 5% expressed an interest in getting vaccinated).[34] Studying a sample of students at a college in the USA, Sunil and Zottarelli[35] found that the odds of being vaccinated were higher for students whose friends or family had been vaccinated before. At Northern Kentucky University, the top reasons for getting vaccination among students included doctor recommendations, having previously had a seasonal vaccine and being at high risk for influenza.[8] Given this common lack of awareness and knowledge, there is a need to discover and evaluate strategies to help encourage social distancing and self-isolation as well as increase awareness of the importance of flu vaccinations.

MIT's response to the 2009 H1N1 pandemic

The university's response to the 2009 H1N1 outbreak provided an opportunity to examine the behaviors and perceptions of students. It also provided an opportunity to assess the effectiveness of the strategies used to enforce the CDC policy of encouraging the use of NPIs. The university employed the following strategies:

(i) University medical center (MIT Medical): Students reporting to urgent care were asked not to attend classes and to rest in their dorms. Up-to-date information on the H1N1 influenza pandemic was posted on the MIT website. E-mails were sent to students and faculty members advising them about the use of NPIs. Pamphlets on H1N1 were given to every student who reported the illness.
(ii) Public awareness: Posters in the main campus building (primarily), posters and movies in the hallways and influenza awareness signs in the restrooms. Hand sanitizers were installed in some of the busier locations, including the student center.
(iii) Self-isolation: Students were asked to stay in their dorms and call in sick if they exhibited flu-like symptoms. Housemasters were to check on them.
(iv) Med-links: These trained undergraduate student health liaisons were asked to take the temperatures of students who were feeling weak or sick in their dorms.
(v) Student support services: Counseling services were asked to inform professors about student illness, allowing arrangements to be made for students to make up missed coursework.
(vi) Educational efforts: Special information sessions about swine flu and its management were held by student support services and all departments, housemasters and med-links.

In September 2009, during the second wave of the pandemic, posters were again placed in corridors and restrooms, e-mails and text messages were sent to members of the community

and notices were placed on the MIT website. Advice was given about diligent hand hygiene, including the frequent use of alcohol-based sanitizers, increased hand washing, and coughing and sneezing etiquette. Students were also instructed to stay away from other students and crowds (social distancing) and to stay away from classes and remain at home until fever-free for at least 24 h (self-isolation). Students were also strongly encouraged to contact the student health center if symptoms worsened. The general feeling was that all these strategies should keep the student community well informed, since it was the beginning of the second wave of the pandemic and the first wave had passed only a few months before.

Methods

Subject enrollment

The student population at MIT is divided into three distinct groups. Undergraduate students constitute the youngest cohort; the majority is unmarried and live in close proximity in dormitories, fraternities and sororities. Graduate students (non-business) represent an older cohort; some are married and have children, and many live off-campus. Doctoral students' educational activities commonly revolve around research and coursework centered in a single discipline-based academic department. A third distinct community consists of business students (and fellows in the business school), who pursue studies toward a professional degree (or certificate) in the business and management fields.

Beginning in late September 2009, with the second wave of the H1N1 influenza pandemic in Massachusetts, ∼350 students [undergraduate, graduate (by graduate students, we mean all non-business graduate students) and business students] contacted the student health center in person or by telephone and reported influenza-like illness (ILI). The students with ILI had one or more of these symptoms: congestion, rhinorrhea, cough and/or sore throat, with or without fever and were not suffering from seasonal allergies or underlying medical conditions. After getting institutional review board approval, a survey was sent to students with the flu via e-mail; they were offered the opportunity to win a prize. Out of ∼350 students with the flu, 305 responded. For the control group (students with no flu), ∼700 students were randomly selected from the registrar's list and invited to participate; 348 students responded and completed the survey. The total sample was 653 students. There were 413 undergraduates (median age = 19), 120 graduate students (median age = 27) and 120 business students (median age = 30).

Surveys

Initially, we conducted 48 preparatory student interviews at random, of ∼20 min each. These unstructured interviews helped in the development of the survey questionnaire. The final survey included questions related to the practice of NPIs. The questions specifically asked whether: students practiced increased hand washing; stayed away from crowds and distanced themselves from social events; attended classes; self-isolated when they had the flu and ate in dining halls when they had the flu. Questions were also asked about routine health habits prior to the outbreak, regarding nutrition, regular exercise and sleep habits. The reason for asking about health habits was to relate the practice of NPI use with the practice of healthy habits. The respondents were also questioned about their demographic characteristics and their awareness of the mechanisms used to inform and educate members of the community about preventive behavior during the outbreak of the contagious illness.

Statistical analysis

Statistical analysis of the responses was carried out using SPSS version 23.0 and Microsoft Office 2013. We conducted logistic regression analysis to study the associations of the NPIs when controlled for age, gender, student group and living on- or off-campus. We specifically looked at whether the practice of NPIs was associated with flu status (or ILI) and also which student group was more likely to practice NPIs at the time of the 2009 H1N1 pandemic.

Results

Descriptive statistics and characteristics of respondents

Table 1 presents the characteristics of the subjects. The sample of 653 students was ∼6% of the total of 10 384 students enrolled at MIT in 2009. Slightly <2% of the student body was seen at the student health center with ILI symptoms during the timeframe of the study. Of the respondents, 51% were female. The median age of the 413 undergraduates was 19. The graduate ($n = 120$) and business ($n = 120$) students were older, having median ages of 27 and 30, respectively. Seventy-four percent of the undergraduates, 46% of the graduates and 22% of the business students were living on campus.

Overall, fewer than half of the respondents reported modifying their behaviors in order to reduce their risk of contracting disease during the outbreak. Figure 1 shows that no students with flu and only 2% of students without flu practiced all three preventive behaviors. There were differences in health habits during the outbreak; more students without flu symptoms reported practicing healthy daily habits (76%) compared with students with flu symptoms (24%).

Table 1 Characteristics of the subjects

	Characteristics	*Undergrad students*	*Non-business graduate students*	*Business students*	*Total*
All subjects	Number of subjects	413	120	120	653
	Female (%)	235 (56.9)	49 (40.8)	52 (43.3)	336 (51.5)
	Age, median (range)	19 (17–22)	27 (22–36)	30 (26–39)	—
	On-campus resident (%)	306 (74.1)	55 (45.8)	26 (21.7)	387 (59.3)
Students with influenza-like symptoms	Number of subjects (%)	169 (40.9)	54 (45.0)	82 (68.3)	305 (46.7)
	Female (%)	69 (40.8)	27 (50.0)	34 (41.5)	130 (42.6)
	On-campus resident (%)	104 (61.5)	21 (38.9)	17 (20.7)	142 (46.6)

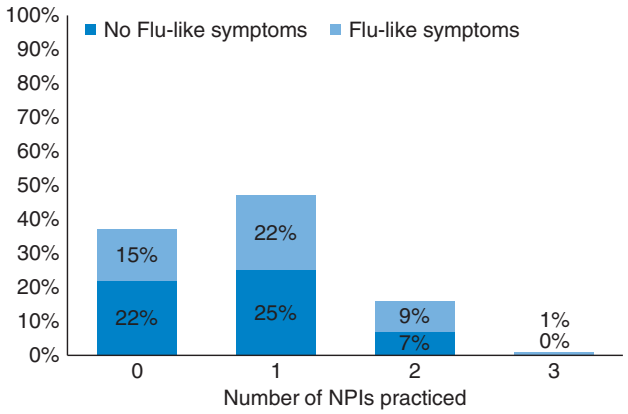

Fig. 1 Percentage of students practicing NPIs with and without ILI at MIT during the 2009 H1N1 outbreak.

Table 2 Comparison results

	Outcomes	*Odds value*	P-*value*	*95% CI*
Flu-like symptoms	Hand washing	1.10	0.055	1.00–1.20
	Social distancing and self-isolation	1.09	0.068	0.99–1.19
Gender (Female = 0)	Hand washing	0.91	0.055	0.83–1.00
	Social distancing and self-isolation	0.98	0.53	0.90–1.05
Business students	Hand washing	0.82	0.064	0.66–1.01
	Social distancing and self-isolation	0.89	0.115	0.78–1.03

Comparative analysis

Students who did not have the flu (all groups) were more likely to practice NPIs compared with those who had the flu. Also, business students were less likely to practice NPIs when compared with non-business students (OR = 0.82, $P = 0.06$). Similarly, females were more likely to practice hand washing than males (OR = 0.91, $P = 0.05$) (Table 2).

Qualitative data analysis

All subjects were asked if they had received the flu vaccine during the second wave of the 2009 H1N1 pandemic. This was followed by an open-ended question: 'If not, then please explain in your own words why not'. The responses were coded as: lack of knowledge; do not seem to care enough (do not seem to prioritize) or fear of getting a vaccination. Interestingly, the analysis showed that most of the students (undergraduate, 53%; graduate, 65% and business, 63%) mentioned lack of knowledge about flu vaccinations. Answers were coded as 'lack of knowledge' when students mentioned something incorrect about the vaccine and its effects. There were students (undergraduate, 39%; graduate, 32% and business, 31%) who mentioned 'carelessness', 'laziness' or 'busy, no time', which was coded as 'don't seem to care enough (don't seem to prioritize)'. Another reasons for not getting vaccinations was fear of needles (undergraduate, 7.5%; graduate, 2.9% and business, 6.1%). Figure 2 shows the common responses from the raw data in the form of a qualitative map.

Discussion

The results of a survey of students indicated that undergraduates, who were younger and more likely to live on campus, and whose activities extended throughout the campus, were more aware of the outbreak-related informational campaign; they also reported more diligently engaging in hand hygiene measures. Similarly, qualitative data analysis showed that lack of knowledge about flu vaccinations existed even in such a highly educated population. This indicates that there is a potential need to increase knowledge and awareness among students, who did not prioritize getting vaccinated, despite

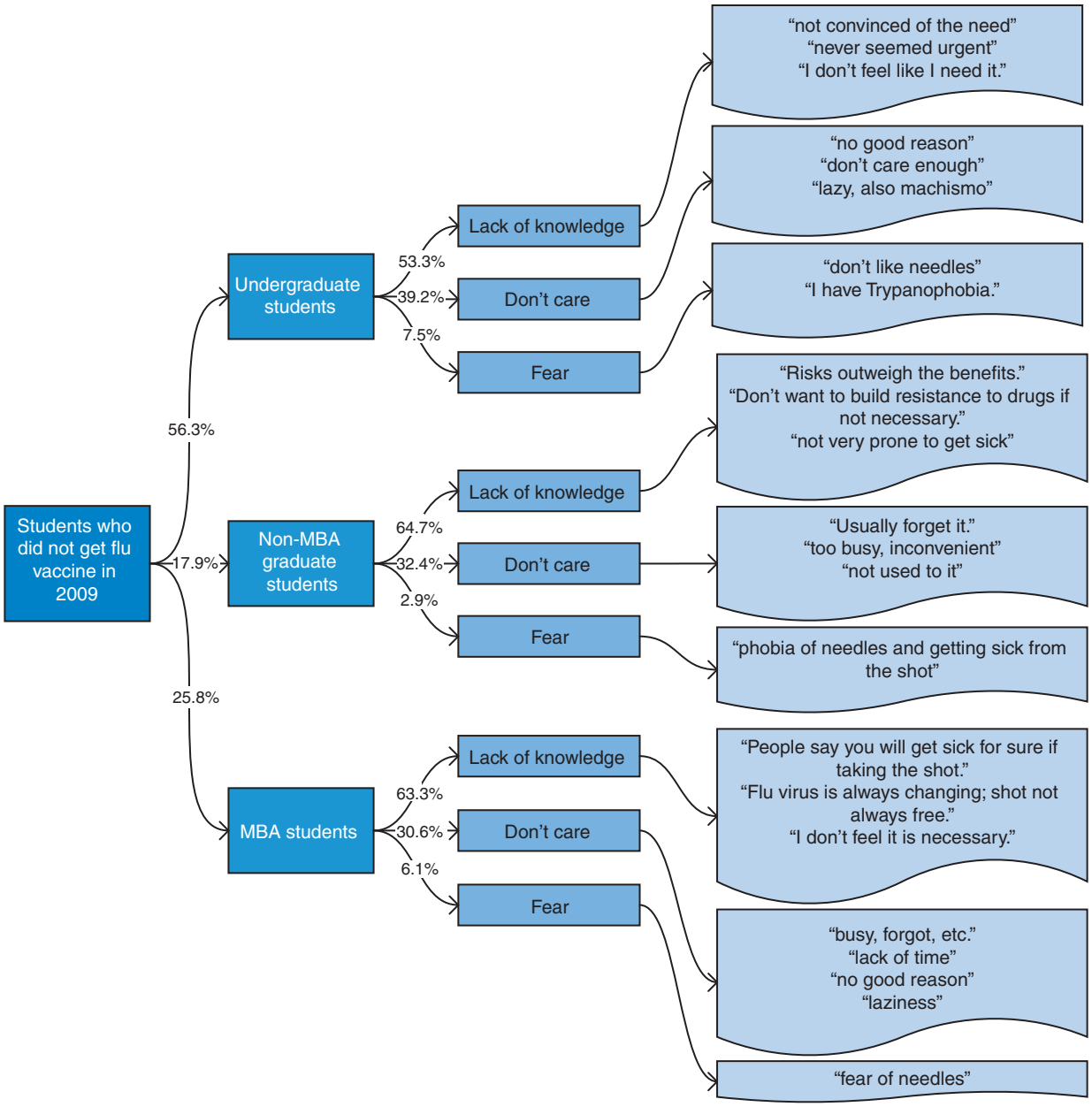

Fig. 2 Students' perceptions of flu vaccination at MIT during the 2009 H1N1 outbreak.

ample available information about its importance during the second wave of the 2009 H1N1 pandemic.

The study results support modifications in the approaches of those caring for the health of university populations in response to future pandemics. Educational campaigns to increase knowledge and awareness of the importance of prevention and vaccination should be designed using different strategies and approaches for each segment within the student population. Graduate and business students might be better informed by short lectures before or after their regular classes, rather than by posters and flyers. Business students, who are under considerable time pressure, might prefer to have a vaccination clinic available in their building for convenience of access. For undergraduate students, campaigns that involve sororities and fraternities could have a bigger impact. As for graduate students, we recommend that graduate student counsels arrange regular educational and motivational seminars to increase awareness. More studies are needed to ascertain the effectiveness of different strategies for different groups of students.

We acknowledge that there are limitations on our study. It was focused only on the MIT student population and did not

include the larger MIT community, which also involves faculty, staff and other community workers. Readers should also be cautious about overgeneralizing our findings, because our results only represent a small fraction of the university student population. In addition, this case study was based on a small sample of data, so that recall bias and self-reported data may lead to inaccuracy.

Despite these limitations, we hope the current study increases understanding of certain student subpopulations that may not be practicing NPIs, so that help may be needed to design better strategies for decreasing the spread of pandemics. Future studies could benefit from using larger data sets to further validate our findings. Future studies could also look into which specific types/sources of information are convincing to various student subpopulations and what messages they listen to more attentively. Comparison of our results with prior findings could also be another potential topic for a meta-analysis or systematic review.

Conclusion

Our study results suggest that improved student understanding of preventive care is needed, especially during a pandemic. We learned that some MIT students practiced NPIs during the 2009 H1N1 influenza outbreak, but many more might have done so, had efforts to educate them and persuade them been more effective. Similarly, we learned that there is a need to improve the perceptions and attitudes of students regarding flu vaccinations by developing strategies for education and increased awareness. We conclude that learning communities require more targeted efforts to most effectively implement health policies and that different strategies are needed to better prepare for and respond to a possible pandemic in the future.

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