# Uptake of the COVID-2019 Vaccines Among College Students: Assessing Health Beliefs and Reasons for Vaccine Uptake

Gladys Ekong, PhD
Western New England University

Dominic Siaw, BS
Western New England University

Kitt Lee, PharmD
Western New England University

Shames Radi, BA
Western New England University

Aisha Morgan, BS
Western New England University

## ABSTRACT

**Background:** College students are susceptible to airborne infectious diseases due to a communal living or learning environment. Adherence to vaccine regimens could safeguard population health in college communities.

**Aim:** The aim of this study was to assess the relationship between COVID-19 vaccine uptake and health beliefs among university students using the Health Belief Model (HBM) constructs. The secondary objectives were to identify sources of health information on COVID-19 and reasons for vaccine uptake.

**Methods:** A cross-sectional study was implemented among students at a university in the Northeastern region of the United States. The online survey assessed perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy. Data analyses include qualitative, descriptive statistics, and logistic regression.

**Results:** Of the 385 participants, 266 (69.1%) were within the age range of 20-29 years old. Three HBM constructs predicted vaccine uptake: (1) perceived benefits (aOR 5.02, 95% CI [2.86, 8.82], $p$ = < 0.001), (2) perceived barriers (aOR 0.24, 95% CI [0.14, 0.42], $p$ = <0.001), and (3) cues to action (aOR 4.36, 95% CI [1.92, 9.93], $p$ = <0.001). The reason for vaccine uptake included protecting themselves and the community. A primary source of information varied in the study population.

**Conclusion:** The study findings may inform college administrators' decision-making to incorporate effective health promotion methods for vaccine uptake.

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## INTRODUCTION

Health beliefs span a broad continuum, ranging from disease prevention, management, and healthcare utilization behaviors (Al-Noumani et al., 2019; Zuckerman et al., 2015). The outbreak of the novel coronavirus disease 2019 (COVID-19) highlighted the need for stringent preventive measures such as social distancing, wearing protective face coverings, and receiving the COVID-19 vaccine when it was made available. Vaccines play a major role in disease prevention and population health. Despite the availability of COVID-19 vaccines, heightened vaccine hesitancy and refusal rates were observed among patients globally (Lucia et al., 2021; Sallam, 2021). Prior to the development of the COVID-19 vaccines, vaccine hesitancy or refusal among patients was observed in the uptake of other types of vaccines, like the influenza vaccine (Schmid et al., 2017).

Younger adults such as college students, who typically reside in communal settings, are at risk of contracting and transmitting infectious airborne diseases such as COVID-19. Hence, it is important to prioritize vaccination efforts to protect the well-being of college students from potential infections and prevent the spread of infection to other members of the university community (Shon et al., 2021). Optimal vaccine uptake is important to safeguard the well-being of college communities. Research studies that examined various aspects of vaccine hesitancy and uptake may offer valuable insights towards understanding vaccine hesitancy, health beliefs, and attitudes towards vaccination behaviors and effective methods to promote vaccine uptake.

The constructs of the Health Belief Model (HBM) have been used in population health research to better understand preventive behaviors like vaccine uptake (Asihaer et al., 2022; Fallucca et al., 2022; Trent et al., 2021; Tsai et al., 2021). As a framework, the HBM is useful in assessing perceptions and health beliefs which may undermine adherence to preventive health behaviors (Limbu et al., 2022; Xiao et al., 2021). The constructs of the HBM are perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action, and self-efficacy. The HBM constructs assess a person's belief about their chances of contracting a disease (susceptibility) and their perceptions of the severity of such illness (perceived severity). Perceived benefits refer to the perceptions of the importance of such behavioral change, while cues to action refer to factors that prompt a specific behavior, such as promotional or reminder messages. Self-efficacy refers to an individual's belief in their abilities to execute a specific health behavior like receiving a vaccine. The HBM constructs were applied in the current study to evaluate vaccination beliefs and attitudes among college students.

College students are apt to seek information on various topics and the current study explored the views of students on their preferred sources of health information and reasons to receive or refuse the COVID-19 vaccine in the absence of a mandatory vaccination policy. Studies have shown that there is hesitancy among college students to receive COVID-19 vaccines (Silva et al., 2021; Szilagyi et al., 2020). However, there is a dearth of literature on college students' perspectives on COVID-19 vaccines and factors that support vaccine uptake in university communities, including sources of health information to support decision-making for the COVID-19 vaccine uptake. Given this evidence gap in the literature, this study assessed the beliefs and perceptions towards the COVID-19 vaccine utilizing the HBM constructs and its impact on the uptake of the COVID-19 vaccines among college students.

### Study Objectives

The primary objective of this study was to assess the relationship between COVID-19 vaccine uptake and beliefs among college students, using the Health Belief Model constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy). The secondary objectives were to identify sources of health information on COVID-19 and explore the reasons for vaccine uptake among college students.

## METHODS

### Participants and Setting

A cross-sectional study was implemented in a university setting in the Northeastern region of the United States. Eligible participants were undergraduate and graduate students enrolled for the spring semester at the study site. A comprehensive email list of students enrolled at the study site was obtained from the University's Office of Institutional Research and Planning (OIRP). Recruitment emails were sent to eligible participants using the online survey platform, Qualtrics. Survey data collection was in the early phase of COVID-19 vaccination (May 2021) and vaccination was not mandatory at the time of data collection. Incentives were not offered to study participants and participation was voluntary. The time needed to complete the survey was approximately 12 minutes and the survey was in English. The study was approved by the Institutional Review Board at the study setting.

### Measure and Outcomes

The survey items were developed based on HBM constructs to assess beliefs and perceptions on the COVID-19 disease. The survey assessed six constructs in the HBM using 16 items. The number of items for each construct include perceived susceptibility (two items), perceived severity (three items), perceived benefits (four items), perceived barriers (two items), cues to action (two items), and self-efficacy (three items). A four-point Likert-type scale was applied (*agreed*, *partially agree*, *partially disagree*, and *disagree*) to every item.

The Cronbach's alpha coefficient was calculated to ascertain the internal consistency of the measure. The total Cronbach's alpha for the measure was 0.837, indicating a strong internal consistency. The Cronbach's alpha for the HBM constructs ranged between 0.95 (perceived benefits) to 0.46 (perceived barriers). The primary outcome variable, COVID-19 vaccine uptake, was assessed using a dichotomous variable, "Have you received the Covid-19 vaccine?" and the response was either a "*yes*" or "*no*". An open-ended question was used to collect responses on participants' reasons for vaccine uptake. Another open-ended question was applied to assess preferred sources for health information. Study variables for participants' characteristics were age, year in college, gender, and college of enrollment.

### Statistical Analysis

Participant characteristics were summarized using descriptive statistics. Average scores were calculated for the items on the HBM constructs. Bivariate correlation analyses were conducted using Spearman's rank correlation coefficient to identify statistically significant relationships between vaccine uptake and HBM constructs. Logistic regression

models were performed to determine statistically significant predictors of vaccine uptake. A dichotomous variable for COVID-19 vaccine uptake was used as the dependent variable for the logistic regression analyses while covariate variables were age, gender, and college of enrollment. Predictor variables for the adjusted regression models were perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. The Adjusted Odds Ratio (aOR) and Confidence Intervals (CI) were reported for the regression analysis. Thematic analysis was performed for both variables on "reasons for vaccine uptake" and "preferred sources for health information." Descriptive statistics were applied to summarize themes for both variables using percentages. A significance level of $p < 0.05$ was applied for all inferential statistical tests. All analyses were performed using SPSS Windows, version 28.

## RESULTS

### Study Participants

Of the 449 university students who accessed the survey, 385 consented providing a 85.75% participation rate. Most participants were female ($n$ = 227, 59%), had received the COVID-19 vaccine ($n$ = 222, 57.7%), and were within the age range of 20-29 years old ($n$ = 266, 69.1%). Table 1 summarizes the study participants' characteristics.

**Table 1**
*Participants' Characteristics* ($n$ = 385)*

| Characteristics | n(%) |
|---|---|
| Gender | |
| • Male | 151(39.2) |
| • Female | 227(59.0) |
| • Other | 7(1.8) |
| Age (years) | |
| • 19 or younger | 93(24.1) |
| • 20–29 | 266(69.1) |
| • ≥30 | 26(6.8) |
| Year in College | |
| • Freshman | 65(16.9) |
| • Sophomore | 63(16.4) |
| • Junior | 74(19.2) |
| • Senior | 74(19.2) |

| | |
|---|---|
| • Graduate | 109(28.3) |
| College | |
| • Arts & Science | 131(34.0) |
| • Business | 90(23.4) |
| • Engineering | 67(17.4) |
| • Pharmacy and Health Sciences | 55(14.3) |
| • Law | 39(10.1) |
| • Undecided | 3(0.8) |
| COVID-19 Vaccine Update | |
| • Yes | 222(57.7) |
| • No | 150(39.0) |
| • Not Reported | 13(3.4) |

*Missing data observed. Percentages did not add up to 100%.

**Relationship between Vaccine Uptake and HBM constructs**

The bivariate correlation showed that among the study participants, there was a statistically significant relationship between vaccine uptake and five HBM constructs (Table 2). Perceived benefits of the COVID-19 vaccine had the strongest strength of association with vaccine uptake (r = 0.63, $p$ = < 0.001), and the weakest was observed for cues to action (r = 0.22, $p$ = <0.001). A negative association was observed between perceived barriers and COVID-19 vaccine uptake (r = -0.36, $p$ = <0.001), suggesting that participants who had received the COVID-19 vaccine were more likely to have a lower perception of barriers to vaccine uptake. Self-efficacy was not statistically significantly correlated with vaccine uptake.

**Table 2**

*Bivariate Correlation between COVID-19 Uptake and HBM Constructs*

| HBM Constructs | r | p |
|---|---|---|
| Perceived Susceptibility | 0.46 | <0.001 |
| Perceived Severity | 0.43 | <0.001 |
| Perceived Benefits | 0.63 | <0.001 |
| Perceived Barriers | -0.36 | <0.001 |
| Cues to action | 0.22 | <0.001 |
| Self-efficacy | 0.16 | 0.002 |

*Note.* HBM = Health belief model; r = Spearman correlation.

**Predictors of Vaccine Uptake**

Three of the HBM constructs were statistically significant predictors of vaccine uptake in the adjusted regression model (Table 3). These HBM constructs were perceived benefits of the COVID-19 vaccine (aOR 5.02, 95% CI [2.86, 8.82], $p$ = <0.001), perceived barriers to receiving the vaccine (aOR .24, 95% CI [0.14, 0.42], $p$ = <0.001), and cues to action (aOR 4.36, 95% CI [1.92, 9.93], $p$ = <0.001). Perceived susceptibility, perceived severity, and self-efficacy were not significant predictors of vaccine uptake among the study participants.

**Table 3**

*Binary Logistic Regression on Health Belief Model Constructs that Predict the Uptake of COVID-19 Vaccine Among College Students*

| HBM Constructs | aOR | 95% CI | | p |
|---|---|---|---|---|
| Perceived Susceptibility | 1.03 | 0.40 | 2.69 | 0.945 |
| Perceived Severity | 1.10 | 0.53 | 2.29 | 0.796 |
| Perceived Benefits | 5.02 | 2.86 | 8.82 | <0.001 |
| Perceived Barriers | 0.24 | 0.14 | 0.42 | <0.001 |
| Cues to action | 4.36 | 1.92 | 9.93 | <0.001 |
| Self-efficacy | 1.456 | 0.79 | 2.67 | 0.23 |

*Note.* Adjusted Odd Ratio = (aOR)

**Sources of Health Information on COVID-19 and Reasons for Vaccine Uptake**

Findings on the thematic analysis of the participants' primary reason for vaccine uptake included "to protect self, loved ones and community" (34.65%), "had already received the first COVID-19 vaccine dose" (46.53%), and "to help bring an end to the pandemic" (14.85%). For participants who did not receive the vaccine, reasons for vaccine refusal were "a lack of trust for the COVID-19 vaccine" (78.8%), "COVID-19 disease is not real" (5.9%), or "the vaccine is not needed" (15.3%).

Participant's preferred sources of health information showed that a majority of participants ($n$ = 119, 41.5%) preferred to obtain health information from the Centers for Disease Control and Prevention (CDC), news media (e.g., CNN, FOX, USA Today; $n$ = 36,12.54%), and internet search (e.g., Google; $n$ = 23, 8.01%). Table 4 summarizes the findings on thematic analysis of reasons for the COVID-19 vaccine uptake and preferred sources of health information.

**Table 4**

*Reasons for Vaccine Uptake and Sources of Information on Covid-19 Vaccines*

| *Reasons for COVID-19 Vaccine Uptake or Refusal* | *n*(%)* |
|---|---|
| **The primary reason to receive the vaccine (*n* = 202)** | |
| • Had already received the first vaccine dose | 94(46.5) |
| • Protect self, loved ones and the community | 70(34.6) |
| • High-risk population | 3(1.5) |
| • Help bring an end to the pandemic | 30(14.9) |
| • Workplace requirement | 5(2.5) |
| **The primary reason for vaccine refusal (*n* = 85)** | |
| • Don't trust it or feel safe receiving it | 67(78.82) |
| • Covid-19 isn't real or serious | 5(5.88) |
| • Vaccine is not needed | 13(15.29) |
| ***Sources of Health Information on COVID-19 Disease* (*n* = 287)** | |
| • Centers for Disease Control and Prevention (CDC) | 119(41.46) |
| • News Media (such as CNN, FOX, USA Today) | 36(12.54) |
| • Medical Journals and Articles | 23(8.01) |
| • Internet search (such as Google and YouTube) | 23(8.01) |
| • Family Members | 21(7.32) |
| • Primary and Tertiary sources (such as FDA website, Pub-med and UpToDate) | 21(7.32) |
| • Healthcare providers | 18(6.27) |
| • Information at Workplace | 10(3.48) |
| • Multiple sources | 8(2.79) |
| • Social Media (such as Instagram, TikTok and Twitter) | 4(1.39) |
| • Subjective (e.g., God or self) | 4(1.39) |

*Percentage obtained from responses in each category.

## DISCUSSION

The study findings in this research are useful in understanding behaviors and beliefs among young adults in a college setting towards the COVID-19 vaccine. The study applied HBM constructs to assess the relationship between COVID-19 vaccine uptake and health beliefs among college students, sources of health information on COVID-19, and reasons for vaccine uptake. There was a statistically significant bivariate correlation between vaccine uptake and five HBM constructs. However, three HBM constructs predicted the uptake of the COVID-19 vaccine in the study population. Findings from this study showed that for the HBM construct, perceived benefits was the strongest predictor for the COVID-19 vaccine uptake among the study participants. Studies in the literature have found a relationship between perceived benefits and the uptake of other types of vaccine like the influenza vaccine and human papillomavirus vaccines (Oh et al., 2021; Trent et al., 2021).

The significant predictors of vaccine uptake were perceived benefits of the COVID-19 vaccine, perceived barriers, and cues to action. Our findings are supported by the literature where perceived benefits of the vaccine and cues to action were positively correlated with the acceptance of the COVID-19 vaccine (Wong et al., 2021). Findings from the current study indicate that perceived benefits was the strongest predictor of vaccine uptake followed by cues to action. In addition, perceived susceptibility and perceived severity were significantly associated with vaccine uptake but not significant predictors of vaccine uptake. These findings may be linked to the public perception that the COVID-19 disease may not lead to severe symptoms among young patients, although studies have shown these beliefs to be false (DeBiasi et al., 2020; Sandoval et al., 2021). Although, many young adults may not present severe COVID-19 symptoms, it is important for college communities to communicate the usefulness of vaccine uptake towards disease prevention.

There was a negative correlation between perceived barriers and COVID-19 vaccine uptake, suggesting that participants who had received the COVID-19 vaccine were more likely to have a lower perception of barriers to receiving the COVID-19 vaccine. Various factors impede vaccine uptake based on the findings from a review article that assessed the role of barriers to optimal influenza vaccine uptake in the United States (Fisk, 2021; Zhang & Fisk, 2021). Barriers to vaccine uptake were primarily linked to beliefs and structural barriers in the general population. Structural barriers may include a lack of access to vaccination clinics, adequate transportation, or difficulty with technology to sign-up for vaccination appointments, among others. Health beliefs, mistrust in the healthcare system, and negative attitudes to preventive health services like vaccination may pose a barrier to vaccine uptake. Therefore, college administrators may have to identify effective strategies to address negative attitudes and structural barriers to vaccination among students. Thus, increasing the risk perception among the population of young adults may impact preventive behaviors and reduce the outbreak of infectious diseases (Verelst et al., 2016).

In looking at the participants' primary reason for vaccine uptake, 46.5% ($n$ = 94) of the participants did not cite a specific reason for receiving the COVID-19 vaccine but indicated that they had received the vaccine already, while 34.6% ($n$ = 70) of the study population wanted to protect themselves, loved ones, and the community. Another reason was to support the effort to end the COVID-19 pandemic ($n$ = 30, 14.9%). A small number of participants chose to get the vaccine due to work requirements ($n$ = 5, 2.5%) and protecting high-risk populations ($n$ = 3, 1.5%). Surprisingly, healthcare professionals' advice was not included as a reason to get vaccinated, although clinicians were cited as a source of health information on the COVID-19 disease. There may be several reasons for these findings,

which may include a low rate of healthcare visits during the pandemic leading to a missed opportunity for clinicians to impact vaccination decision-making among patients.

Participants indicated a variety of information sources for the COVID-19 disease. However, most of the participants preferred to obtain health information from the CDC. Other sources of health information were news media and internet searches. A small percentage of participants chose social media as their health information source which is significant due to concerns over the spread of misinformation on social media platforms regarding the COVID-19 disease and vaccines (Ali et al., 2020). It is important to safeguard population health by identifying the most effective information sources to support decision-making on vaccine uptake.

## Limitations

Study limitations include potential biases like recall bias and social desirability bias. Recall bias has the potential for participants to self-report inaccurate information due to forgetfulness. Social desirability bias occurs in survey responses when participants tend to report desirable behaviors. The potential for social desirability bias was reduced by collecting anonymous responses since identifiable data collection may increase the potential for social desirability bias. The study was performed in one university community in the northeastern region of the United States, hence, external generalizability is a limitation since findings may differ in a national sample of participants or in a multi-site study.

## Conclusions

Overall, there were positive health beliefs and perceptions towards the COVID-19 vaccines among college students in the study setting. From the research findings, the predictors of vaccine uptake were perceived benefits, perceived barriers, and cues to action. More than half of the participants had received the vaccine even without a mandatory vaccine protocol at the time of the study. The primary reasons for vaccine uptake were varied and included a firm belief to protect themselves and others and to support efforts to end the COVID-19 pandemic.

At the time of the study, participants used different sources of health information to learn about the novel COVID-19 vaccine. Most of the health sources reported by participants were CDC, news media, and internet searches. Future studies may examine the impact of effective sources of health information as educational platforms to support public health promotion for vaccine uptake among college students.

## REFERENCES


Al-Noumani, H., Wu, J. R., Barksdale, D., Sherwood, G., AlKhasawneh, E., & Knafl, G. (2019). Health beliefs and medication adherence in patients with hypertension: A systematic review of quantitative studies. *Patient Education and Counseling*, *102*(6), 1045-1056. https://doi.org/10.1016/j.pec.2019.02.022

Ali, S. H., Foreman, J., Tozan, Y., Capasso, A., Jones, A. M., & DiClemente, R. J. (2020). Trends and predictors of COVID-19 information sources and their relationship with knowledge and beliefs related to the pandemic: Nationwide cross-sectional study. *JMIR Public Health Surveillance*, *6*(4), e21071. https://doi.org/10.2196/21071

Asihaer, Y., Sun, M., Li, M., Xiao, H., Amaerjiang, N., Guan, M., Thapa, B., & Hu, Y. (2022). Predictors of influenza vaccination among Chinese middle school students based on the health belief model: A mixed-methods study. *Vaccines (Basel)*, *10*(11). https://doi.org/10.3390/vaccines10111802

DeBiasi, R. L., Song, X., Delaney, M., Bell, M., Smith, K., Pershad, J., Ansusinha, E., Hahn, A., Hamdy, R., Harik, N., Hanisch, B., Jantausch, B., Koay, A., Steinhorn, R., Newman, K., & Wessel, D. (2020). Severe coronavirus disease-2019 in children and young adults in the Washington, DC, metropolitan region. *Journal of Pediatrics*, 223, 199-203.e191. https://doi.org/10.1016/j.jpeds.2020.05.007

Fallucca, A., Immordino, P., Riggio, L., Casuccio, A., Vitale, F., & Restivo, V. (2022). Acceptability of HPV vaccination in young students by exploring health belief model and health literacy. *Vaccines (Basel)*, *10*(7). https://doi.org/10.3390/vaccines10070998

Limbu, Y. B., Gautam, R. K., & Pham, L. (2022). The health belief model applied to COVID-19 vaccine hesitancy: A systematic review. *Vaccines (Basel)*, *10*(6). https://doi.org/10.3390/vaccines10060973

Lucia, V. C., Kelekar, A., & Afonso, N. M. (2021). COVID-19 vaccine hesitancy among medical students. *Journal of Public Health (Oxford)*, *43*(3), 445-449. https://doi.org/10.1093/pubmed/fdaa230

Oh, K. M., Alqahtani, N., Chang, S., & Cox, C. (2021). Knowledge, beliefs, and practice regarding human papillomavirus (HPV) vaccination among American college students: Application of the health belief model. *Journal of American College Health*, 1-10. https://doi.org/10.1080/07448481.2021.1967362

Sallam, M. (2021). COVID-19 vaccine hesitancy worldwide: A concise systematic review of vaccine acceptance rates. *Vaccines (Basel)*, *9*(2). https://doi.org/10.3390/vaccines9020160

Sandoval, M., Nguyen, D. T., Vahidy, F. S., & Graviss, E. A. (2021). Risk factors for severity of COVID-19 in hospital patients age 18-29 years. *PLoS One*, *16*(7), e0255544. https://doi.org/10.1371/journal.pone.0255544

Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior - a systematic review of influenza vaccine hesitancy, 2005 - 2016. *PLoS One*, *12*(1), e0170550. https://doi.org/10.1371/journal.pone.0170550

Shon, E. J., Choe, S., Lee, L., & Ki, Y. (2021). Influenza vaccination among U.S. College or university students: A systematic review. *American Journal of Health Promotion*, *35*(5), 708-719. https://doi.org/10.1177/0890117120985833

Silva, J., Bratberg, J., & Lemay, V. (2021). COVID-19 and influenza vaccine hesitancy among college students. *Journal of the American Pharmacist Association*, *61*(6), 709-714.e701. https://doi.org/10.1016/j.japh.2021.05.009

Szilagyi, P. G., Thomas, K., Shah, M. D., Vizueta, N., Cui, Y., Vangala, S., & Kapteyn, A. (2020). National trends in the US public's likelihood of getting a COVID-19 vaccine-April 1 to December 8, 2020. *Journal of the American Medical Association*, *325*(4), 396-398. https://doi.org/10.1001/jama.2020.26419

Trent, M. J., Salmon, D. A., & MacIntyre, C. R. (2021). Using the health belief model to identify barriers to seasonal influenza vaccination among Australian adults in 2019. *Influenza Other Respiratory Viruses*, *15*(5), 678-687. https://doi.org/10.1111/irv.12843

Tsai, F. J., Hu, Y. J., Chen, C. Y., Tseng, C. C., Yeh, G. L., & Cheng, J. F. (2021). Using the health belief model to explore nursing students' relationships between COVID-19 knowledge, health beliefs, cues to action, self-efficacy, and behavioral intention: A cross-sectional survey study. *Medicine (Baltimore)*, *100*(11), e25210. https://doi.org/10.1097/MD.0000000000025210

Verelst, F., Willem, L., & Beutels, P. (2016). Behavioural change models for infectious disease transmission: a systematic review (2010-2015). *Journal of the Royal Society Interface*, *13*(125). https://doi.org/10.1098/rsif.2016.0820

Wong, M. C. S., Wong, E. L. Y., Huang, J., Cheung, A. W. L., Law, K., Chong, M. K. C., Ng, R. W. Y., Lai, C. K. C., Boon, S. S., Lau, J. T. F., Chen, Z., & Chan, P. K. S. (2021). Acceptance of the COVID-19 vaccine based on the health belief model: A population-based survey in Hong Kong. *Vaccine*, *39*(7), 1148-1156. https://doi.org/10.1016/j.vaccine.2020.12.083

Xiao, X., Lee, D. K. L., Wong, R. M., & Borah, P. (2021). The impact of theory in HPV vaccination promotion research: A systematic review and meta-analysis. *American Journal of Health Promotion*, *35*(7), 1002-1014. https://doi.org/10.1177/08901171211012524

Zhang, Y., & Fisk, R. J. (2021). Barriers to vaccination for coronavirus disease 2019 (COVID-19) control: Experience from the United States. *Global Health Journal*, *5*(1), 51-55. https://doi.org/10.1016/j.glohj.2021.02.005

Zuckerman, K. E., Lindly, O. J., Sinche, B. K., & Nicolaidis, C. (2015). Parent health beliefs, social determinants of health, and child health services utilization among U.S. school-age children with autism. *Journal of Developmental and Behavioral Pediatrics*, *36*(3), 146-157. https://doi.org/10.1097/DBP.0000000000000136

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Address author correspondence to:
Gladys Ekong, PhD
gladys.ekong@wne.edu

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