Attitudes, beliefs, and knowledge about MMR vaccination among university students: Findings from a cross-sectional survey

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Abstract

Objective: This study aims to examine the knowledge, attitudes and beliefs of health science students at a regional Queensland university regarding measles, mumps, and rubella, as well as their understanding of occupational immunisation requirements.

Methods: A cross-sectional survey was conducted, collecting quantitative data via an online questionnaire from July 2023 to May 2024.

Results: Students demonstrated limited knowledge of measles, mumps and rubella (MMR) transmission, severity and treatment. While 67.27 % (n=37) recognised the seriousness of MMR, only 40.38 % (n=21) understood that infection confers lifelong immunity. Despite knowledge gaps, 59 % (n=23) supported vaccination for those lacking MMR antibodies, and 75 % (n=30) would recommend immunity testing.

Conclusions: There are critical gaps in MMR knowledge and awareness of occupational immunisation among health science students.

Implications for Public Health: Gaps in MMR knowledge among health science students present a risk to public health during clinical placements. Strengthening immunisation education in health curricula and promoting immunity testing and vaccination are vital for ensuring future healthcare workers are adequately prepared to protect themselves and their patients, and to prevent transmission of vaccine-preventable diseases in healthcare settings.

Key words: health belief model, health science students, measles, mumps, rubella

Introduction

Vaccination is one of the most effective public health interventions for the prevention of infectious diseases.[1] Immunisation programs have successfully reduced the global burden of vaccine-preventable diseases (VPDs), including measles, mumps, and rubella (MMR), with some diseases like smallpox eradicated entirely.[2] The MMR vaccine, delivered in a two-dose schedule during early childhood in Australia, stimulates the production of IgG antibodies to provide long-term immunity.[3]

Despite proven safety and efficacy, immunisation gaps remain, particularly in healthcare settings where vulnerable populations are at greater risk. The World Health Organisation identifies vaccine hesitancy, a delay or refusal of vaccines despite availability, as a global health threat, driven by complacency, convenience, and lack of confidence.[1,4] Misinformation, such as the discredited claim linking MMR to autism, continues to affect public perceptions.[5,6]

Since the COVID-19 pandemic, global MMR coverage has declined, exacerbated by misinformation amplified on social media.[7,8] Alarmingly, vaccine knowledge gaps extend to university students in health disciplines.[9] As future healthcare providers, their attitudes and knowledge play a vital role in public health messaging and vaccine promotion.[10]

Although some international studies have explored vaccination knowledge and attitudes among specific student cohorts, such as nursing students in the United States,[11] Korean nurses[12] and Austrian medical students.[13] Limited research exists on immunisation knowledge, beliefs, and attitudes among Australian university health science students. Given the ongoing need to safeguard both healthcare providers and patients from VPDs, this study aimed to explore the understanding of MMR among health science students at

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a regional Australian university. Specifically, using the Health Belief Model (HBM), this study sought to identify knowledge gaps and attitudinal trends among nursing and paramedicine students to inform future immunisation education and public health strategies (Appendix 1).

Methodology

Conceptual framework of this study

This study was guided by the HBM, a well-established theoretical framework used to explain and predict health-related behaviours with disease prevention and health promotion.[14] The HBM posits that health behaviours are shaped by perceptions of severity, benefits, barriers, cues to action, and self-efficacy.[14,15] The HBM framework enabled structured analysis of student perceptions regarding MMR diseases and vaccination.

To address the study's objectives, two research questions were developed:

1. What is the level of health science students' knowledge regarding MMR diseases?
2. What are health science students' attitudes and beliefs regarding MMR vaccination and serological testing for immunity?

Participants, setting and sample size

The study participants were recruited from a university health service in Ipswich, Queensland, during consultations for VPD immunity checks, a requirement for clinical placement. Inclusion criteria included students enrolled in undergraduate health science programs who provided informed consent before completing an online survey during their appointment with a nurse practitioner. Those completing less than 50 % of the survey were excluded from the study. Data collection occurred from July 2023 to May 2024.

Measurement instrument development

An online survey, structured around the HBM, was adapted from validated instruments by Kim and Choi and Abd Elaziz et al.[12,16] Both of these studies explored student perspectives on measles and rubella immunisation. Modifications to the survey included the addition of mumps-related items and new questions on vaccine cost and rubella complications. Six reviewers, experts and students, assessed the content for validity and clarity. Pilot testing confirmed a completion time of 10–15 minutes (Appendix 2).

The final instrument was structured into the following three sections:

(1) Demographics: age, gender, course of study and MMR vaccination;

(2) Attitudes and beliefs: fourteen Likert scale and multiple-choice items assessing perceptions aligned with HBM constructs; and

(3) Knowledge: fourteen multiple-choice questions assessing understanding of MMR transmission, symptoms, treatment and immunisation.

Knowledge of measles, mumps and rubella transmission, infection and vaccination

Knowledge questions covered MMR transmission (4), symptoms (4), treatment (1) and vaccination (5). Each correct answer was scored as one point, while incorrect or "unsure" responses were scored as zero. Scores were then categorised by percentage into correct, incorrect, or uncertain response groups, in line with standard practice for vaccine knowledge assessments in health research.[17] The knowledge section showed strong internal consistency and coherence across the question set (Cronbach's $\alpha = 0.90$), indicating reliable performance and alignment with the study's aim to evaluate immunisation preparedness among future health professionals.

Attitudes and beliefs towards measles, mumps and rubella vaccination

Student attitudes and beliefs about MMR vaccination were assessed using a 14-item belief section aligned with HBM constructs: susceptibility (2), severity (2), benefits (3), barriers (4), cues to action (2) and self-efficacy (1). Responses used a 5-point Likert scale. Internal consistency was high (Cronbach's $\alpha = 0.97$), with strong subscale reliabilities of 0.78 for perceived barriers and 0.79 for perceived susceptibility. Principal Component Analysis identified a single dominant factor, with loadings from 0.811 to 0.947, supporting construct validity. These results indicate that the instrument effectively captured students' motivational orientation towards MMR vaccination and testing, consistent with prior HBM-based vaccine studies.[18]

Ethics approval

This study received ethical approval from the university's Human Research Ethics Committee (H22REA11). Informed consent was obtained, participation was voluntary, and responses were anonymised.

Data analysis

Quantitative data were analysed using IBM SPSS Statistics for Windows, Version 29 (IBM Corporation, Armonk, NY, USA). Descriptive statistics (frequencies, means, medians and modes) were used to summarise demographic characteristics and survey responses. Associations between categorical demographic variables and selected survey items were assessed using χ^2 tests. Likert scale items aligned with the HBM constructs were analysed descriptively. Internal consistency of HBM subscales was assessed using Cronbach's α, with $\alpha \geq 0.70$ considered acceptable.[19] Spearman's rank-order correlation (Spearman's p) was used to explore relationships between knowledge scores and HBM belief domains. Statistical significance was set at $p<0.05$. Figures were generated using GraphPad Prism version 10.4.2 (GraphPad Software, San Diego, CA, USA) to aid data visualisation and interpretation.

Results

Participant demographics

Due to recruitment constraints and limited promotion of the study, a total of 98 undergraduate health science students who presented to the university's health service in Ipswich, Queensland, were invited to participate. This figure fell short of the initially projected sample size of 200 students. Of the 98 invited, 68 students completed 50 % of the survey or more and were included in the analysis. The majority were female (75 %, n=51), with 54.4 % (n=37) being international students, a statistically significant distribution ($p<0.001$). Most were enrolled in nursing (83.3 %, n=57), while the rest studied paramedicine (16.2 %, n=11) ($p<0.001$). Ages ranged from 18 to 37 years (median = 20.5 years).

A self-reported history of MMR infection was noted in 23.5 % (n=16), and 61.8 % (n=42) reported being vaccinated in childhood. However, 30.9 % (n=21) were unsure of their status, and 7.4 % (n=5) reported that they were not vaccinated (p<0.001) (Appendix 3).

Knowledge of MMR transmission

Knowledge of MMR transmission among 62 respondents, 45 % (n=30) correctly identified airborne transmission. However, 48 % (n=28) incorrectly believed transmission occurs via food or water (M=2.15). Only 21 % (n=13) recognised MMR as a viral infection and 26 % (n=15) knew that antibiotics are ineffective, highlighting misconceptions about MMR (Figure 1).

Knowledge of MMR severity and Immunity

Knowledge of MMR severity and immunity appeared stronger than transmission knowledge. Of 55 respondents, 67.3 % (n=37) understood that adults can also contract MMR. Common symptoms such as fever and rash were correctly identified by 78.2 % (n=43). Awareness of complications was variable: 53.8 % (n=28/52) recognised serious risks such as otitis media, diarrhoea and meningitis; 50.0 % (n=28/56) knew the high infection risk in unvaccinated individuals and 54.9 % (n=28/51) understood that natural infection often provides lifelong immunity.

Knowledge of MMR vaccination

Only 32.7 % (n=16/48) correctly understood that two vaccine doses generally provide lifelong immunity and 40.8 % (n=20/49) understood that one dose is insufficient. While 45.8 % (n=22/48) recognised the risks of rubella in pregnancy, only 34.1 % (n=15/44) knew that mumps can lead to permanent hearing loss or infertility. Knowledge about the airborne persistence of measles was higher, with 54.3 % (n=25/46) responding correctly.

Student attitudes and beliefs about MMR

Using HBM constructs, 43 students responded to the attitude questions. Perceived susceptibility was low, with 40 % (n=17) disagreeing that they were more at risk, while 44 % (n=18) were ambivalent about the fear of infection. Conversely, 93 % (n=40/43) viewed MMR as serious, and 62 % (n=26/42) believed it could affect their careers.

Among 40 respondents, 85 % (n=34) believed in vaccine efficacy, and 92 % (n=35/38) agreed that adults without immunity should be vaccinated. Perceived barriers were low: 53 % (n=22/42) did not find returning for a second dose inconvenient, and 71 % (n=29/41) were unconcerned about side-effects. However, 38 % (n=15/40) viewed the $40 cost as too high.

Cues to action and motivational factors were positive: 75 % (n=30/40) would recommend testing to a friend, and 50 % (n = 20/40) would seek it themselves. Self-efficacy was high: 59 % (n=23/39) prioritised MMR testing over other diseases, and 91 % (n=38/42) viewed MMR immunity as essential for healthcare professionals (see Figure 2).

Correlations between health belief model constructs

Table 1 presents statistically significant correlations among HBM questions, based on Spearman's rank correlation coefficients. Strong relationships were observed across multiple variables (p<0.001), indicating internal consistency among students' beliefs and perceptions.

Perceived susceptibility to MMR infection was positively correlated with fear of infection (r=0.83–0.95) and the belief that vaccination is painful (r=0.77–0.93). Perceived severity was associated with belief in vaccine effectiveness (r=0.67–0.90) and with a sense of professional responsibility (r=0.37–0.77). Cost-related concerns were negatively correlated with belief in vaccine effectiveness (r=-0.66 to -0.90), suggesting that students who viewed the vaccine as effective were less likely to see cost as a major barrier.

All correlations were statistically significant at the p<0.001 level, supporting the interconnectedness of HBM domains and reinforcing the value of comprehensive vaccine education strategies.

Discussion

Study findings

This study provides important insight into the knowledge, attitudes and beliefs of undergraduate health science students at a regional

Figure 1: Responses to knowledge-based questions on MMR infection and vaccination among undergraduate health science students (n=68). Each horizontal bar represents one question. Response categories are colour-coded: correct (blue), incorrect (purple), or not sure (pink). MMR = measles, mumps and rubella.

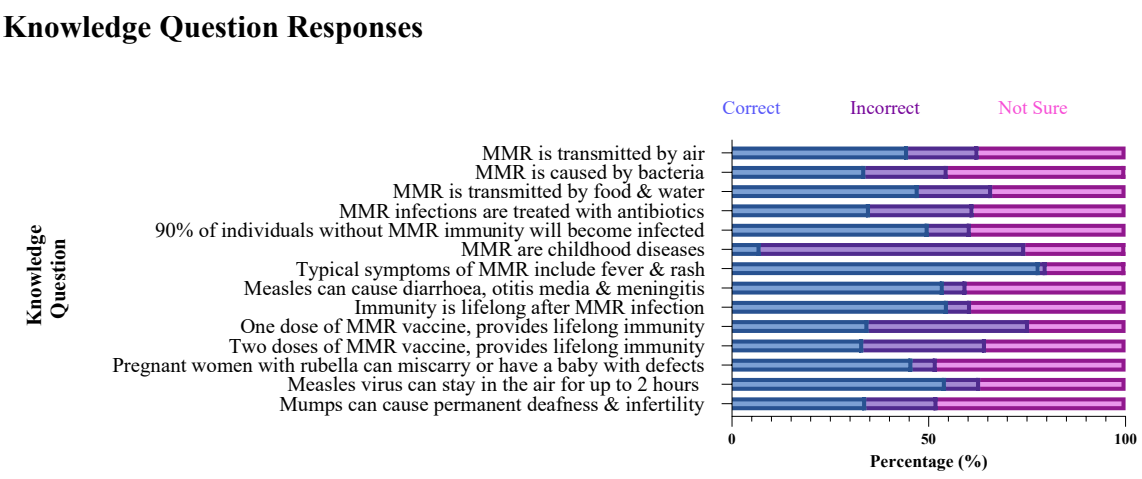
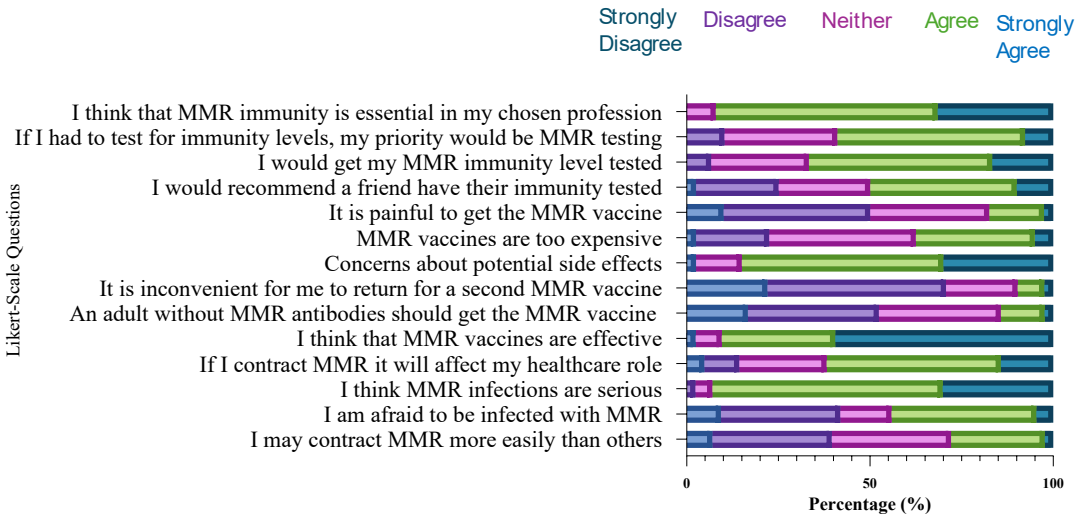


Figure 2: Attitudes and beliefs regarding MMR infection and vaccination among undergraduate health science students. Responses were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Items were categorised according to HMB constructs, including perceived susceptibility, severity, benefits, barriers, cues to action and self-efficacy. HMB = health belief model; MMR = measles, mumps and rubella.



Queensland university concerning MMR and the associated vaccine. Findings revealed gaps in student understanding of transmission pathways, immunity duration and vaccine effectiveness. These are areas that are critical to both individual and public protection. While respondents demonstrated relatively high awareness of clinical symptoms and disease severity, knowledge was limited regarding complications of mumps, the risks of rubella during pregnancy, and the protective value of immunity testing.

Only 26 % correctly recognised that measles cannot be treated with antibiotics, suggesting a lack of foundational knowledge about viral illnesses. These results mirror findings by Kim and Choi (2016)[12] who identified similar gaps among graduate nurses managing patients with acute measles. Notably, in the present study, 78 % of students correctly identified common symptoms of measles, such as fever and rash, a result consistent with findings by Brieger et al. (2017),[5] who assessed parental knowledge of MMR in Australia. As these students were predominantly in the early stages of their training, it is anticipated that their knowledge will continue to evolve throughout their academic and clinical development.

Table 1: Summary of key correlations between the Health Belief Model constructs (Spearman's p).

Variable 1	Variable 2	Spearman's p (range)	*p* value
I may contract MMR more easily than others	I am afraid of being infected with MMR	0.83–0.95	< 0.001
I think MMR infections are serious	I think MMR immunity is essential for my profession	0.37–0.77	< 0.001
I think the MMR vaccination is effective in preventing disease	I think MMR infections are serious	0.67–0.90	< 0.001
I may contract MMR more easily	Vaccination is painful	0.77–0.93	< 0.001
I think the MMR vaccine is too expensive	I think the MMR vaccination is effective	0.66–0.90	< 0.001

Note. Spearman's rank correlation coefficients were calculated to assess associations between paired belief items from the HBM. Significance was set at $p<0.05$.

HMB = health belief model; MMR = measles, mumps and rubella.

The HBM served as a guiding framework to examine students' perceptions of susceptibility, severity, benefits and barriers related to MMR vaccination and immunity testing. Variability in perceived susceptibility was evident. Similar to Kim and Choi (2016),[12] many participants in this cohort expressed low personal risk yet demonstrated concern about infection and its consequences. Although only 17.5 % of participants perceived vaccine injections as painful, 44 % expressed greater concern about contracting MMR, suggesting the coexistence of fear and hesitation in the context of low perceived vulnerability.

Perceived disease severity emerged as a stronger determinant of vaccine intention than perceived susceptibility, aligning with Donkers et al. (2015),[20] who reported that students were more likely to accept an MMR booster during a mumps outbreak when they recognised the severity of the disease. In the present study, 91 % of participants agreed that immunity is essential for healthcare professionals. This belief strongly correlated with their perceptions of MMR as a serious illness ($p<0.0001$), supporting the view that increased awareness of professional implications may drive preventive behaviours.

Concerns about vaccine safety and side-effects were relatively uncommon, reported by only 10 % of participants, consistent with findings from Kunze and Schweinzer (2020),[13] who reported a 7 % rate among Austrian medical students. However, a significant positive correlation between perceived susceptibility and concern about vaccine pain or side-effects ($p<0.01$) highlights that students who feel at risk of infection may also experience greater emotional

hesitancy towards vaccination. These findings support the Yaqub et al. (2014)[21] argument that mistrust of institutions, rather than vaccines themselves, often underpins hesitancy. Their research showed that vaccine confidence is more effectively strengthened by trusted sources than by information volume alone. The role of perceived credibility, therefore, remains a critical consideration in the design of future interventions.

Although 85 % of students in this study believed that the MMR vaccine is effective in preventing acute illness, 37.5 % perceived the cost as a barrier, despite the vaccine being available at subsidised or no cost through many public health programs. This perception echoes the findings of Kunze and Schweinzer (2020),[13] where 86.8 % of medical students preferred free access to vaccines. This study found a significant positive correlation between perceived vaccine cost and reduced belief in vaccine effectiveness ($p<0.01$), suggesting that even modest financial barriers may influence confidence in health interventions.

Monitoring students' attitudes and beliefs about vaccination is essential because these beliefs not only shape their immunisation behaviours but may also influence their future professional conduct. Students with limited knowledge may be less likely to engage in immunity testing or promote vaccination, thereby affecting broader public health outcomes.[21] Kim and Choi (2016) [12] highlighted the impact of infectious disease education on vaccine attitudes, while Kadir et al. (2021) [22] demonstrated that healthcare professionals' attitudes towards vaccines are shaped by socioeconomic status and educational background.

Together, these findings identify the importance of targeted educational strategies that address both cognitive knowledge and affective concerns that encourage ongoing immunity monitoring as a component of professional responsibility.

Strengths and limitations

A key strength of this study lies in its use of a validated conceptual model, the HBM, to inform both survey design and analytical interpretation. This approach ensured that the constructs measured were relevant, theoretically grounded, and applicable to health education and behaviour change strategies. The application of Spearman's correlation enabled an in-depth exploration of relationships among knowledge, attitudes, and perceived barriers, offering nuanced insight into the drivers of vaccine-related decision-making in a student cohort.

Despite these strengths, several limitations must be acknowledged. The study achieved a smaller than expected sample size ($n=68$), falling short of the 200 participants recommended for subgroup analysis. This shortfall, primarily due to time constraints and limited recruitment opportunities, reduced statistical power and limits the generalisability of findings.

Additionally, incomplete data, particularly among international students, may have been influenced by language comprehension challenges, as the survey was delivered in English. Although pilot testing demonstrated content clarity, future research could benefit from translation into multiple languages and the inclusion of culturally tailored communication strategies to improve accessibility and participation rates.

Finally, the study relied on self-reported data, which may be subject to recall bias or social desirability bias, particularly in the context of attitudes towards professional responsibility.

Implications for policy and practice

The findings suggest several implications for educational and institutional policy. First, incorporating immunisation literacy and infectious disease education as core competencies in health science curricula may improve knowledge and professional preparedness. Introducing vaccine education early in academic training can help students develop the foundational understanding needed for safe clinical practice.

Second, universities and health authorities should collaboratively review immunisation policies to ensure student compliance with mandatory vaccine requirements and promote understanding of their rationale. Addressing perceived barriers, such as cost and access, may further improve uptake. Institutions could subsidise or bundle vaccinations with student health services, or provide immunity testing during orientation or placement preparation.

Innovative strategies, such as peer-led education, mobile vaccination clinics, culturally tailored messaging, and digital campaigns, may foster positive beliefs and support a culture of vaccine advocacy. These efforts should be backed by credible sources, including clinicians and professional bodies, to enhance trust and engagement.

Embedding vaccine education in both academic and clinical settings enables universities to shape the next generation of healthcare professionals and, more broadly, influence public health behaviours.

Directions for future research

Future research should recruit larger, more diverse student populations across multiple institutions to enable comparison by geographic location, cultural background, and program of study. Expanding the scope in this way will strengthen generalisability and provide a broader understanding of vaccination beliefs among emerging health professionals.

Longitudinal studies may offer insight into how knowledge and beliefs evolve as students transition from classroom learning to clinical environments. These studies could assess how exposure to real-world infectious disease risk and institutional vaccine requirements influences decision-making and compliance.

Qualitative methods such as interviews or focus groups may reveal deeper insights into the personal, cultural, and emotional factors shaping vaccine attitudes. This could inform interventions that address not only factual knowledge gaps but also underlying values, fears, and motivations.

Conclusions

This study adds to the growing literature on knowledge, attitudes and beliefs about MMR vaccination among health science students. Significant gaps in knowledge were identified, alongside varied beliefs about disease risk, vaccine effectiveness and immunity testing, the factors that may influence both personal protection and professional conduct.

Students who recognised the seriousness and relevance of MMR were more likely to support vaccination and immunity monitoring. However, concerns about pain, cost, and susceptibility indicate that beliefs are shaped by both emotional and practical considerations.

Educational programs that address cognitive and affective dimensions are essential in preparing future healthcare professionals for immunisation responsibilities. By promoting vaccine literacy,

professional accountability and trust in public health, educational providers and policymakers can help equip the next generation of healthcare workers to protect themselves, their patients and the broader community.

Ethics approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee, and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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Conflicts of interest

The authors have no competing interests to declare.

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Data availability statement

This study was not formally registered. The analysis plan was not formally pre-registered. De-identified data from this study are not available in the public archive. De-identified data from this study will be made available (as allowable according to institutional standards) by emailing the corresponding author.

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Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anzjph.2025.100263.