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GENDER DIFFERENCES IN COVID-19 VACCINATION IN UKRAINE

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The COVID-19 pandemic is among the greatest challenges for the worldwide. Vaccine development is an effective weapon against pandemic development. But there is a paucity of data of COVID-19 vaccine data by sex/gender in Ukraine. The purpose of the study was to assess diversity in COVID-19 vaccination among gender groups of Ukrainian population. A retrospective-archive study was conducted in Ukraine from 24 February 2021 to 16 January 2022. The obtained data showed in trends gender differences in COVID-19 vaccination status. Women preferred vaccination with Pfizer/Biontech and AstraZeneca vaccines more often than men. Significantly higher level of weekly cases among persons who received two doses than one dose of Pfizer/BioNTech vaccine with as among males ($p<0.05$), as females ($p<0.05$). These findings support idea that a gendered lens should also be applied when designing COVID-19 vaccination campaign that can help to maximize benefits and minimize adverse events.

Key words: vaccine, SARS-CoV-2, sex, Ukraine

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ГЕНДЕРНІ ВІДМІННОСТІ У ВАКЦИНАЦІЇ ВІД COVID-19 В УКРАЇНІ

Пандемія COVID-19 є одним із найбільших викликів для всього світу. Розробка вакцин є ефективним засобом боротьби проти розвитку пандемії. Проте, даних про COVID-19 вакцинацію за статтю/гендером в Україні мало. Метою дослідження було оцінити різноманітність вакцинації проти COVID-19 серед гендерних груп українського населення. Ретроспективно-архівне дослідження проводилося в Україні з 24 лютого 2021 року по 16 січня 2022 року. Встановлено гендерні відмінності в трендах вакцинації проти COVID-19. Жінки віддавали перевагу щепленню вакцинами Pfizer/Biontech та AstraZeneca частіше, ніж чоловіки. Відмічено вірогідно вищу кількість тижневих випадків вакцинації двома дозами вакцини Pfizer/BioNTech, ніж однією дозою, як серед чоловіків ($p<0.05$), так і серед жінок ($p<0.05$). Отримані дані дозволяють зробити висновки про необхідність врахування гендерної відмінності при плануванні кампанії вакцинації проти COVID-19, що сприятиме максимізації переваг та мінімізації побічних ефектів.

Ключові слова: вакцина, SARS-CoV-2, стать, Україна

The COVID-19 pandemic is among the greatest challenges for the worldwide. In Ukraine more than 5.4 million people have already been infected with SARS-CoV-2 and with 110 920 deaths [3,10]. COVID-19 vaccine development is an effective weapon against pandemic [12]. Five types of COVID-19 vaccines (AstraZeneca (Covishield, SKBio), Coronavac/Sinovac Biotech, Comirnaty/Pfizer-BioNTech.) have been approved and vaccination rates accelerated as of February 24, 2021. It was estimated that 50–70% rates of vaccination are needs to receive for development herd immunity and protection from a severe increase of infections SARS-CoV-2. But there is a paucity of data of COVID-19 vaccine data by sex/gender in Ukraine. Therefore, analysis of COVID-19 vaccination trends with a gender-sensitive way can help to assist in building public confidence and promote high vaccine coverage.

Sex differences on infections SARS-CoV-2 as rates of illness, death, immune response to vaccines across the life course and acceptance to vaccination are well documented. Men with COVID-19 are more at risk for worse outcomes and death [8]. Men's cases tended to be more serious than women's and the number of men who died from COVID-19 is 2.4 times that of women. Women with mild to moderate COVID-19 infection show more robust cellular responses and higher antibody levels than men, while men show higher levels of inflammatory cytokines and chemokines than women [13]. Some surveys reported about lower COVID-19 vaccination intentions among women [15]. Analysis of the rate of current COVID-19 vaccine rollout taking into account gender; the potential impact of vaccinations on pandemic outcomes such as morbidity and mortality have the potential to shape public attitudes towards vaccinations, reduce vaccine hesitancy and, ultimately, lead to an improved response to the pandemic.

The purpose of the study was to assess diversity in COVID-19 vaccination among gender groups of the Ukrainian population.

Materials and methods. Data collection of COVID-19 vaccination were derived from the website of the Ministry of Public Health of Ukraine [5]. A retrospective-archive study was conducted in Ukraine from 24 February 2021 to 16 January 2022. The beginning time point for accessing COVID-19 vaccination was selected based on the date when Ukraine started its vaccinations, and the end time point was the date of completion of our analysis.

The variables used in this analysis were the weekly total number of people who received 1 dose and all doses prescribed by the vaccination protocol (complete vaccination) taking into account gender. In addition, it was described the distribution of different types of vaccines during campaign of COVID-19 vaccination, including the time of vaccine initiation and vaccination rates, gender characteristics among Ukrainian population, using aggregated vaccination data.
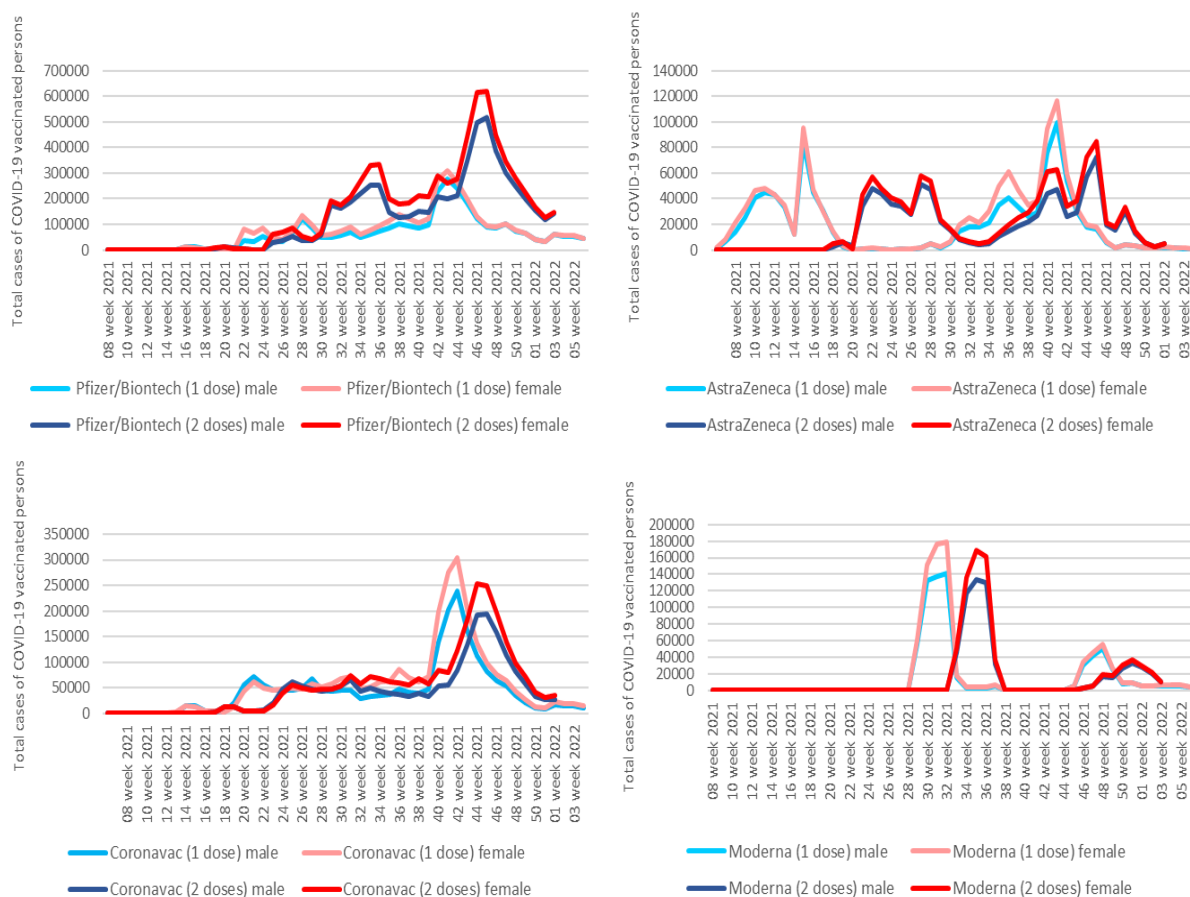

Fig. 1. Gender differences in COVID-19 vaccination trends with 1 and 2 doses in Ukraine

In this study, "STATISTICA 10.0" (StatSoft, Inc., USA) was used for basic statistical description and data analysis. Received data presented as sum, median, interquartile range (IQR). Wilcoxon signed-rank test was used to compare the locations of two populations using two matched sample. $p < 0.05$ was considered statistically significant.

Results of the study and their discussion. Fig. 1 shows that the beginning of the vaccination campaign started with the AstraZeneca vaccine on February 24, 2021. Women started receiving 1st or 2nd doses of the AstraZeneca vaccine more intensively than men. This trend was maintained until the end of the studied period. The peak of vaccination cases with the 1st dose of the AstraZeneca vaccine was noted

at weeks 11, 15, 36 and 41 of 2021, and with the 2nd dose – at weeks 23, 28, 40, 45 of 2021. Between the 1st and 2nd doses of vaccines injection, there was 4 weeks shift among women and 6 weeks shift for men.

At the beginning of April 2021 (15th week), vaccination with the Coronavac vaccine began. There were 2 maximal peaks of 1 dose of the Coronavac vaccine injection – on 23 and 43 weeks 2021. On week 23 of 2021, men were vaccinated more intensively than women (71 749 persons vs. 62 996 persons, respectively), while on week 43, the opposite trend was observed (202 946 persons vs. 274 996 persons, respectively). The peak of vaccination cases with 2nd dose of the Coronavac vaccine was observed on 25 and 45 weeks 2021. Similarly, on 25th week 2021, men were intensively vaccinated than women (21 332 persons vs. 17 158 persons, respectively), and the opposite trend was registered on 45th week (132 931 persons vs. 181 678 persons, respectively). Between the 1st and 2nd doses of vaccine injection was noted 3 weeks shift for women and 2 weeks shift for men.

Vaccination with the Pfizer/BioNTech vaccine on 16th week of 2021 was began. The peak of maximum 1st dose of the Pfizer/BioNTech vaccine injection was noted on 22, 28 and 42 weeks 2021, and 2nd dose vaccine on 20, 25, 36 and 45 weeks. In dynamics, the number of women prevailed over the number of men during vaccination with 1st dose and 2 doses of the Pfizer/BioNTech vaccine. It was noted a 4-week shift between 1st and 2nd doses of the Pfizer/BioNTech vaccine for both genders.

The beginning of vaccination with Moderna vaccine on 29th week 2021 was registered. The maximum level of vaccination with 1st dose was noted at 30 and 48 weeks, with 2nd doses – at 33 and 51 weeks 2021 for both genders. The number of men and women who vaccinated with 1 dose or 2 doses of the Moderna vaccine was comparable throughout the entire period. It was not detected any shift between 1st and 2nd doses of vaccination with the Moderna vaccine.

It was revealed (fig. 2) that weekly count of total cases who were vaccinated with a one dose by vaccine Pfizer/BioNTech among men was 3134682 persons (median 60693.5 [IQR 36089–88805]) and women - 3696246 persons (median 75553 [IQR 49849–107794]), vaccine Coronavac among men - 2185995 persons (median 42917 [IQR 14855–54944]) and among women 2756235 persons (median 49320 [IQR 18324–69252]), vaccine AstraZeneca among men – 970020 persons (median 13095 [IQR 1601–31284]) and among women - 1153887 persons (median 13376,5 [IQR 1869–35350]), vaccine Moderna among men – 701268 persons (median 7019,5 [IQR 5275–41919]) and among women - 825179 persons (median 7583 [IQR 5715–45695]) in Ukraine.
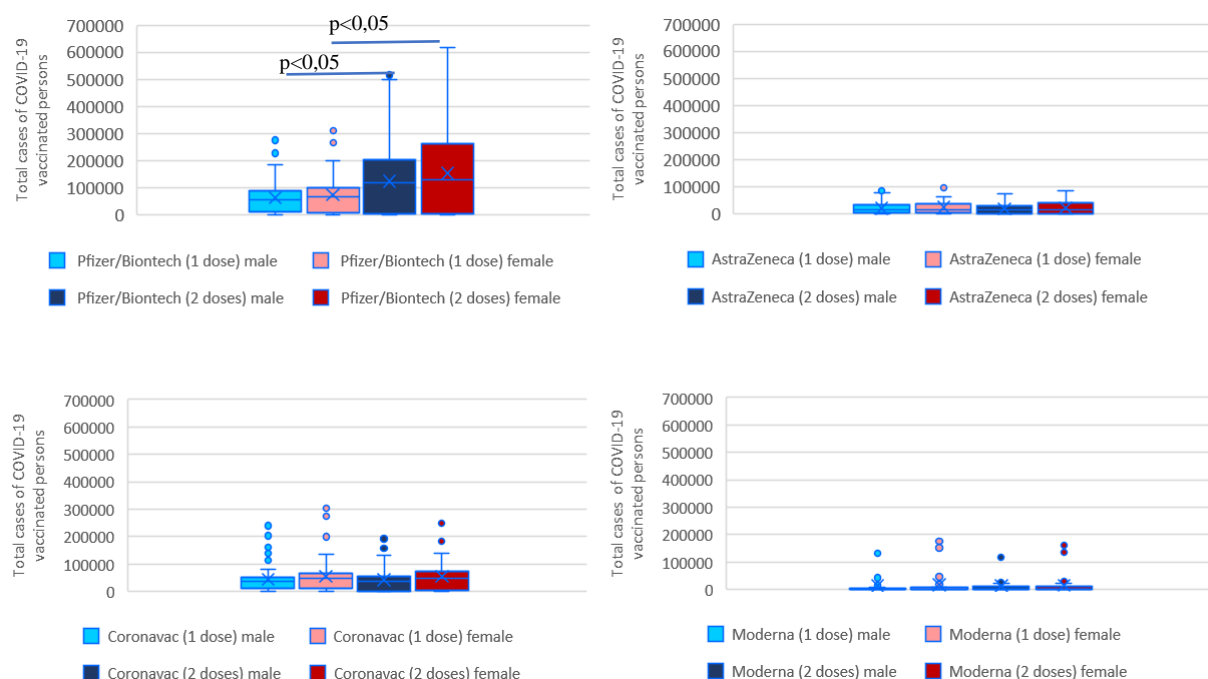

Fig. 2. Average data of COVID-19 vaccination trends with 1 and 2 doses among genders in Ukraine

Weekly count of total cases of persons who were vaccinated with two doses by vaccine Pfizer/BioNTech among men was 5763466 persons (median 147790,5 [IQR 37144,5–215451,5]) and among women - 7147531 persons (median 186821 [IQR 64797–279387,5]), vaccine Coronavac among men was 2025086 persons (median 44037,5 [IQR 26453–58255]) and among women - 2563838 persons (median 56696 [IQR 34755–73218]), vaccine AstraZeneca among men was 857642 persons (median 19091 [IQR 5103–34404]) and among women – 1029324 persons (median 19848 [IQR 5349–38535]), vaccine Moderna among men was 617624 persons (median 16786 [IQR 628–33130]) and among women - 730430 persons (median 18953 [IQR 645–37389]) in Ukraine.

It was noted that during the entire period weekly count of total cases of persons who were vaccinated by vaccine Pfizer/BioNTech with two doses were significantly higher than those who received one dose both among males ($p<0.05$) and among females ($p<0.05$).

This study was carried out in the period from February 2021 to January 2022, after which access to the open platforms of the Ministry of Public Health on the COVID-19 vaccination was closed. Our findings showed that in dynamic during studied period the frequency of overall vaccination with vaccines Pfizer/BioNTech and AstraZeneca, was higher in women than in men, regardless of whether it was the first or second injection. A greater number an overrepresentation of women of AstraZeneca COVID-19 vaccines was due to the early roll-out of vaccine among healthcare workers, the majority of whom are women and who were prioritized. Also, women compared to men, are more involved in social professions, who are at high risk of contracting and passing on COVID-19 that probably determined a high level of vaccinated persons among them. Lack of trust in AstraZeneca vaccine due to reported in mass media negative outcomes also contributed to the increase in demand for vaccine Pfizer/Biontech. Overall, past research has shown significant differences between women and men in susceptibility to vaccines, and frequency and severity of adverse events of vaccines.

The differences in vaccine efficacy among females and males are small, but they are measurable [8, 11]. In the case of the Moderna vaccine, clinical trials showed it was 95.4% effective at preventing COVID-19 cases for males, compared with 93.1% for females, the Pfizer/BioNTech - 96.4% for males and 93.7% for females.

The peer-reviewed studies investigating vaccine safety and efficacy outcomes in the general population reported overall higher rates of adverse reactions to the vaccines in females compared to males. Adverse events, including local, systemic and sensory events following the Pfizer/BioNTech COVID-19 vaccine were substantially higher in females than in males. In Israel was shown that after 1st and 2nd doses of the Pfizer/BioNTech vaccine the increased risk among females at all ages included local events such as pain at the injection site, systemic events such as fever, and sensory events such as paraesthesia in the hands and face [6]. According to previously reported data [7] adverse reactions as anaphylaxis cases were observed after Pfizer/BioNTech, Moderna vaccinations [1]. Following AstraZeneca and Janssen vaccinations, very rare thrombosis with thrombocytopenia syndrome was reported more frequently among women, after Pfizer/BioNTech and Moderna vaccinations has been noted an increased risk of myocarditis and pericarditis among men [4]. Similarly, in Switzerland was reported that 69.2% of adverse side effects were experienced by females, whereas only 27.8% were experienced by males, with severity ranging from mild (e.g., injection site erythema) to serious (e.g., death) after the Moderna and Pfizer/BioNTech vaccines [14]. This may be associated with hormonal and psychological factors related to them [2].

Conclusion

The obtained data showed gender differences in COVID-19 vaccination status. In COVID-19 vaccination trends during 2021-2022 was noted that women had increased intentions to favouring vaccination compare to men. Women more often preferred one dose or two doses injection with the Pfizer/Biontech and AstraZeneca vaccines then men. Significantly higher level of weekly cases of persons who received of Pfizer/BioNTech vaccine with two doses than one dose as among males, as females. These findings support idea that a gendered lens should also be applied when designing COVID-19 vaccination campaign. Gender differences in receiving certain vaccines against COVID-19 can help to maximize benefits and minimize adverse events.

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ELECTRONIC SYSTEM OF DIFFERENTIAL DIAGNOSIS
OF CHRONIC DISEASES OF SMALL BRONCHI IN CHILDREN

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The purpose of the study was to create an automated decision support system for the differential diagnosis of chronic nonspecific diseases of the small bronchi in children. It was based on a questionnaire used to study the prevalence of various forms of chronic nonspecific lung diseases and the features of the immunological status in children with chronic diseases of the small bronchi in children at the Research Institute of Pulmonary Diseases (Azerbaijan). The test cards were filled out and the correctness of the probability of pathology scores was assessed in 113 children with bronchial asthma, 139 children with chronic bronchiolitis and 103 children with bronchopulmonary dysplasia and with a history of bronchopulmonary dysplasia. A decision support system has been developed for the differential diagnosis of chronic nonspecific diseases of the small bronchi in children. The main feature of this technique is the ease of obtaining results after 3–5 minutes from the start of filling out the test card. The approbation of the developed automated system of early detection in children at the outpatient stage made it possible to clarify the form of diseases of the small bronchi, and to conduct informative research methods to confirm the diagnosis without using additional financial costs. For the first time, an automated decision support system has been developed for the differential diagnosis of chronic nonspecific diseases of the small bronchi in children. The application of the developed system has confirmed its practical significance in clarifying the form of chronic nonspecific diseases of the small bronchi in children.

Key words: bronchial asthma, bronchiolitis, bronchopulmonary dysplasia, children

І.А. Мустафаєв

ЕЛЕКТРОННА СИСТЕМА ДИФЕРЕНЦІЙНОЇ ДІАГНОСТИКИ
ХРОНІЧНИХ ХВОРОБ ДРІБНИХ БРОНХІВ У ДІТЕЙ

Метою дослідження було створення автоматизованої системи підтримки прийняття рішень під час проведення диференціальної діагностики хронічних неспецифічних хвороб дрібних бронхів у дітей. За основу було взято опитувальник, що використовується при вивченні поширеності різних форм хронічних неспецифічних хвороб дрібних бронхів та особливості імунологічного статусу у дітей з хронічними хворобами дрібних бронхів у дітей у НДІ легеневих захворювань (Азербайджан). Проведено заповнення тест-карт та оцінка коректності виставлених балів ймовірності патології у 113 дітей з бронхіальною астмою, у 139 дітей з хронічним бронхіолітом та у 103 дітей з бронхолегеневою дисплазією та з бронхолегеневою дисплазією в анамнезі. Розроблено систему підтримки прийняття рішень під час проведення диференціальної діагностики хронічних неспецифічних захворювань дрібних бронхів у дітей. Основною особливістю цієї методики є простота отримання результатів через 3–5 хвилин від початку заповнення тест-карти. Апробація розробленої автоматизованої системи раннього виявлення в дітей на амбулаторному етапі дозволило уточнити форму захворювань дрібних бронхів, провести інформативні методи дослідження на підтвердження діагнозу, не використовуючи додаткових фінансових витрат. Вперше розроблено автоматизовану систему підтримки прийняття рішень при проведенні диференціальної діагностики хронічних неспецифічних захворювань дрібних бронхів у дітей. Застосування розробленої системи підтвердило своє практичне значення при уточненні форми хронічних неспецифічних хвороб дрібних бронхів у дітей.

Ключові слова: бронхіальна астма, бронхіоліти, бронхолегенева дисплазія, діти.

Chronic diseases of the small bronchi belong to one of the most difficult problems of pulmonology and, above all, in the pulmonology of childhood. The complexity of the diagnosis of these diseases is reflected to a certain extent in the International Statistical Classification of Diseases and Health-related Problems (WHO Revision 10, 1995), where there are different variants and by name, course and causes of the formation of nonspecific diseases of the small bronchi, combined into a single heading. In pediatric