



# COVID-19 Vaccination - Acceptance, Realization and Adverse Effects in an Orthopedic Hospital

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## Abstract

**Background:** Since its first report in 2019 the SARS-CoV-2 pandemic has spread from Wuhan, China across the globe with a major impact on daily and social life, education, health care and economic growth. Since the development and availability of COVID-19 vaccine it is believed that community immunity may be achieved.

**Material and Methods:** BioNTech/Pfizers' vaccine Comirnaty<sup>®</sup> was offered to all employees of a specialized 54 orthopedic hospital (Hessing Foundation, Augsburg, Germany). A questionnaire was established to document all adverse events and satisfaction with the vaccination regimen.

**Results:** 55.2% of the hospitals employees agreed to get vaccinated. With 98.7% the highest acceptance of the vaccine was found in the group of physicians, whereas the lowest acceptance of the vaccine was found in the group of housekeeping staff and medical functional service with only 25.7% respectively 25.5% being vaccinated. The questionnaire had a completion rate of 75.2%. No severe adverse effects were noted. Adverse effects were described to be mild to moderate. Local pain at injection site was more often reported after the first vaccination whereas general symptoms like fatigue, muscle pain and headache were predominant after the second vaccination. Satisfaction with the vaccination protocol and realization was 97.1%. 95.3% of employees vaccinated would agree to get vaccinated again.

**Discussion:** Our findings support previously published data that COVID-19 acceptance is associated with higher education and income, whereas younger females of lower education and income are less likely to accept vaccination. Serious adverse effects were absent and mild to moderate adverse effects tend to be more distinct after the second vaccination with Comirnaty<sup>®</sup>.

**Conclusion:** An effective vaccination protocol can be established at a specialized orthopedic hospital. Despite care for patients' affected by COVID-19 disease acceptance of COVID-19 vaccination of the employees of the specialized orthopedic hospital was comparable to the general population. Further efforts must therefore be taken to address social inequalities in vaccine hesitancy.

**Keywords:** COVID-19; Vaccination; Adverse effects; Acceptance; Orthopedic hospital

## Abbreviations

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus-2; FV: First Vaccination; SV: Second Vaccination; CDC: Centers for Disease Control and Prevention

## Introduction

The Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) pandemic was first reported in Wuhan, China in December 2019 [1]. From there COVID-19 has spread across the world with more than 150 millions confirmed infected and more than three millions dead [2], still counting.

The pandemic has severely affected and disrupted societies in various aspects starting from individual lives, to educational and health systems as well as economic growth.

Germany being one of the largest economies in the European Union [3] has, as many other European countries, been severely affected by the pandemic with 3.4 million confirmed cases and 83,292 COVID-19 associated deaths [2]. It is common knowledge that the widespread of preventative vaccination plays a pivotal role in protecting people from viral infections, resulting in complete

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elimination or at least significantly reduced transmission within the herd population [4]. Thus COVID-19 vaccination is believed to be a key strategy in overcoming the pandemic and preferably achieve herd immunity. Several vaccines have already been authorized whereas others are still in different stages of development or clinical testing [5]. In brief, those COVID-19 vaccine forms may be inactivated virus, live-attenuated virus RNA, DNA, recombinant protein or viral vector-based vaccine [6]. With BioNTech/Pfizers' Comirnaty® (BNT162b2) a mRNA vaccination with an efficacy in phase 3 trials of 95% became available [5,7] that was initially granted an emergency use authorization by the FDA [6] and a conditional marketing authorization by the European Commission/EMA on December 21<sup>st</sup> 2020 [8].

Exposure to people infected by the virus will obviously increase the probability of infection. This accounts for medical personal, healthcare providers and other essential workers in particular and despite personal protective equipment [9]. Moreover outbreaks within hospitals amongst personnel and patients have been described [10]. Accordingly, persons employed in units in medical facilities with a very high risk of exposure to SARS-CoV-2 were given highest priority vaccination by the Federal Ministry of Health of Germany [11].

Being founded in 1886, the Hessing Foundation, with its six highly specialized department's ranges amongst Europe's largest Specialized Orthopedic Hospitals with 150 patient beds, 6,900 in-patient and 39,600 out-patients treated annually [12]. Due to the rising numbers of COVID-19 infections within the administrative district of Augsburg, Germany and the overflow of patients from the University Hospital of Augsburg [13], the Hessing Foundation was called to help in treatment of SARS-COVID-19 patients on ICU and general stations. This was due to the integration of the Hessing Foundation into the so coined "Bavarian hospital plan" for the treatment of COVID-19 patients, regarding ventilated and non-ventilated patients. For that reason, Hessing-Foundation personnel became eligible for highest priority vaccination as previously mentioned.

The aim of the study was to identify vaccination acceptance amongst the personnel of a specialized Orthopedic Hospital and monitor adverse effects of the realized vaccination.

## Material and Methods

The realization of the vaccination against COVID-19 of the Hessing Foundations' personnel (Hessing Stiftung, Augsburg, Germany) started at the end of December 2020 and ended in February 2021. The used vaccine was the mRNA vaccine Comirnaty® (BNT162b2, BioNTech/Pfizer). It was administered twice with a time period of 3 weeks in between the two vaccinations. The vaccination centre was established within the specialized orthopedic hospital according to the regulatory rules of the German government as stated by the Federal Ministry of Health of Germany [11].

A survey was developed for this study regarding acceptance and compatibility respectively side effects (Table 1). The institutional review board of the Hessing Foundation approved the study with a positive vote [01/02/03/21].

## Results

### Acceptance of vaccination

In the orthopedic hospital 715 persons were eligible for COVID-19 vaccination. Thereof 395 accepted to get vaccinated (55.2%).

**Table 1:** Distribution of vaccinated personnel, Hessing Foundation.

Occupational group	No. eligible for vaccination	No. accepted vaccination	Percentage of vaccination
Physicians	77	76	98.7
Facility management (company technicians)	24	17	70.8
Physiotherapy	30	20	66.7
Nurses	252	145	57.5
Medical administration	142	79	55.6
Hospital kitchen	34	18	52.9
Housekeeping	105	27	25.7
Medical functional service	51	13	25.5
<b>Total</b>	<b>715</b>	<b>395</b>	<b>55.2</b>

Regarding medical professionals, 76 out of 77 physicians 137 (98.7%), 145 out of 252 nurses (hospital ward, anesthesiology, intensive care, scrub nurses) 138 (57.5%), 20 out of 30 physiotherapists (66.7%) and 13 out of 51 of the medical functional service (e.g. X-ray assistants, medical assistants, medical laboratory) (25.5%) were vaccinated. Moreover, 17 out of 24 employees of the facility management (company technicians) (70.8%), 18 out of 34 employees of the hospital kitchen (52.9%), 27 out of 105 of the housekeeping staff (25.7%) and 79 out of 142 of the associated medical administration (55.6%) agreed to get vaccinated (Table 1).

### Survey

75.2% of all vaccinated persons completed the survey regarding compatibility and side effects. Fortunately, there was not a single serious side effect after vaccination with Comirnaty® like a severe anaphylactic allergic reaction or a thrombotic/embolic event.

### Local effects at the vaccination site

The predominant side effect after the First Vaccination (FV) and Second Vaccination (SV) was local pain at the vaccination site (after the first administration 78.5% and 67.3% survey participants after the second). A swelling at the administration site occurred in 21.2% (FV) respectively 20.9% after SV. An overheating at the same site was documented in 14.5% (FV) and 14.8% (SV) respectively. Redness at the administration site and local swelling of lymph nodes were noticeably less common (8.1% and 4.0% (FV), respectively 9.8% and 9.8% (SV)). In summary, there was no significant difference regarding side effects after the first and second vaccination (Table 2).

### Systemic effects

Nearly half of all persons completed the survey (47%) were without a systemic reaction after the FV, in contrast only one third (31.7%) were symptoms free after the SV. Fatigue was the predominant symptom reported (33.7% (FV), respectively 55.2% (SV)). The second most common side effect was headache (28.6% (FV), respectively 37.4% (SV)). Other often mentioned symptoms were muscle (26.3% (FV) and 37% (SV)) and joint pain (10.4% (FV) and 25.9% (SV)). Regarding fever, there was again a notable increase comparing the situation after the first and second vaccination. Only 3.4% had fever after FV, however 11.1% after SV. In addition, night sweats were only documented in 5.4% after the first vaccination but in 14.1% after the second one. Joint swelling was an underrepresented symptom with 1% after the first Comirnaty® injection and was also not often represented after the SV with only 3.7%. This however

**Table 2:** Survey with frequency of side-effects/symptoms in descending order.

Local effects	First vaccination in %	Second vaccination in %
Local pain	78.5	67.3
Swelling	21.2	20.9
Overheating	14.5	14.8
Redness	8.1	9.8
Swelling of lymph nodes	4	9.8
Systemic effects	First vaccination in %	First vaccination in %
Fatigue	33.7	55.2
Headache	28.6	37.4
Muscle pain	26.3	37
Joint pain	10.4	25.9
Night sweats	5.4	14.1
Fever	3.4	11.1
Nausea	3	6.8
Swelling of lymph nodes	2.4	4.7
Joint swelling	1	3.7

represents an increase by the factor of three. Nausea and systemic lymph nodes swelling was rarely documented (Table 2).

### Satisfaction

Overall satisfaction in vaccination protocol and procedure was high (97.1%). 95.3% of all vaccinated persons with complete participation in the survey would undergo vaccination against COVID-19 again. Named reasons against a future vaccination were side effects, uncertainty if there is a benefit and vaccination is “maybe only briefly effective”.

### Discussion

The COVID-19 disease still has a major impact on most everyone's daily life. The key to return to a “normal” life is the highly cited concept of herd immunity (also known as population/community) that has made its way not only into scientific but also social media. Herd immunity i.e. community immunity is hereby defined as “a situation in which a sufficient proportion of a population is immune to an infectious disease (through vaccination and/or prior illness) to make its spread from person to person unlikely”. This means that even individuals not vaccinated (such as newborns and those with chronic illnesses) are offered some protection because the disease has little opportunity to spread within the community [14]. It is assumed that a vaccine against COVID-19 is necessary to achieve this herd immunity [15]. Since the availability of COVID-19 vaccine many countries have hence shown unprecedented efforts to vaccinate as many individuals as possible in order to change the course of the COVID 19 pandemic.

Despite the fact, that orthopedic surgeons are not frontline in managing COVID-19 patients, the pandemic had an significant impact on all aspects of orthopedic care and practice [16] However, due to the overflow of patients during the pandemic our specialized orthopedic hospital actually became frontline in treating such patients according to the Bavarian Hospital Plan by the Federal Ministry of Health of Bavaria, Germany [17]. This poses a possible yet not previously described scenario also for other regions and countries. Due to this fact, personnel of the Hessing Foundation, Augsburg, Germany became eligible for priority vaccination with BioNtech/

Pfizers' Corminaty' COVID-19 vaccine.

We therefore conducted a survey based study of acceptance and adverse effects of mRNA based COVID-19 vaccination with Comirnaty' in a specialized orthopedic hospital (Hessing Stiftung, Augsburg Germany).

An ongoing multicentre trial has proved a two-dose regimen of Corminaty' to be safe and 95% effective against COVID-19. The safety profile was hereby characterized by short-term, mild-to- moderate pain at the injection site, fatigue and headache. The incidence of serious adverse events was low and similar in the vaccine and placebo groups [7].

These findings are consistent with the data published by the Centers for Disease Control and prevention (CDC) [18]. Nevertheless anaphylaxis, a life-threatening allergic reaction, has occurred at a rate of 11.1 per million doses administered [19]. These findings are also consistent with our relatively small sample group where only mild to moderate local and systemic reactions were observed (Table 2). However, symptoms of systemic effects were more distinct after the second vaccination in our cohort (Table 2). Yet again this has previously been described in a recent study of vaccinated Czech Healthcare Workers [20]. The more interesting finding in our study however is the acceptance of COVID-19 vaccination in a specialized orthopedic hospital of only 55.2% (Table 1). This reflects an even lower proportion than stated in a global survey of potential acceptance of a COVID-19 vaccine of 71.5% [21, 22]. Yet the acceptance of 97.8% (Table 1) amongst the homogenous group of physicians with a high level of education and income stands out and has previously been reported [21,22]. The lowest acceptance in the specialized orthopedic hospital of COVID-19 vaccine was found in the workforce of medical functional services and housekeeping with 25.5% and 25.7% respectively (Table 1). With the mentioned housekeeping staff being all female, of lower education and income and a high percentage of ethnic minority groups and the medical functional services also containing a large amount of female workers as well as a lower average age these findings are again consistent with published results stating that being female, younger, of lower income or education level and belonging to an ethnic minority group is associated with being less likely to intend to vaccinate [23]. This is despite the fact that health care workers and people with family members/friends who received a COVID-19 vaccination are more likely to intend to receive the vaccine if available [24].

In contrast, the company technicians of the facility management in our hospital all being male and central Europeans with literally no migration background were the second highest group to accept vaccination (Table 1).

### Conclusion

To our knowledge this is the first study regarding acceptance and adverse effects of BioNtech/Pfizers' Corminaty' COVID-19 vaccination in a specialized orthopedic hospital. Findings of our study were consistent with previous findings in literature of mainly mild to moderate symptoms slightly more dominant after the second vaccination. Moreover, the acceptance of vaccination is highest in highly educated personnel with a higher income and lowest in work groups with predominantly younger female employees being of lower education, income and a high percentage of ethnic minority groups. Community immunity plays a key role in overcoming the global COVID-19 pandemic. Vaccination against COVID-19 again

is considered to be vital in succeeding to achieve this immunity. Further efforts must therefore be taken to address social inequalities in vaccine hesitancy.

Obviously, this study does have certain limitations. To begin with, no questionnaire was made available to employees who were not willing to get vaccinated. More information could have been gathered regarding the vaccine hesitancy. A further limitation is that no differentiation was made between the age groups and ethical demography. Finally, due to the relatively small sample size, no statistical evaluation was performed.

### Author's Contribution

Study design was established by SV, TB, RL and AF. VH did the data analysis. SV and MH were responsible for data interpretation and writing of the manuscript. All authors discussed the results and were contributed to the final manuscript.

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