# Evaluation Effectiveness of the Moderna Booster Vaccine on Health Workers in Indonesia

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Abstract:     This study was conducted to evaluate the effectiveness of the moderna booster vaccine in health workers in Indonesia. This study used a mixed method and prospective crossectional studies, for all health workers in Indonesia who have been vaccinated with the third dose of the Moderna vaccine or booster with the convenience sampling method. The purpose of this study was to find out whether there was a relationship between the sociodemography of health workers who received the moderna booster vaccine after 6 months with the incidence of covid-19 and the use of vitamins after vaccination. It was found that the moderna booster vaccine has an effectiveness of 97.2%. Other factors that influence the side effects and effectiveness of the vaccine are genders, BMI, and vitamins with a p-value of each variable <0.05. The conclusion is that there is a relationship between the genders, BMI, and the consumption of vitamins with the effectiveness of the vaccine.

## 1 INTRODUCTION

The outbreak that emerged in late 2019 brought a new disease that is Coronavirus 2019 (COVID-19), the disease was first discovered in the city of Wuhan, the capital of Hubei province. In addition to causing thousands of deaths in China, the virus began to become a pandemic that spread rapidly to 213 countries, or territories around the world (Ramatillah and Isnaini 2021). Coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that attacks the lower respiratory tract (Lee et al. 2020). So far the World Health Organization has reported more than 6 million cases of COVID-19 with more than 150 thousand deaths in Indonesia as of June 1, 2022 (WHO Coronavirus (COVID-19) Dashboard | WHO Coronavirus (COVID-19) Dashboard With Vaccination Data n.d.).

Health workers (HW) are those who handle any work in the health care environment, being at the forefront of the risk of infection because SARS-CoV-2 is easily transmitted through the air, direct contact with contaminated surfaces, exposure in the workplace, and inadequate use of personal protective equipment (PPE) (Soebandrio et al. 2021). Some studies in some countries state that, risk factors among health workers are lack of PPE, exposure to infected patients, overwork, poor infection control, and pre-existing conditions (Adelina and Dwijayanti 2021).

The Ministry of Health of the Republic of Indonesia stated that, technically, the Moderna vaccine has a high efficacy rate and is proven to be able to significantly suppress the transmission of COVID-19 in the United States so that the vaccine A third dose of Moderna is given to health workers as a booster in order to optimally protect them (Sekretariat Kabinet Republik Indonesia | Gov't to Provide Moderna's Vaccines for Public, Health Workers n.d.).

The Moderna COVID-19 vaccine is a vaccine developed by Moderna and the Vaccine Research Center at the National Institute of Allergy and Infectious Diseases (NIAID), within the National Institutes of Health (NIH) (Baden et al. 2021). This vaccine is based on messenger RNA (mRNA) which will later provide instructions to the host cell to produce the S antigen protein unique to SARS-CoV-2 so that the body can store immune information that is generated in immune cell memory (Moderna mRNA-1273, COVID-19 vaccine n.d.).

According to research by medxiv on the Effectiveness of a third dose of BNT162b2 or

mRNA-1273 vaccine for preventing post-vaccination COVID-19 infection: an observational study. The third dose of mRNA-1273 was 46.6% effective in preventing SARS-CoV-2 infection and 50.0% in preventing COVID-19 hospitalization. The study also showed a reduction in post-vaccination infection in people who received a third dose of the vaccine 6 months after completing the main series of mRNA-1273 (Sharma, Oda, and Holodniy 2021).

In an observational study of the third dose of mRNA was mild (i.e., fatigue, lymphadenopathy, nausea, and diarrhea) and there was no increase in which was significant in the EHR reporting of severe side effects after the third dose compared to after the second dose (Niesen et al. 2022).

Although data relating to efficacy and side effects regarding the moderna booster vaccine already exists. Further clinical research is needed on Effectiveness Evaluation among Indonesians especially for health workers by looking at various other aspects such as sociodemographies that allow there is a link with the efficacy and side effects of this vaccine.

## 1.1 Covid-19

SARS-CoV-2 is the novel coronavirus responsible for the 2019 Coronavirus Pandemic (COVID-19) disease. Coronavirus disease 2019 (COVID-19) is caused by the severity of the coronavirus acute respiratory syndrome (SARS-CoV-2). It has been declared a new pandemic by the World Health Organization (WHO) on March 11, 2020. The causes of COVID-19 are pneumonia and acute respiratory distress syndrome (ARDS). Other COVID-19 complications may include acute liver, heart, and kidney injuries, as well as secondary infections and inflammatory responses. The absence of protective immunity to the virus and this virus is then able to escape from the innate immune response. The innate immune sensing mechanism serves as the first line of defense antivirals, which is an important aspect of immunity to viruses (Umar et al. 2021).

SARS-CoV-2, SARS-CoV and MERS-CoV have a similar structure and phylogenetics, and consist of four main structural proteins: spike (S), envelope (E) glycoprotein, nucleocapsid (N), membrane protein (M), 16 proteins nonstructural, and 5-8 accessory proteins (Moncunill et al. 2022).

## 1.2 Symptoms of Covid-19

The average incubation period for COVID 19 is 5.2 days, symptoms usually begin with non-specific syndromes such as fever, dry cough, and malaise.

There are several systems that may be involved such as the respiratory system (cough, shortness of breath, sore throat, rhinorrhea, hemoptysis, chest pain), gastrointestinal (diarrhea, nausea, vomiting), musculoskeletal system (muscle pain), nervous system (headache and confusion). More common signs and symptoms are fever (83% -98%), cough (76% -82%), and shortness of breath (31-55%). There are about 15% of cases of fever, cough, and shortness of breath. No conjunctival injections were reported in the first series, with some cases under the age of 18. Post-onset symptoms are mild, with the average time for first hospital admission being 7 days. However, the disease develops into shortness of breath on the 8th day, acute respiratory distress syndrome (ARDS) on the 9th day, and the use of mechanical ventilation on the 10.5th day occurs in about 39% of patients (Wu, Chen, and Chan 2020).

However, the clinical condition can quickly develop into severe pneumonia and eventually, death, especially in patients who have comorbidities, such as obesity, type 2 diabetes and cardiovascular disease (Teotônio et al. 2021).

## 1.3 Vaccine

The covid-19 vaccine has four types, including mRNA vaccines were developed by Pfizer-BioNTech and Moderna. RNA and DNA vaccines are cutting-edge approaches that use genetic engineering of RNA or DNA to produce proteins that themselves trigger an immune response safely. Viral vector vaccines (adenoviruses) developed by Astra-Zeneca, Johnson & Johnson, Reithera and Sputnik. Viral vector vaccines use genetically engineered viruses and do not cause disease but produce coronavirus proteins to safely trigger an immune response. An inactivated viral vaccine was developed by Sinovac. Attenuated or attenuated viral vaccines use attenuated or attenuated forms of the virus to obtain an immune response without causing disease. A protein subunit vaccine developed by Novavax. Protein-based vaccines use harmless protein fragments, or protein shells, that mimic Covid-19 to safely produce an immune response (Mascellino et al. 2021).

Moderna vaccine also has been one of the preferred vaccines as it has a higher efficacy which is 94-95% vaccine efficacy that was tested in less than a year, recommended for 18 y old people and has been proven to have benefits in preventing SARS-CoV-2 (Article, Araminda, and Ramatillah 2022).

The mRNA-1273 vaccine is administered as a sterile liquid for injection at a concentration of 0.5 mg per milliliter. Normal saline is used as a diluent to

prepare the administered dose (Jackson et al. 2020). To date, 11.8 billion doses have been distributed and more than 60% of the population has been vaccinated.

## 2 MATERIALS AND METHODS

### 2.1 Design

This study used a mixed method and prospective crossectional studies, The sampling time is March-June 2022. The data collection technique carried out in this study is convenience sampling. Sampling takes all the items that make up the research inclusion criteria. The inclusion in this study is all health workers in Indonesia who received the third dose of vaccine or booster and are still actively working (not retired). The exclusion of this study is all health workers in Indonesia who suffer from cancer, HIV / AIDS, TB, autoimun.

### 2.2 Participants

Participants in this study were health workers in Indonesia that have been conducting a booster dose of vaccination with the vaccine Moderna. The total of participants in the study were 323 respondents.

### 2.3 Instruments

This study used questionnaires distributed through social media, such as WhatsApp, Twitter, Facebook, Instagram, and Telegram. The questionnaires consisting of questions about the identity, efficacy of the Moderna booster vaccine after the vaccinations, the short and long term and monitoring the efficacy of the vaccine for 6 months after being vaccinated.

### 2.4 Statistical Analysis

The collected results were analyzed using SPSS application version 25. Fisher, Chi-square, Mann-Whitney, and Kruskal Wallis tests were then performed to find the relationship between risk factors (gender, comorbidities, age, BMI) to the effectiveness of the vaccine. The value of $p < 0.05$ is considered significant.

### 2.5 Ethical Consent

This research has received ethical approval from the ethics committee of health research at the University of 17 August 1945 Jakarta, with approval letter No.37/KEPK-UTA45JKT/EC/EXP/07/2022.

## 3 RESULTS AND DISCUSSION

In this study, 323 respondents were found who worked as health workers with an age range of 21-58 years. All respondents have received a covid-19 vaccination booster dose of moderrna which is an inclusion of this study.

Based on figure 1, it can be seen that the number of female respondents is higher with a percentage of 75.85% compared to male respondents with a percentage of 24.15%.
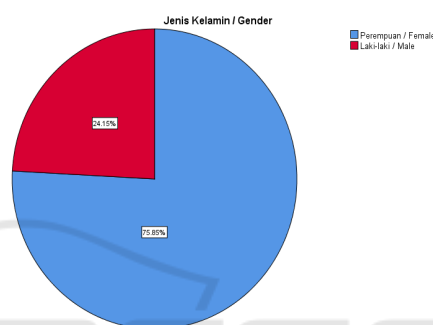


Figure 1: Gender

Respondents who participated in this study were spread almost throughout Indonesia. The highest percentage for respondents' domicile was 90.09% for Java Island, then Sumatra Island with 5.26%, Kalimantan Island with 3.72%, Sulawesi Island with presemtasse 0.62%, and Bali island with the lowest percentage is 0.31%. In this study, researchers were unable to get respondents with a domicile on Papua Island.

The percentage of respondents based on domicile can be seen in figure 2.
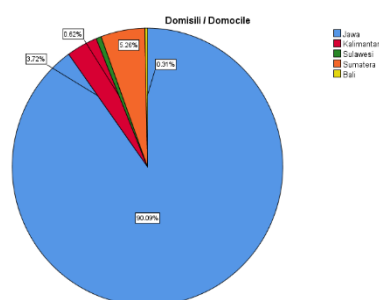


the 323 respondents who participated in this study, the highest percentage for respondents' jobs was 61.30% for Nurses, then Pharmacists with a percentage of 10.84%, General Practitioners with a

percentage 8.98%, Midwives with 7.43%, Pharmacist Assistants with a percentage of 5.26%, Dentists and Specialists with 1.86%, Pharmaceutical Technical Personnel and Dentist Assistants 0.93%, Radiographers and Radiology Assistants with the lowest percentage being 0.31%.

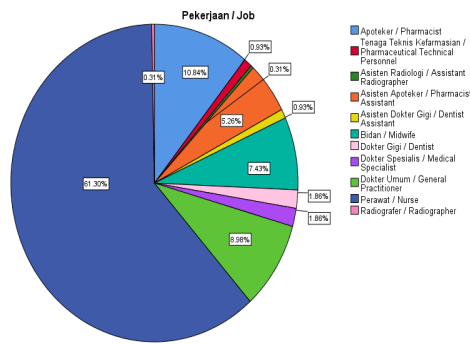The percentage of respondents by occupation can be seen in figure 3.



Figure 3: Job

In 323 respondents there was 1 respondent with asthma-borne disease. The percentage of respondents with comorbidities can be seen in figure 4.
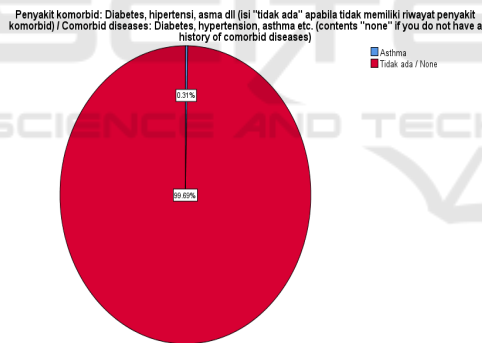


Figure 4: Comorbidities

## 3.1 Efefectiveness

The effectiveness of the Moderna booster vaccine in the 1-3rd month is 98.8% and, in the 4th-6th month is 98.5%.

Based on these data, it can be known that the effectiveness of the Moderna booster vaccine in a period of 1-6 months is 97.2%. This can be seen in figure 5.
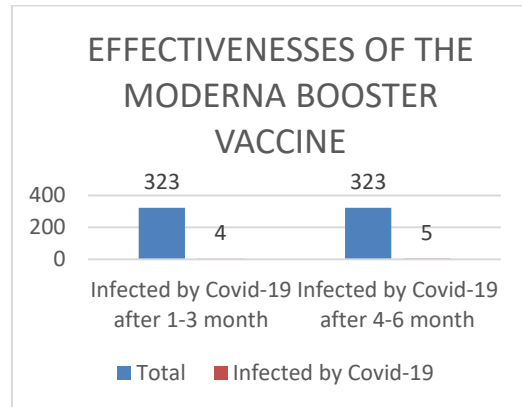


Figure 5: Effectivenesses of The Moderna Booster Vaccine

### 3.1.1 Association between Genders with Vaccine Effectiveness

It can be seen from the data presented in table 1, it is known that after the vaccine there were 20 female respondents who had diarrhea, then in 1-3 months after vaccination there was 1 respondent with female gender, and 3 respondents with male gender infected with covid-19. Then 18 female respondents felt a state of fatigue easily and another 15 female respondents felt arm pain. Immunotherapy aimed at stimulating immune responses, e.g. vaccines, develop a stronger response in women and may experience greater efficacy than men (Bischof, Wolfe, and Klein 2020)

### 3.1.2 Association between Jobs with Vaccine Effectiveness

From the data figure 6, it can be seen that there are 9 out of 11 workers who are recorded as having a fever, starting from Pharmaceutical Technical Personnel, Radiographers, Dental Assistants, Specialist Doctors, Pharmacists and Assistant Pharmacists, Midwives, Nurses, and the last one is the General Practitioner. Then for the Radiographer Assistant and Dentist no symptoms of fever were found.

In the study conducted by Angle, among health workers at a center in Tel Aviv, Israel who received the BNT162b2 vaccine had significantly lower symptomatic and asymptomatic sars-CoV-2 infection rates for more than 7 days after the second dose. Results are limited by observational design (Angel et al. 2021).

Table 1: Relationship between Genders with Vaccine Effectiveness.

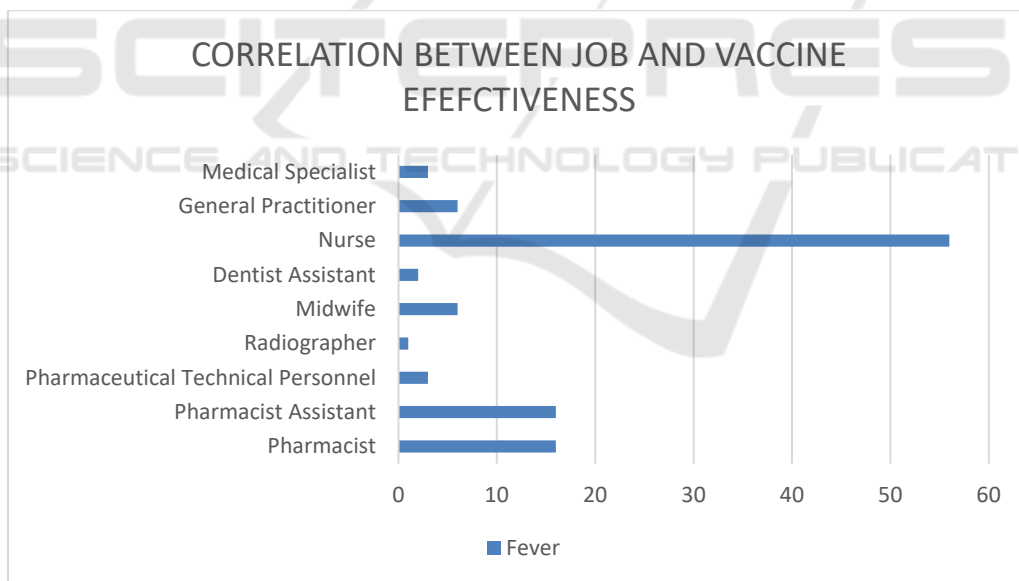| Variable | Female (n=245) | | Male (n=78) | | p-value |
|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage | |
| After the vaccine | | | | | |
| Diarrhea | 20 | 8,16% | - | - | 0,049* |
| 1-3 months | | | | | |
| Infected with Covid-19 after vaccination | 1 | 0,41% | 3 | 3,85% | 0,045* |
| 4-6 months | | | | | |
| Easy fatigue | 18 | 7,35% | - | - | 0,006* |
| Arm pain | 15 | 6,12% | - | - | 0,026* |



Figure 6: Relationship Between Job with Vaccine Effectiveness.

### 3.1.3 Association between Jobs with Vitamin Use after Vaccination

Table 2: Relationship between job and vitamins use after vaccination.

| Variable | TTK (n=3) | | Pharmacist (n=35) | | Assistant Pharmacist (n=17) | | p-value |
|---|---|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage | |
| Vitamin C | - | - | 5 | 14,29% | - | - | 0,016 # |
| Vitamin C &Vitamin D3 | - | - | 1 | 2,86% | - | - | 0,016 # |
| Vitamin D | - | - | - | - | - | - | 0,016 # |
| Vitamin B12 | 2 | 66,67% | 2 | 5,71% | 1 | 5,88% | 0,016 # |

Table 3: Relationship between job and vitamins use after vaccination.

| Variable | Specialist Doctor (n=6) | | General Practitioner (n=29) | | Nurse (n=198) | | p-value |
|---|---|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage | |
| Vitamin C | - | - | - | - | 30 | 15,15% | 0,016 # |
| Vitamin C &Vitamin D3 | - | - | 1 | 3,45% | 2 | 1,01% | 0,016 # |
| Vitamin D | - | - | - | - | 1 | 0,51% | 0,016 # |
| Vitamin B12 | 1 | 16,67% | 5 | 17,24% | 12 | 6,06% | 0,016 # |

#Test Chisquare

From the data presented in the table, it can be seen that a fairly large percentage of respondents who took vitamin C, vitamin B12, vitamin C & D3, in all jobs then with the smallest percentage was vitamin D in Nurses.

In research conducted by Jaehyun showed that taking vitamin D supplements at doses recommended by the Endocrine Society can help reduce the risk of SARS-CoV-2 infection from severe consequences, including death (Bae et al. n.d.).

The main reason for severe lung pain in COVID-19 patients is the immune system that does not function to kill the virus, but instead injures the patient, causing oxidative stress as well as radicals free. Vitamin C can reduce oxidative damage and neutralize these free radicals in the lungs (Sarowar Uddin et al. n.d.).

In COVID-19 and post-COVID-19 patients, symptoms such as vitamin B12 deficiency were found. Studies testing vitamin B12 supplementation can be used to alleviate some of the symptoms of various diseases that are also present in COVID-19. Thus, vitamin B12 can be used in the additional treatment of mild to severe COVID-19 symptoms, due to its analgesic function and role in neuromuscular disorders (Batista et al. n.d.).

In a study conducted by Igor conducted on hospitalized COVID-19 patients, one high dose of vitamin D3, when compared to placebo, vitamin D3 did not significantly reduce the duration of hospitalization. The findings in this study do not support the use of vitamin D3 for the treatment of moderate to severe COVID-19 (Murai et al. 2021).

Table 4: Relationship between job and vitamins use after vaccination.

| Variable | Dentist (n=6) | | Radiology Assistant (n=3) | | p-value |
|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Presentation | |
| Vitamin C | 1 | 16,67% | - | - | 0,016 # |
| Vitamin C &Vitamin D3 | 1 | 16,67% | - | - | 0,016 # |
| Vitamin D | - | - | - | - | 0,016 # |
| Vitamin B12 | - | - | 1 | 33,33% | 0,016 # |

Table 5: Relationship between job and vitamins use after vaccination.

| Variable | Dental Assistant (n=3) | | Midwife (n=24) | | Radiographer (n=1) | | p-value |
|---|---|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage | |
| Vitamin C | - | - | 1 | 4,17% | - | - | 0,016 # |
| Vitamin C &Vitamin D3 | - | - | 1 | 4,17% | - | - | 0,016 # |
| Vitamin D | - | - | - | - | - | - | 0,016 # |
| Vitamin B12 | 1 | 33,33% | 4 | 16,67% | 1 | 100% | 0,016 # |

### 3.1.4 Association between BMI with Vaccine Effectiveness.

Table 6: Presents the relationship between BMI on vaccine effectiveness

| Variable | Underweight (n=31) | | Normal (n=265) | | Overweight (n=24) | | Obesitas (n=3) | | p-value |
|---|---|---|---|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage | Frequency | Presentation | |
| Diarrhea | - | - | 17 | 6,41% | 3 | 12,5% | - | - | 0,049 # |
| Easy fatigue | 1 | 3,22% | 16 | 6,03% | - | - | 1 | 3,33% | 0,032 # |

#Tes Chisquare

It can be seen in the table presented that respondents with normal weight experience more get tired easily than diarrhea, respondents with overweight have more diarrhea, while respondents with underweight and obesity, they get tired easily.

In the study conducted by Iguacel, respondents with overweight and obesity experienced fewer side effects than respondents with normal weight In fact, in the relationship between side effects COVID-19 vaccines with gender and age are quite significant, while the status of body weight or BMI, is not significant (Iguacel et al. 2021).

In the other study by researchers at the University of Oxford, people with obesity have more risk and the cause is unknown. It is the same as seasonal flu infections. Among people with a low BMI the reduced effectiveness of COVID-19 vaccines may cause due to frailty or other conditions associated with low body weight. Further research is needed to explore the relationship between BMI and immune responses (Piernas et al. 2022).

## 4 CONCLUSIONS

In this study, it was found that the effectiveness of the vaccine was 97.2% and the variables related to the effectiveness of the vaccine were gender, BMI, and vitamins. In the sexes, women get greater side effects than men but have a greater degree of effectiveness, for the side effects of the moderna booster vaccine in this study found in female respondents namely; diarrhea, fatigue, arm pain, and 1 respondent infected with covid-19, while in men, 3 respondents infected with covid-19 were found. On the BMI it was found that the relationship was insignificant. Meanwhile, vitamins C, B12, and D were found to be able to help the body in recovery after being infected with covid-19.

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