

Vaccination coverage, knowledge and attitudes among students in Papua New Guinea – cross sectional study

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ABSTRACT

Introduction: Vaccinations have a crucial role in the prevention of infectious diseases. Medical students are at high risk of acquiring infectious diseases and transmitting them to vulnerable patients. The success of any vaccination project is closely related to the knowledge and awareness of healthcare workers. The main objective of this study was to assess the vaccination status, knowledge, and attitudes towards vaccination among students being trained at Divine Word University on the Madang campus, Papua New Guinea.

Material and methods: A cross-sectional study using a semi-structured questionnaire.

Results: Out of 89 participants, there were 67 medical students and 22 non-health sciences students. Only one-third of students provided the book with vaccination records. The self-reported vaccination coverage was low. For measles, it was 42% for health sciences and 20% for non-health sciences students; for tetanus and polio, it was approximately 20% for all students. Only 9% of medical students received vaccination against hepatitis B, while no non-health sciences students were vaccinated. Medical students knew five diseases, other health sciences students knew 4.1 diseases, and non-medical students knew 3.6 diseases that are preventable by vaccination. The knowledge of the preventive role of vaccinations was shallow.

Conclusions: The study disclosed not only poor vaccination records but also low awareness and knowledge about vaccinations among students. This poses a risk for future healthcare workers and patients and calls for the improvement of education. Universal precautions, prevention of occupational infections, and optimizing students' vaccination should be taught in the early years at university.

KEY WORDS: knowledge, student, vaccination coverage.

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INTRODUCTION

Vaccinations have a crucial role in the prevention of infectious diseases. Despite the ambitious targets of the World Health Organization (WHO) announced in the Global Vaccine Action Plan (2011-2020), such as polio eradication and measles elimination, primary health practices worldwide struggle to meet targets [1, 2]. Vaccination coverage in Papua New Guinea (PNG) is far from ideal. According to the latest statistics in PNG,

the vaccination coverage for measles (2nd dose) is 27%, while for the conjugated pneumococcal vaccine (PCV) and the *Haemophilus influenzae* type b (Hib) vaccine it is 39% [3, 4]. PNG has a population of around eight million people, and the number is growing. This is a country where vaccine-preventable diseases are still present, and healthcare resources are limited. In recent years in PNG, a decreasing trend in the vaccination rate has been observed. Between 2016 and 2017, the vaccine coverage

rate in PNG dropped for measles from 26.6 to 12.5% and for the pentavalent vaccine from 33.4 to 16.6% [3]. Data provided by the WHO and United Nations Children's Fund (UNICEF) estimated vaccination coverage in PNG in 2017 at 62% for the third dose of the diphtheria-tetanus-pertussis-containing vaccine (DTP) and the first dose of the measles-containing vaccine (MCV), and at 60% for the third dose of the oral polio vaccine [5]. By contrast, the vaccination coverage for these diseases in European countries is around 97% [6]. Thus, it is not surprising that low vaccination coverage in PNG results in local epidemics such as measles and, recently, polio [7, 8].

Under-vaccination is not only a challenge for PNG healthcare systems. It remains a challenge for healthcare systems in many countries [9]. Some factors that may contribute to low vaccination coverage include a low level of education, negative beliefs, superstitions, a considerable distance from the nearest vaccination facility, and the high cost of traveling to health centers [4, 10-12].

Vaccination coverage is an essential indicator of the quality of health care.

The doctor-to-patient ratio in PNG is estimated at 1 : 19,399 population; most doctors work in the capital – Port Moresby. PNG trains most of its health workforce. In 1960, the Papuan Medical College at Taurama was established as the first health workers' training institution in the then Territory of Papua and New Guinea. Now there are two medical schools in PNG, one at the University of Papua New Guinea in Port Moresby and the second at Divine Word University in Madang. The main objective of this study was to assess the vaccination status, knowledge, and attitudes towards vaccination among students being trained at Divine Word University on the Madang campus, PNG.

TABLE 1. Vaccination coverage against common preventable diseases as reported by health and non-health students, PNG, 2019

Disease prevented by vaccination	Vaccination coverage (in percentage)	
	Health sciences students (n = 67)	Non-health sciences students (n = 22)
Measles	43%	18%
Mumps	15%	0%
Rubella	9%	9%
TD	21%	18%
Polio	30%	2%
BCG (scar)	84%	82%
Hepatitis B (1 dose)	30%	9%
Hepatitis B (3 doses)	6%	0%

TD – tetanus diphtheria, BCG – bacillus Calmette-Guérin

MATERIAL AND METHODS

This cross-sectional study was carried out in September 2019 at Divine Word University in PNG. A total of 89 students from different programs (medicine, other health sciences, non-health sciences) were recruited. Students studying on campus in Madang were asked to fill in a vaccination questionnaire and bring their vaccination booklet, if available. Students were only included if they gave verbal consent. A semi-structured questionnaire collected data. The questionnaire was self-delivered, and the questions were grouped into four sections: demographic characteristics, knowledge, attitude, and self-reported vaccination status. Data from the closed questions were summarized using descriptive statistics. For the qualitative data, thematic analysis and grouping of themes were performed, and the data were quantified to express frequencies of particular themes.

The study received ethical clearance from the Faculty of Medicine and Health Sciences Research Committee (No FRC/MHS/40-18) at Divine Word University.

RESULTS

DEMOGRAPHIC FEATURES

In the study, there were 89 students: 45 males and 44 females. There were 67 health-sciences students (medicine 42, other health-sciences 25) and 22 non-health sciences students.

One-third (30/89) of students had proof of vaccination (vaccinations booklet).

VACCINATION COVERAGE

Vaccination status is presented in Table 1. The majority of students were unaware of their vaccination status. For those with vaccination proof, the maximum was three vaccination visits, but in some, it was only one visit. As regards disease history, most students could not recall having any infectious diseases. Only 6% of medical students reported receiving the complete vaccination (3 doses) against hepatitis B (HBV), while among non-health students, none was fully vaccinated. Approximately 80% of students presented a scar after BCG vaccination. Mean students' awareness about vaccination coverage for eight preventable diseases listed in the table was 29% for health and 18% for non-health sciences students.

KNOWLEDGE ABOUT VACCINATION

The knowledge about the preventive role of vaccination was shallow. On average medical students knew five diseases, other health-sciences students knew 4.1 diseases, and non-health sciences students knew 3.6 conditions. The percentage of students aware of cervical cancer prevention was only 8%, against invasive pneumococcal disease 8%, against influenza 8%, against tuberculosis 29%, against tetanus 54%. Non-health sciences students were not aware of the possibility of prevention through vaccination for such diseases as cervical cancer, hepatitis B,

TABLE 2. Knowledge among the university students about the diseases preventable by vaccination, PNG, 2019

Disease preventable by vaccination	Medical (n = 42)	%	Health (n = 25)	%	Non-health (n = 22)	%
Cervical cancer (HPV)	7	16	0	0	0	0
Diphtheria	14	32	9	36	8	36.4
Influenza	2	4.8	3	12	2	9
Hepatitis B	32	76.2	3	12	0	0
Measles	37	88	19	86.4	13	59
Mumps	22	52.4	15	60	12	54.5
Pertussis	12	28.6	8	32	7	31.8
Polio	42	100	22	88	16	72.7
Pneumonia	4	9.52	3	12	0	0
Rubella	12	28.6	7	28	7	31.8
Tetanus	29	69	8	32	11	50
Tuberculosis	18	42.3	5	20	3	13.6
Average	5		4.1		3.6	

and invasive pneumococcal disease. Details are presented in Table 2.

ATTITUDE TO VACCINATIONS

One-third of participants choose the expression “protect the child from illness or disease or infection”. Only 3 out of 89 mentioned that vaccination might “protect the child from disability”.

Medical students showed a better understanding than non-health sciences students of how vaccines work. Sixty-seven percent of medical students (28 out of 42) explained that vaccines contain “antigens from pathogens inducing antibody production” and “creating memory cells” in the immunological system. One-third of non-medical students (16 out of 47) have no idea how vaccines work; the remaining medical and other students used general statements such as vaccines “boost/strengthen/train the defense system” or “boost white cells to fight”.

In our study, 36% of the participants (32 out of 89) saw the importance of vaccines in preventing or protecting children from diseases. Less common explanations were:

- “Prevent a child from dying”;
- “Keep away from a hospital”;
- “Help a child grow healthy”.

To convince parents of the benefit of vaccination, most students (74%, 66 out of 89) would say that “vaccines prevent diseases that can harm a child”. Only a few participants used a more positive approach, saying that vaccines “help the immune system to mature or develop” or suggesting that after vaccination, a child would “live longer” or “have a healthy life”. Another small group would give an excellent example of a child vaccinated and a bad example of a child who contracted one of the vaccine-preventable diseases and faced severe consequences.

DISCUSSION

Our findings showed the poor status of students’ vaccination records. Only one-third of students had records of their vaccination status, but a highly significant number of respondents had a TB scar. Our findings are in accordance with previous literature data. Morgan and Saweri generally demonstrated a poor state of records of vaccination in Papua New Guinea [10]. The major limitation of our study was reliance on the self-reported vaccination status, deemed less reliable [13]. In many countries, assessing students’ vaccination records is routine for school admission. Another way of determining vaccination status is through serological testing [12, 14, 15]. However, serological evaluation of immunity for common diseases was not feasible in low-resource settings. Studies that looked at students’ vaccination coverage and knowledge tended to assess specific vaccine-preventable conditions that study populations were at higher risk of acquiring as part of occupational exposure [14, 16]. Vaccination coverage among students reflects general low vaccination coverage in the country [3, 4, 17]. here is a large gap between vaccination coverage in low-income and high-income countries, including differences in students’ vaccination status [3]. On average, in low-resource countries such as Nigeria or Syria, 30.5% of undergraduate public health students completed HBV vaccination courses [14, 18, 19]. Knowledge, testing, and vaccination history of HBV in Ghana found that 73.9% of participants had a moderate knowledge about HBV infection, 44.2% had received at least one dose of the vaccine, and 30.5% had completed all HBV vaccination. Similar to our results, Ibrahim and Idris found that Syrian medical students were unaware of the serious consequences of HBV infection and the risk they pose to the patient in case they become carriers of HBV [19]. By comparison, self-reported vaccination status among

medical students at Vienna Medical University was 90.1% for HBV, 89.9% for tetanus, 88.1% for polio, 78% for MMR, 70.5% for varicella, and 70.5% for pertussis [12]. HBV vaccination coverage among medical students in Australia was over 95% and 86% in Germany [20, 21]. A study in Australia examined medical students' knowledge, attitudes, and practice toward the influenza vaccine and factors associated with vaccine uptake [22]. The researchers found that 53.8% of students were vaccinated against influenza. This particular study identified misconceptions and access to the influenza vaccine as barriers to the uptake of the influenza vaccine.

Furthermore, a Canadian study also looked at the knowledge, attitudes, beliefs, and behaviors of three groups of health-sciences students (medical students, pharmacy students, and nursing students) towards influenza vaccination [13]. It was found that vaccination status varied by program type, with 86.3% of medical students being vaccinated against influenza, 52.4% of nursing students, and 67.7% of pharmacy students. However, on looking at knowledge of the influenza vaccine, the pharmacy students scored a higher mean knowledge score (10.0 out of 13 questions), followed by the medical students (9.26) and nursing students (8.88). Hepatitis B used to be the commonest infection associated with hospitalization. Low vaccination rates among healthcare workers raise concerns about safety both for patients and staff [23]. Healthcare workers have the highest occupational risk for HBV infection [24]. The disease incidence following needle stick injury is 6-30% [23]. Data from the United States in the 1990s revealed that unvaccinated health care workers had serologic evidence of past or current HBV infection three to five times greater than the general population [25]. Vaccinations are essential primary prevention procedures. Educational institutions should conduct awareness programs and facilitate free vaccination for students [19]. Proper training and education of healthcare workers are crucial [10]. Knowledge about vaccine-preventable diseases is influenced by both level of education and the level of media awareness [26]. It has been shown that socio-economic factors such as household income and parents' education are associated with better health and immunization coverage [27]. A widespread campaign in mass media after the recent polio outbreak in PNG made the students aware that vaccination can prevent polio and, subsequently, severe disability. Insufficient knowledge among health students shown by our and other studies raises concern and calls for reviewing health education curricula [19]. The only optimistic part of this study was that overall, students presented a positive attitude towards vaccinations and had positive suggestions on how to encourage parents to vaccinate their children. Besides barriers to vaccination in the low-resource health system, growing widespread misconceptions and hesitancy towards vaccinations add to the existing challenges. These concerns and misconceptions about immunization

need to be recognized and addressed in all countries regardless of economic status. There is little evidence on interventions to tackle them [28]. There is scarce evidence on concerns about vaccination in PNG [29]. More studies shedding light on that issue would provide baseline data for preparing a strategy to address this challenge.

This study provides a unique opportunity to have an insight into healthcare workers in developing countries. We are aware that our study has certain limitations. The number of participants in the study group is not big and the questionnaires were collected at one time point. There are not many published studies performed in PNG – so our analysis is of special value.

CONCLUSIONS AND RECOMMENDATIONS

Poor vaccination coverage for students has public health consequences. Firstly, unvaccinated healthcare workers have a much higher risk of preventable occupational infection [20, 21, 24, 25]. They may become carriers of avoidable diseases and pose a real threat to patients under their care. Unvaccinated healthcare workers are less likely to actively encourage patients to get vaccinated. They cannot be positive role models.

Therefore, there is a need to redefine the curriculum to include basic knowledge on vaccination in the early years of university. Poor vaccination coverage among students showed the need to perform complementary vaccination aiming to minimize the risk of transmission of preventable infectious diseases by future healthcare workers. Therefore, vaccination status should be routinely checked on admission to the university, and additional vaccination against common preventable diseases before the students enter clinical practice should be obligatory.

Vaccination requirements at the university entry should include:

- mumps measles rubella two doses (exclude pregnancy in female students);
- tetanus three doses with the last dose within ten years;
- diphtheria three doses;
- polio three doses;
- hepatitis B three doses;
- additional vaccinations;
- pertussis one dose given no later than ten years earlier;
- meningococcal ACYW 1 dose;
- meningococcal B two doses;
- hepatitis A two doses;
- varicella two doses – for students with no history of chickenpox.

Students who are well educated about vaccinations and fully vaccinated are the solution for under-vaccination in the community. Unvaccinated doctors are not effective in fighting epidemics. Mass vaccination campaigns must start by convincing and encouraging healthcare workers. The expected benefit can be raising awareness of vaccinations and their importance in protecting children and adults.

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DISCLOSURE

The authors report no conflict of interest.

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AUTHORS' CONTRIBUTIONS

EG, JK, DJL prepared research concept and design. JK, MH, DJL collected data. EG, DJL analyzed data. EG, JK wrote the article. EG, MH, DJL critically revised the article. All authors approved the final version of publication.