

# Side effects after COVID-19 vaccinations among residents of Poland

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**Abstract. – OBJECTIVE:** Side effects of vaccines are common, but people react differently to different vaccines. Manufacturers provide lists of the side effects of their products. Adverse reactions are proof of the effectiveness of vaccines and that the immune system is responding. In this study, we compare the side effects of the AstraZeneca and Pfizer vaccines. Our survey results show that the side effects of the first dose of the AstraZeneca vaccine are more common than after the first and second doses of the Pfizer vaccine. Most respondents in our survey reported at least one side-effect after the AstraZeneca and Pfizer vaccine, but these reactions were less common after the Pfizer preparation.

**PATIENTS AND METHODS:** A survey was distributed via the internet. It was conducted among people vaccinated with Pfizer or AstraZeneca. The respondents were asked about the side effects after the first and second doses of the vaccines, such as injection site pain, arm pain, muscle pain, headache, fever, chills, and fatigue.

**RESULTS:** The questionnaire was completed by 705 people. 196 of them had been vaccinated with Pfizer and 509 with AstraZeneca. Among those vaccinated with the first dose of the AstraZeneca vaccine, 96.5% reported at least one post-vaccination reaction. 17.1% of respondents reported all the side effects listed in the survey. Among those vaccinated with the first Pfizer dose, vaccine reactions were reported by 93.9% of respondents; 2% of respondents experienced all the side effects mentioned in the survey. The second dose of the Pfizer vaccine caused post-vaccinal reactions in most of the subjects: 54.8% of respondents had more adverse reactions, and 15.8% had fewer adverse reactions than after the first dose of this vaccine; 29.4% experienced the same side effects after the first and second doses of the Pfizer vaccine.

**CONCLUSIONS:** Side effects as a result of vaccination are not rare and are proof that the immune system is responding. However, severe adverse reactions to vaccines can be danger-

ous, and they engender fear. Concerns about the side effects and complications of COVID-19 vaccines may eclipse opinions regarding their benefits. This study shows that the first dose of the AstraZeneca vaccine causes side effects more often than either dose of the Pfizer vaccine.

*Key Words:*

COVID-19 vaccine, AstraZeneca, Pfizer, side effects.

## Introduction

COVID-19 vaccines have been the world's most desirable commodity over the past year. Many companies have attempted to develop an effective and safe preparation in the shortest possible time. Currently, several products that differ in form and effectiveness are approved for sale. These are preparations based on mRNA technology, such as Moderna and Pfizer. Others like AstraZeneca and Sputnik-V are vector vaccines<sup>1</sup>.

Until the end of March 2021 in Poland, vaccinations were carried out according to a scheme based on division into groups. Group 0 included people born before 1950 and health care professionals. This group mainly consists of doctors and nurses, but also physiotherapists, medical analysts, pharmacists, and students of medical faculties. The Pfizer vaccine was used in this group. Vaccinations in group 0 started in December 2020. This made it possible to administer the second dose in January and February 2021. Group 1 included teachers up to 65 years of age, who received the AstraZeneca vaccine. People in this group who were born before 1956 received a different product, mostly Pfizer. Vaccinations in group 1 began at the end of February 2021, so most people in this group have only received the first dose of the vaccine so far<sup>2</sup>.

Vaccine manufacturers provide a list of post-vaccination side effects with their preparations. Adverse vaccine reactions are evidence of the effectiveness of the vaccine and of increasing immunity against this disease. The list of these reactions includes injection site pain and swelling, fatigue, headache, chills, fever, muscle and joint pain, nausea, delayed swelling, redness or a rash at the injection site, swollen lymph nodes (typically manifests as a lump in the armpit or above the collarbone). Most of these reactions should resolve within a few days, according to the U.S. Center for Disease Control and Prevention (CDC)<sup>3,4</sup>.

### Patients and Methods

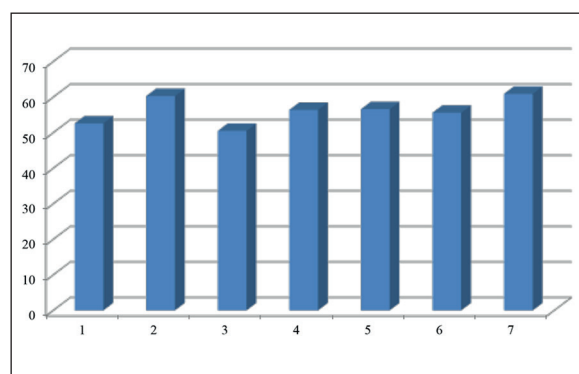
For this study, we collected data on the side effects of two vaccines used in Poland: Pfizer and AstraZeneca. A survey was distributed via the internet. It was conducted among people from group 0 and group 1.

The questions that were included in the survey are: age, sex, occupation, type of vaccine received, number of doses of the vaccine taken, side effects after the first and second dose of the vaccine (injection site pain, arm pain, muscle pain, headache, fever, chills, fatigue). Every respondent could also mention unusual symptoms. Additionally, the respondents were asked if they had suffered from COVID-19. If they had, they were asked about the course of the disease and the symptoms that occurred. Respondents could also add their own opinions.

### Results

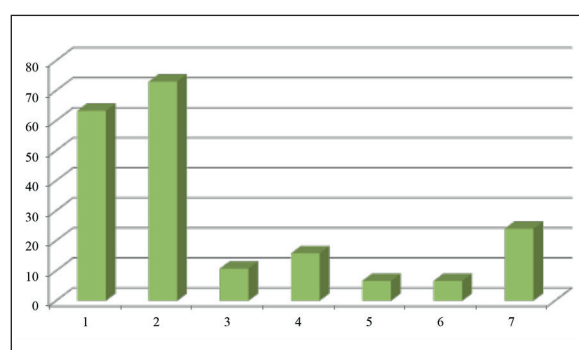
The questionnaire was completed by 705 people. 196 of them had been vaccinated with Pfizer and 509 with AstraZeneca. The age of the vaccinated people varies between 20 and 84 years. The 40-60 age range is predominant (438/62.1%). Among the respondents, 599 (85%) were women and 106 were men (15%).

The occurrence of adverse reactions among people vaccinated with a single dose of the AstraZeneca or Pfizer vaccine is shown in Figure 1 and Figure 2. Of the 509 people vaccinated with AstraZeneca, 268 individuals (52.6%) reported injection site pain, 307 (60.3%) reported shoulder pain, 257 (50.5%) reported muscle aches, 287 (56.4%) reported headaches, 288 (56.6%)



**Figure 1.** Side effect in vaccinated with one dose of AstraZeneca: 1 - injection site pain, 2 - arm pain, 3 - muscle pain, 4 - headache, 5 - fever, 6 - chills, 7 - fatigue.

reported fever, 283 (55.6%) reported chills, and 310 (60.9%) reported weakness. In this group, 87 individuals (17.1%) reported all the listed side effects, and 131 individuals (25.7%) reported five or six of these reactions. The remaining respondents reported several side effects, but in different combinations. Additional side effects not mentioned in the survey were reported by 115 people (22.6%): nausea (14/2.7%); vomiting (7/1.4%); diarrhea (3/0.6%) and general stomach problems (6/1.2%); osteoarticular pain, e.g., back pain or neck pain (17/3.3%); drowsiness (9/1.8%); feeling cold (7/1.4%), fast heart rate and palpitations (4/0.8%). Individual respondents also reported symptoms, such as dyspnea, cough, stuffy nose, dizziness, fainting, thirst, excessive sweating, sore throat, enlarged lymph nodes, loss of appetite, insomnia, irritability, stupor, photosensitivity, eye pain, numbness in



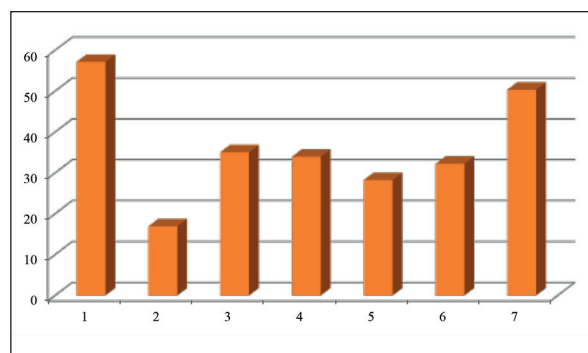
**Figure 2.** Side effect in vaccinated with one dose of Pfizer: 1 - injection site pain, 2 - arm pain, 3 - muscle pain, 4 - headache, 5 - fever, 6 - chills, 7 - fatigue.

the extremities, generally feeling unwell, rash, kidney pain, and blue lips and nails. The most unusual side effects were reported by those who also reported most of the basic side effects listed above. Of those vaccinated with AstraZeneca, 18 (3.5%) reported no side effects.

Of the 196 people vaccinated with the first dose of Pfizer, 124 (63.3%) reported injection site pain, 143 (73%) reported shoulder pain, 21 (10.7%) reported muscle aches, 31 (15.8%) reported headaches, 13 (6.6%) reported fever, 13 (6.6%) reported chills, and 47 (24%) reported weakness. In this group, 4 individuals (2%) reported all the listed side effects. Additional side effects not mentioned in the survey were reported by 14 people (7.1%): neck pain, nausea, vomiting, drowsiness, diarrhea, dizziness, hand numbness, enlarged lymph nodes, decreased alcohol tolerance. Each of these symptoms was reported by only one person. In this group, 12 persons (6.1%) reported no side effects.

After the second dose of the Pfizer vaccine, many more people reported side effects than after the first dose (Figure 3). Among 177 individuals who had received the second dose, 101 (57.1%) reported injection site pain, 30 (16.9%) reported shoulder pain, 62 (35%) reported muscle aches, 60 (33.9%) reported headaches, 50 (28%) reported fever, 57 (32.2%) reported chills, and 89 (50.3%) reported weakness. Additional side effects not mentioned in the survey were reported by 26 people (14.7%); no side effects were reported by 2 individuals (1.1%).

After the second dose of the Pfizer vaccine, 97 people (54.8%) reported more side effects and 28 persons (15.8%) reported fewer side effects than after the first dose. 52 persons (29.4%) had the



**Figure 3.** Side effect in vaccinated with second dose of Pfizer: 1 - injection site pain, 2 - arm pain, 3 - muscle pain, 4 - headache, 5 - fever, 6 - chills, 7 - fatigue.

same adverse reactions after both the first and second doses of this vaccine.

As revealed by the answers given in the questionnaire, a history of COVID-19 disease does not correlate with the occurrence of vaccine reactions. Adverse vaccine reactions occurred in both those who had no COVID-19 and those who were previously ill.

## Discussion

Side effects as a result of vaccination are not rare and are proof that the immune system is responding<sup>5,6</sup>. However, severe side effects can be dangerous, and they engender fear. Concerns about the complications and side effects of COVID-19 vaccines may eclipse opinions about their benefits and thus influence the decision to accept or reject the vaccination.

This study shows that a single dose of the AstraZeneca vaccine causes side effects more often than the Pfizer vaccine. The analysis shows that after the second dose of the Pfizer vaccine, 84.2% of subjects had the same or more adverse reactions than after the first dose of this vaccine. Comparing these data shows that the second AstraZeneca dose can be expected to cause even more side effects than the first dose. In this situation, it is not surprising that many people refuse the AstraZeneca vaccine, not only in Poland but also in other European countries.

This study had some limitations. First, the analysis was based only on completed surveys, and we had no influence on the participants in the research group. The sex and age disproportion of the participants is due to the fact that most healthcare professionals, i.e., nurses, and most teachers in Poland are women aged 40-60. Thus, women dominate among the vaccinated so far. This means that we are not able to establish a relationship between side effects and the age of the vaccinated people. We also cannot compare results collected among women to those collected among men.

Many more people in the research group had been vaccinated with AstraZeneca than with Pfizer, which can be explained by the general reluctance of health care professionals to participate in various types of research. On the other hand, people vaccinated with AstraZeneca who experienced more frequent side effects might have been more willing to complete the survey and share their experiences.

The side effects of all COVID-19 vaccines wear off over time<sup>7,8</sup>. It takes a few days, as some respondents mentioned in additional comments in the survey.

COVID-19 is not characterized by a very high mortality rate, but it causes significant limitations in the functioning of society<sup>9</sup>. Due to limited treatment options, vaccines are the only way to stop this pandemic as they help build protection against this disease and are one of the most important weapons in the fight against this pathogen<sup>10</sup>.

### Conclusions

To sum up, it is important that patients are informed of any possible post-vaccine or allergic reactions. Every patient should be able to consult the available data on the safety of vaccines. However, transient reactions should not deter people from being vaccinated against COVID-19. Most importantly, vaccinations are currently the only effective weapon in the fight against this infection.

### Conflict of Interest

The Authors declare that they have no conflict of interests.

### References

- World Health Organization (WHO). COVID-19 vaccines. Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines>. Cited dated, March.27, 2021.
- Service of the Republic of Poland. Available at: [www.gov.pl/web/koronawirus](http://www.gov.pl/web/koronawirus). Cited dated, March.27, 2021.
- Centre for Disease Control Prevention (CDC). Information about the COVID-19 Vaccines. Available at: [https://www.cdc.gov/mmwr/volumes/70/wr/mm7008e3.htm?s\\_cid=mm7008e3\\_w#T1\\_dow](https://www.cdc.gov/mmwr/volumes/70/wr/mm7008e3.htm?s_cid=mm7008e3_w#T1_dow). Cited dated, March.27, 2021.
- Centre for Disease Control Prevention (CDC). Information about the Pfizer-BioNTech COVID-19 Vaccine. Available at: <https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/pfizer-biontech-covid-19-vaccine#additional>. Cited dated, March. 27, 2021.
- Mulligan MJ, Lyke KE, Kitchin N, Absalon J, Gurtman A, Lockhart S, Neuzil K, Raabe V, Bailey R, Swanson KA, Li P, Koury K, Kalina W, Cooper D, Fontes-Garfias C, Shi PY, Türeci Ö, Tompkins KR, Walsh EE, Frenck R, Falsey AR, Dormitzer PR, Gruber WC, Sahin U, Jansen KU. Phase I/II study of COVID-19 RNA vaccine BNT162b1 in adults. *Nature* 2020; 586: 589-593.
- Walsh EE, Frenck RW Jr, Falsey AR, Kitchin N, Absalon J, Gurtman A, Lockhart S, Neuzil K, Mulligan MJ, Bailey R, Swanson KA, Li P, Koury K, Kalina W, Cooper D, Fontes-Garfias C, Shi PY, Türeci Ö, Tompkins KR, Lyke KE, Raabe V, Dormitzer PR, Jansen KU, Şahin U, Gruber WC. Safety and immunogenicity of two RNA-based Covid-19 vaccine candidates. *N Engl J Med* 2020; 383: 2439-2450.
- Folegatti PM, Ewer KJ, Aley PK, Angus B, Becker S, Belij-Rammerstorfer S, Bellamy D, Bibi S, Bittaye M, Clutterbuck EA, Dold C, Faust SN, Finn A, Flaxman AL, Hallis B, Heath P, Jenkin D, Lazarus R, Makinson R, Minassian AM, Pollock KM, Ramasamy M, Robinson H, Snape M, Tarrant R, Voysey M, Green C, Douglas AD, Hill AVS, Lambe T, Gilbert SC, Pollard AJ; Oxford COVID Vaccine Trial Group. Safety and immunogenicity of the ChAdOx1 nCoV-19 vaccine against SARS-CoV-2: a preliminary report of a phase 1/2, single-blind, randomised controlled trial. *Lancet* 2020; 396: 467-478.
- Voysey M, Clemens SAC, Madhi SA, Weckx LY, Folegatti PM, Aley PK, Angus B, Baillie VL, Barnabas SL, Bhorat QE, Bibi S, Briner C, Cicconi P, Collins AM, Colin-Jones R, Cutland CL, Darton TC, Dheda K, Duncan CJA, Emary KRW, Ewer KJ, Fairlie L, Faust SN, Feng S, Ferreira DM, Finn A, Goodman AL, Green CM, Green CA, Heath PT, Hill C, Hill H, Hirsch I, Hodgson SHC, Izu A, Jackson S, Jenkin D, Joe CCD, Kerridge S, Koen A, Kwatra G, Lazarus R, Lawrie AM, Lelliott A, Libri V, Lillie PJ, Mallory R, Mendes AVA, Milan EP, Minassian AM, McGregor A, Morrison H, Mujadidi YF, Nana A, O'Reilly PJ, Padayachee SD, Pittella A, Pletsted E, Pollock KM, Ramasamy MN, Rhead S, Schwarzbald AV, Singh N, Smith A, Song R, Snape MD, Sprinz E, Sutherland RK, Tarrant R, Thomson EC, Török ME, Toshner M, Turner DPJ, Veekmans J, Villafana TL, Watson MEE, Williams CJ, Douglas AD, Hill AVS, Lambe T, Gilbert SC, Pollard AJ; Oxford COVID Vaccine Trial Group. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *Lancet* 2021; 397: 99-111.
- World Health Organization (WHO). Coronavirus disease (COVID-19) outbreak situation. Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>. Cited date March. 27, 2021.
- Dong Y, Dai T, Wei Y, Zhang L, Zheng M, Zhou F. A systematic review of SARS-CoV-2 vaccine candidates. *Signal Transduct Target Ther* 2020; 5: 237.