**Vaccine hesitancy among students in Israel: Exploring the relationship to vaccination history, knowledge and attitudes towards influenza vaccines**

**Abstract**

Influenza vaccination is a highly effective strategy in mitigating the health, societal, and economic repercussions of influenza. Despite the severity of the flu and the availability of secure vaccines, global flu vaccination rates remain insufficient, particularly among students. The study aimed to examine the correlation between flu vaccine history, knowledge, attitudes toward flu vaccines, and vaccine hesitancy among college students. We conducted a cross-sectional study encompassing 610 students, employing an online questionnaire. A significant majority of participants reported prior experiences with the flu (82%), with slightly more than half having received flu vaccinations in the past (57%). Concerning the current research year, health sciences students exhibited a higher likelihood of either being vaccinated or intending to receive the vaccine than their counterparts. Among students who had been vaccinated previously, approximately one-fifth opted for vaccination in the present year (21%). Likewise, a fifth of the students whose parents were vaccinated chose to get vaccinated this year (22%). Notable disparities in knowledge about flu vaccines were observed across various faculties, with health sciences students demonstrating the highest levels of awareness. Moreover, a negative relationship was found between knowledge, attitudes, and vaccine hesitancy. To bolster the vaccination rate, targeted lectures by professionals emphasizing vaccine safety and university-hosted events addressing this subject in collaboration with the Ministry of Health—incorporating influenza vaccination stations—could be instrumental.

**1. Introduction**

Influenza is one of the significant concerns in public health. The estimate is that every year, influenza leads to approximately 3-5 million severe cases and 290,000-650,000 respiratory-related deaths worldwide (Doyon-Plourde et al., 2019; Kim et al., 2022). In the past year, the infection rate in Israel was 53.9 cases per 100,000 individuals. In contrast, in other Western countries, the incidence of illness is significantly lower. In the United States, the incidence rate is 20.45 per 100 individuals, in France 15.13, in Germany 3.75, and Italy 0.62 (Corporate Value Associates, 2022). The influenza vaccine is one of the most efficient strategies to reduce the health, social, and economic impact of influenza (Cassini et al., 2018). The World Health Organization recommends annual influenza vaccination due to continuous genomic changes in the influenza virus (WHO, 2019). Despite the severity of the flu and the availability of safe vaccines, influenza vaccination rates are low, contributing to the burden of the disease on healthcare systems worldwide (Chotpitayasunondh et al., 2021). Influenza vaccination coverage among students lags other age groups and remains well below the target (CDC, 2020). Reported vaccination rates vary between 9-30%, and annual influenza virus outbreaks cause severe diseases and can be fatal among students (Ratnapradipa et al., 2017; Schlenker et al., 2013).

The Israeli Ministry of Health recommends that the entire population over six months get vaccinated against influenza every year before the onset of winter at no cost. In the 2019-2020 influenza season, approximately 25% of the total population in Israel was vaccinated (Israel Center for Disease Control, 2020). Studies have shown that seasonal influenza vaccination rates among the student population are low, ranging from 12% to 30% (Benjamin & Bahr, 2016). A study conducted by the National Foundation for Infectious Diseases (NFID) among students in the United States revealed that although 70% of students believed in vaccinating against the flu, only about 46% reported getting vaccinated (NFID, 2016). Influenza can quickly spread on campuses due to crowded living quarters and frequent social activities, adversely affecting students' academic performance, class attendance, increased use of health services, and prescription drug use (Hayward et al., 2014). Students interact with family members and the community through their work, presence in fitness centers, and social events, and can thus be a source of community outbreaks (Nichol et al., 2008). Investigations of outbreaks among subgroups of students showed high infection rates, up to 73% (Benjamin & Bahr, 2016). Despite the low hospitalization rates attributed to influenza among students, the potential burden on the student population is significant (Benjamin & Bahr, 2016).

Vaccine hesitancy is defined as a combination of beliefs, attitudes, and behaviors exhibited by the general population and healthcare professionals regarding their children's vaccinations, resulting in reduced vaccine coverage and an increased risk of preventable disease outbreaks (Dubé et al., 2013). In 2019, the World Health Organization classified vaccine hesitancy as one of the top ten global health threats (WHO, 2019). It is estimated that vaccine hesitancy is responsible for diminishing vaccine coverage and escalating the risk of outbreaks of preventable diseases that can be immunized against (Majid & Ahmad, 2020). As vaccine hesitancy and refusal continue to grow worldwide, the protection against vaccine-preventable diseases provided by immunizations continues to decline (Vrdelja et al., 2018). Vaccine hesitancy is a complex phenomenon influenced by a combination of scientific, economic, socio-cultural, psychological, and political factors (MacDonald et al., 2015). The threat of vaccine hesitancy persists despite significant clinical evidence supporting the benefits and importance of vaccines in preventing the spread of diseases (Koslap-Petraco, 2019).

The reasons for delaying or refusing vaccinations are complex and highly variable. The rapid development of vaccines and the pharmaceutical industry's commercial interests have heightened public concerns and may impact decision-making (Al-Mulla et al., 2021). Studies on healthcare system employees have shown high levels of vaccine hesitancy, even among doctors (Al-Mulla et al., 2021). Doctors from Belgium, Austria, and other countries have voiced their reservations publicly regarding the vaccine. Similarly, surveys have shown high levels of vaccine hesitancy among academics. A recent study among medical students revealed that 23% of the participants were unwilling to take a COVID-19 vaccine even with FDA approval (Lucia et al., 2021).

The reasons for influenza vaccine hesitancy among students have not been sufficiently researched. Documented barriers include vaccine inaccessibility, perceived lack of necessity, low motivation to vaccinate, and lack of knowledge about the vaccine (Logan et al., 2018). Casting doubt on vaccine efficacy and beliefs that the vaccine may have dangerous side effects reinforces the perception of contracting influenza due to the vaccine (Berg & Wicker, 2021). A large public university study in the United States showed a higher rate of vaccine acceptance among students with a history of childhood vaccinations. Additionally, when unvaccinated students learned how the influenza vaccine protects healthy young individuals, most expressed increased willingness to get vaccinated (Ryan et al., 2019).

While vaccine hesitancy has been extensively researched in the general adult population, young adults have not been a strategic focus of vaccination encouragement and public health communication. The motivation for students to receive the influenza vaccine is challenging (Cornally et al., 2013; NFID, 2017). Generally, students perceive themselves as healthy and at low risk of illness, although the influenza virus spreads rapidly in areas near campuses. However, low seasonal influenza vaccination rates among students are a global phenomenon (Lee et al., 2018). Students with influenza immunity also play an essential role in protecting their peers, family members, high-risk population groups, and others in the community. Therefore, increasing vaccination rates among students in universities will help enhance overall coverage and contribute to achieving herd immunity against seasonal influenza (Plans-Rubió, 2012).

Students represent an interesting group for investigating vaccine hesitancy, as they are considered educated, broad-minded, and understand the perceived threat to humans from infectious diseases. Students constitute a special category of the young population and are considered open-minded individuals capable of responding quickly to public health issues (Harrison et al., 2020). Therefore, understanding the factors of vaccine hesitancy among them could yield a tailored plan to increase influenza vaccination rates. Hence, the research aim is to examine whether there is a correlation between influenza vaccination history, knowledge, attitudes towards influenza vaccination, and influenza vaccine hesitancy among students.

### 2. Materials and Methods

#### 2.1. Research Procedure

A cross-sectional analysis was conducted involving students from Ashkelon Academic College, totaling approximately 4,200 students. Approval for the study was obtained from the Ashkelon Academic College Ethics Committee (approval #42-2023). The survey questionnaires were developed using Qualtrics (Qualtrics, Provo, UT, USA) and were distributed to the students via email on 2 April 2023. A reminder prompting the completion of the questionnaire was sent using the same method after three weeks. On 12 May 2023, the questionnaire was closed for further participation, coinciding with the end of the vaccination season in Israel. On average, participants took 5 ± 1.44 minutes to complete the questionnaire. The introductory page of the questionnaire explained the questionnaire's objectives and purpose. Submitting the completed questionnaire signified the students' informed consent to participate in the survey. Students could halt their responses at any point, and no questions were mandated. The questionnaire received a total of 703 entries, with 610 students completing at least 90% of the questionnaire. Therefore, the response rate was 87% of all entries and represented 15% of the research population.

#### 2.2. Tools

A professional translator translated the anonymous, closed, self-completed questionnaire from English into Hebrew (Appendix A). After it was translated into Hebrew, it was administered to ten students who did not attend the college to ensure the questions were comprehensible. The questionnaire was then revised according to their comments. In addition, one expert in public health and epidemiology and one expert in infectious diseases validated the questionnaire using the content validity method. The following describes the questionnaire sections:

1. Demographic information: Gender, age, marital status, religion, department, and year of study.
2. Vaccination and vaccination history - have you ever had the flu? Have you ever been vaccinated against the flu? Do your parents usually get vaccinated against the flu? Have you been vaccinated against the flu this year? The questionnaire was taken from Ryan et al. (2019).
3. Vaccine hesitancy - Six questions from Silva et al. (2021). The respondents were asked to indicate their degree of agreement with each statement in the questionnaire on a Likert scale ranging from 1 (not at all) to 5 (strongly agree) and the option to answer, "I don't know." The average of the answers was calculated for each participant after reversing the scales in questions 1 and 6 and dropping the "I don't know" answers. A higher score will indicate a higher vaccine hesitancy. Cronbach's α for reliability was α=0.77.
4. Attitudes regarding Influenza vaccines: Five questions from Silva et al. (2021) asking respondents to indicate to what extent they agreed with the given statements on a Likert scale ranging from 1 (not at all) to 5 (strongly agree) and the option to answer, "I don't know." The average of the answers was calculated for each participant. A higher score indicates more positive attitudes towards flu vaccines. Cronbach's α for reliability was α=0.74.
5. Knowledge about Influenza and Influenza Vaccines: Ten questions from Ryan et al. (2019) in which respondents were asked to indicate whether, in their opinion, the statement was correct or incorrect or whether they did not know. The number of correct responses to each statement was totaled to calculate the knowledge score.

#### 2.3. Data Analysis

The data were analyzed using SPSS 29.0 (IBM, Armonk, NY, USA). Relationships between the variables were examined using Pearson correlation analyses. Differences between groups of students were analyzed using χ2 tests, t-tests for independent samples, and one-way analyses of variance (ANOVAs) as appropriate. A linear regression model was used to test the prediction of the level of vaccination hesitancy. All reported *p*-values were based on two-sided tests and were considered significant when the values were below 0.05.

**3. Results**

#### 3.1. Participants' Characteristics

In total, 610 individuals participated in the study, of whom 60% were women, 53% were in relationships, and 21% had children. Most participants were Jewish (83%). Nearly half study in the Faculty of Social Sciences (46%), about a third in Health Sciences (35%), and a fifth in Computer Science and Management (19%). The mean age of the respondents was 27.64 ± 7.20 years. Participant characteristics are summarized in Table 1.

**Table 1.** Participants' characteristics.

|  |  |  |
| --- | --- | --- |
| **Characteristics** | ***n*** | **%** |
| Gender:  Male  Female | 243  367 | 40  60 |
| In relationship | 324 | 53 |
| Have children | 128 | 21 |
| Jewish | 509 | 83 |
| Faculty:  Health Sciences  Social Sciences  Computers & Management | 202  262  106 | 35  46  19 |
| Year of studies:  1st  2nd  3rd & 4th | 310  198  102 | 51  32  17 |

#### 3.2. Influenza Vaccination

Participants were asked about their history of influenza vaccination and whether they intend to get vaccinated this year, including vaccination among their parents and children. Table 2 shows that most participants had experienced the flu at some point (82%, excluding participants who couldn't remember - 89%). More than half had been vaccinated in the past (57%, excluding participants who couldn't remember - 61%), and a similar percentage, as far as the participants are aware, at least one parent is vaccinated. Over a third of the parents report vaccinating their children (38%). Among the participants, just over a tenth are vaccinated (12%), 44% intend to get vaccinated, 8% are undecided, and more than a third (36%) do not intend to get vaccinated.

No significant differences were found between the faculties regarding vaccination history, parental vaccination, and children's vaccination. However, significant differences were found regarding vaccination in the research year between the faculties (χ2=24.66, p<0.001), with more students in the health sciences faculty having been vaccinated or intending to be vaccinated (16% and 47% respectively), compared to computer science and management students (14% and 52% respectively), and social sciences students (11% and 35% respectively).

**Table 2**. Influenza Vaccination (n=610)

|  |  |  |  |
| --- | --- | --- | --- |
| question | values | n | % |
| Ever had the flu | Yes  No  Don't remember | 501  59  50 | 82  10  8 |
| Vaccinated against the flu | Yes  No  Don't remember | 351  223  36 | 57  37  6 |
| Parents vaccinated against the flu | Yes, both  Yes, one of them  Do not know | 197  152  261 | 32  25  43 |
| Participants vaccinated this year against the flu | Yes  Intend to vaccinate  Do not intend to vaccinate Undecided | 76  269  217  48 | 12  44  36  8 |
| Are their children vaccinated (128=n) | Yes  Some of them  No | 32  17  79 | 25  13  62 |

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#### 3.3. The Relationship Between Vaccination History and Parental Vaccination and Current Vaccination

The associations between the history of flu vaccination and parental vaccination and flu vaccination in the current year were examined using chi-square tests after excluding participants who indicated "do not remember." Significant differences were found between students who had been vaccinated in the past and those who had not been vaccinated against the flu in the current year (χ2=55.81, p<0.001). Among the students who had been vaccinated in the past, a fifth were vaccinated in the current year (21%), and 30% do not intend to vaccinate, compared to students who had not been vaccinated against the flu in the past, among whom only 1% were vaccinated this year, and 38% declare that they do not intend to vaccinate at all.

Significant differences were also found between students whose parents were vaccinated and those with only one vaccinated parent in the current year's flu vaccination rate (χ2=15.55, p=0.001). Among the students whose both parents were vaccinated, a fifth were vaccinated this year (22%) compared to students with only one vaccinated parent, among whom a tenth was vaccinated this year (11%).

#### 3.4. Levels of Knowledge, Attitudes, and Vaccine Hesitancy

Table 3 presents the levels of knowledge and attitudes toward influenza vaccines and vaccine hesitancy. The knowledge about and attitudes toward influenza vaccines were relatively low. The level of vaccine hesitancy was medium.

**Table 3.** Levels of Knowledge, Attitudes, and Vaccine Hesitancy

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Maximum**  **Obtainable Score** | **Range Obtained by Respondents** | **Mean** ± **SD\*** |
| Knowledge about influenza vaccines | 9 | 0–10 | 4.04 ± 2.39 |
| Attitudes toward influenza vaccines | 5 | 1.00–5.00 | 2.82 ± 0.97 |
| Vaccination hesitancy | 5 | 1.00–5.00 | 3.11 ± 0.70 |

\* SD = Standard Deviation

#### 3.5. Relationships between Knowledge, Attitudes, and Vaccine Hesitancy

The relationships between variables were analyzed using Pearson correlations. We found negative and significant associations between the level of knowledge, attitudes, and vaccination hesitancy (rp=-0.35, p>0.001; rp=-0.43, p>0.001 respectively). This indicates that a higher level of knowledge and attitudes towards influenza vaccines, the less vaccine hesitancy will be found.

#### 3.6. The relationship between vaccination history and the study variables

The differences between students who had been vaccinated in the past and students who had not been vaccinated in relation to the study variables were tested using t-tests for independent samples. Significant differences were found between the groups in the level of knowledge (t=6.50, p<0.001), attitudes (t=3.24, p<0.001), and vaccination hesitancy (t=6.69, p<0.001) so that students who had been vaccinated in the past had a higher level of knowledge than unvaccinated students (4.62 vs. 3.32 respectively), more positive attitudes (2.96 vs. 2.69 respectively) and a lower level of vaccination hesitancy (2.95 vs. 3.23 respectively).

#### 3.7. Differences Between Faculties

Differences between faculties were examined using One-way ANOVA tests. Significant differences were found between faculties in terms of knowledge (F(551)=7.55, p<0.001). Students in the health sciences faculty demonstrated the highest knowledge level, followed by students in the social sciences and, finally, students in computer science and management (averages of 4.62, 3.87, and 3.67, respectively). Scheffe post hoc tests revealed that students in the health sciences faculty had significantly higher knowledge levels than students in the social sciences and computer science and management.

Significant differences were also found in attitudes toward influenza vaccination (F(566)=16.37, p<0.001). Students in the health sciences faculty showed the highest level of confidence, followed by students in computer science and management, and finally, students in the social sciences (averages of 3.05, 2.95, and 2.56, respectively). Scheffe post hoc tests indicated that students in the social sciences faculty held significantly more negative attitudes than those in the health sciences and computer science and management.

Lastly, significant differences were found among the faculties regarding influenza vaccine hesitancy (F(565)=3.17, p<0.05). Computer science and management students had the highest hesitancy level, followed by students in the social sciences and, finally, health sciences (averages of 3.22, 3.10, and 3.00, respectively). Scheffe post hoc tests revealed that students in computer science had significantly higher hesitancy levels than health science students.

#### 3.8. Regression Model for Predicting Influenza Vaccine Hesitancy

Table 5 presents the results of hierarchical linear regression models predicting influenza vaccine hesitancy. In the final model, which includes all the variables found to be significant in the previous models, the predictive ability of gender, religion, year of study, prior vaccination, and knowledge level is preserved. Knowledge level, year of study, and previous immunization strongly predict vaccine hesitancy. The explained variance of the final model is approximately 28% (p<0.001).

**Table 5.** Hierarchical linear regression model results (adjusted values) for predicting influenza vaccine hesitancy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Demographic | Education | Vaccination | Research variables | Combined model |
| β | β | β | β | β |
| Gender (0-male, 1-female)  Age  Marital status (0-yes, 1-no)  Children (0-yes, 1-no)  Religion (0-Jewish, 1-not Jewish)  Birth (0-Israel, 1-abroad) | \*\*0.13-  0.05-  \*0.09-  0.07  \*0.11  0.05 |  |  |  | \*0.09-  0.03-  \*\*0.11 |
| Year of study  Health Sciences (0-no, 1-yes) Computers & Management (0-no, 1-yes) |  | \*\*\*0.14-  0.04-  0.06 |  |  | \*\*\*0.15- |
| Had flu (0-no, 1-yes)  Vaccinated (0-no, 1-yes)  Parents vaccinated (0-no, 1-yes) |  |  | 0.06  -0.23\*\*\*  -0.11\* |  | -0.15\*\*\*  0.002 |
| Knowledge  Attitudes |  |  |  | \*\*\*0.26-  0.02- | -0.19\*\*\* |
| Adjusted R Square  N | 0.03\*\*\*  605 | 0.03\*\*\*  565 | 0.08\*\*\*  534 | 0.20\*\*\*  575 | 0.28\*\*\*  545 |

p<0.005\*, p<0.001\*\*, p<0.001\*\*\*

**4. Discussion**

Half of the participants in the current study have been vaccinated against the influenza virus in the past. For at least half of the participants, at least one parent was vaccinated against the virus, and among the parents of the children, about a third of the children received a vaccine against the virus. Among the participants, about 10% managed to get vaccinated against the virus, about 44% planned to get vaccinated, and the rest were undecided or did not plan to get vaccinated. Generally, students perceive themselves as healthy individuals with a lower chance of contracting infectious diseases, so their vaccination rate is low. Similar findings were also obtained in studies conducted worldwide to understand the percentage of students who were vaccinated against the influenza virus. In these studies, the prevailing situation is that about 10%-30% of students were vaccinated against the virus (Benjamin & Bahr, 2016; Choucair et al., 2021).

In contrast, a study conducted by the NFID (National Foundation for Infectious Diseases, 2016) among students in the United States found that 46% reported being vaccinated. Among the students who were not vaccinated, about 77% expressed a positive intention to get vaccinated. It is possible that since the healthcare system in the United States is private, and disease treatments are costly (cost of doctor visits, medications, potential hospitalization), the vaccination rate is higher compared to countries where public healthcare services are prevalent.

Regarding vaccination in the research year, significant differences were found between faculties, with more students from the health sciences being vaccinated or planning to be vaccinated compared to computer science and management or social sciences students. Similar findings were obtained in previous studies showing that influenza vaccination was more common among medical students than students in other professions (Ryan et al., 2019; Malhi et al., 2022). This may be because health sciences students often have clinical experience in hospitals and clinics, making them more cautious about the risk of infection. Sometimes, they are required to be vaccinated to start their clinical expertise out of concern for themselves, patients, and the teams they meet.

When comparing students who were vaccinated in the past to those who were not, a significant difference in vaccination was also found in the current year. Among students who were previously vaccinated, more stated that they intend to vaccinate this year than those who were not vaccinated. These findings align with studies that explored factors related to positive intentions to vaccinate against influenza. In these studies, students who planned to vaccinate in the future were mostly those who had already been vaccinated in the past (Pastorino et al., 2021). Similar findings were found in a study by Ryan and colleagues (Ryan et al., 2019), which saw a higher vaccination rate among students with a childhood vaccination history. Similar findings were also obtained in studies conducted in other research populations, showing that previously vaccinated participants were more likely to plan or receive their future vaccinations (Lin et al., 2010; Nowalk et al., 2010).

Additionally, a significant difference was found in vaccination intentions depending on the number of vaccinated parents. Out of the students whose both parents are vaccinated, a fifth was vaccinated in the current year (22%), compared to students with only one vaccinated parent, of whom a tenth was vaccinated this year (11%). These findings align with existing research literature indicating that when children receive support from their parents regarding vaccines, or when their parents support vaccinations, in most cases, they too will keep and receive the vaccine. This can explain the finding that the more parents vaccinated, the higher the likelihood that the child will be vaccinated (Shon et al., 2021). Another study supported the notion that the more family members and friends received the influenza vaccine, the higher the likelihood that the individuals would receive it (Sunil & Zottarelli, 2011).

The research findings indicate differences between students who were previously vaccinated and those who have never been vaccinated in relation to the study variables. The research findings showed that students who were previously vaccinated have higher knowledge levels, more positive attitudes, and lower hesitancy than students who have never been vaccinated. These differences can be explained using the Theory of Planned Behavior, which suggests that a person's behavior is influenced by their attitudes toward the vaccine. According to this theory, someone with a more positive attitude toward the vaccine is more likely to choose to receive it. Additionally, someone who has already received the vaccine is expected to have positive attitudes that initially motivated them to receive the vaccine (Ajzen, 1991). Similar findings were obtained in another study conducted among students in the United States, where it was found that previously vaccinated students are more likely to get vaccinated and have higher levels of knowledge and positive attitudes on the subject (Ryan et al., 2019).

Negative correlations were found between knowledge and attitudes toward influenza vaccines and vaccine hesitancy. Similar findings were observed in studies that examined factors related to vaccine hesitancy. For example, a lack of knowledge was identified as an influencing factor in vaccination intentions among students in the United States (Logan et al., 2018). In a study by Ryan et al. (2019), the relationship between variables among students was examined, and significant correlations were found. A survey conducted among second-degree nursing students in Italy found that as knowledge levels and attitudes became more positive, vaccine hesitancy decreased. In this study, the researchers also expanded and included students in intervention programs to promote vaccination. They found that students involved in the program had increased knowledge levels and reduced vaccine hesitancy (Mellucci et al., 2020).

Moreover, differences were found between health science students and other students regarding the research variables. Health science students had the highest level of knowledge, markedly higher than social science, computer science and management students. This finding makes sense since health science students acquire the relevant knowledge about vaccines as part of their comprehensive training. Therefore, there is a high likelihood that their knowledge levels will be higher than other students who do not acquire this knowledge in their studies (Mallhi et al., 2022). Social science students had more negative attitudes toward vaccines than health science, computer science, and management students. Similar findings were obtained in a study conducted among students in Italy, which found that attitudes and vaccination intentions varied among students from different academic disciplines. These attitudes and intentions were generally more positive among medical students (Pastorino et al., 2021). This may also be because medical and nursing students have more knowledge about vaccination topics, naturally due to dealing with these subjects as part of their curriculum. Knowledge has great significance and is also found in studies conducted among students, as students who received knowledge about vaccines expressed more positive attitudes and intentions to vaccinate after receiving the information (Ryan et al., 2019; Alhawsawi et al., 2020).

Finally, significant differences were found between faculties in influenza vaccine hesitancy. Computer science and management students had the highest hesitancy rates, followed by social science students and health science students. Similar findings were obtained in other studies that included students from various fields. For example, a study conducted in Saudi Arabia found that health sciences students had more positive vaccination intentions, indicating lower hesitancy rates compared to students from other study areas (Mallhi et al., 2022). Based on the research literature, vaccine hesitancy is ultimately expressed in the vaccination rate. Therefore, from the vaccination rate of students from different study fields, it is also possible to learn about their hesitancy levels, assuming that the higher the hesitancy levels, the lower the vaccination rate. In a study conducted in Japan, researchers examined the reasons related to the vaccination rate among students. The study included 604 students from Hokkaido University in Japan. The research findings showed that health science students were vaccinated at a rate three times higher than students from other fields of study (Kawahara & Nishiura, 2020).

Furthermore, based on the study's findings, a hierarchical regression model is constructed to predict vaccine hesitancy among students. In a study by (Shon et al., 2021), it was found that female students were vaccinated more than male students, which may indicate that among students, males have higher levels of vaccine hesitancy, similar to the findings obtained in the current study. Students who have been vaccinated in the past or have vaccinated parents have less vaccine hesitancy. This conclusion was also found in the research estimate and is supported by the research literature, explained in several ways (Ryan et al., 2019; Shon et al., 2021; Sunil & Zottarelli, 2011). According to the comprehensive model, the level of knowledge succeeded in predicting vaccine hesitancy most accurately. Similar findings were obtained in other studies conducted on the subject involving students (Betsch et al., 2015; Logan et al., 2018; Ryan et al., 2019). Vaccine willingness is essential among students and populations that are generally not at risk in order to increase the vaccination rate and generate herd immunity to protect the entire population (Vergara et al., 2021).

#### 4.1. study limitations

The study was conducted among students from only one college, which may affect the generalizability to all students nationwide. Additionally, most participants were not vaccinated against the flu this year, and over a third did not intend to get vaccinated. These data may indicate a selection bias where vaccine-hesitant students were more likely to respond to the questionnaire.

**5. Conclusion**

The research findings emphasize the importance of studying the factors related to vaccine hesitancy among students and increasing knowledge about flu vaccine safety, especially among students who do not receive this information as part of their study program. Young individuals sometimes believe that their vaccination is not essential, and in reality, they hinder herd immunity, allowing vulnerable populations to remain susceptible to the flu virus. Based on the research findings, it is recommended to develop intervention programs to increase vaccination rates among all students, especially those studying non-health-related professions. Rising vaccination rates can be achieved through targeted lectures on vaccine safety by professionals and organizing campaigns within the college, which could include flu vaccination stations in collaboration with the Ministry of Health.

Further research should be conducted to thoroughly understand the factors related to vaccine hesitancy and how to overcome it. Developing intervention programs to increase vaccine coverage and evaluate the most effective intervention strategies is important. Moreover, in future studies, a representative sample of students from various colleges and universities should be included to obtain a more reliable picture. The research should also be expanded to other populations, such as the elderly, pregnant women, parents of young children, and more.

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