

Received: 19 January 2023 / Accepted: 22 February 2023 / Published online: 28 February 2023

DOI 10.34689/SH.2023.25.1.003

UDC 616-036.22:578.834.1(574.25)

ANALYSIS OF EPIDEMIOLOGICAL FEATURES OF COVID-19 IN PAVLODAR REGION

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Introduction: Coronavirus infection (COVID-19), first reported at the end of 2019, which has spilled over into a worldwide pandemic and has affected all aspects of our modern lives.

The aim is to study and analyze the epidemiological features of COVID-19 in the Pavlodar region.

Materials and methods: Study design is a descriptive retrospective study analysis. The data were obtained from official sources of the Republican Center for e-Health of the Ministry of Health of the Republic of Kazakhstan. The study includes patients from June 30, 2020 to October 31, 2021 who received outpatient and inpatient treatment for coronavirus infection in medical institutions of the Pavlodar region. Study materials – uploading reports from the Republican Center for e-Health of the Ministry of Health of the Republic of Kazakhstan.

Results: This article presents epidemiological data on the incidence of coronavirus infection in the population of Pavlodar region. The number of detected cases of COVID-19 from June 30, 2020 to October 31, 2021 was 29,443. Distribution of patients by sex predominated women - 17,831 (60.56%), than men - 11,612 (39.44%). The majority of cases were in the age group from 61 to 70 years old, with a male to female ratio of 1:1.54. Statistical significance was found between duration of stay and type of inpatient care ($p < 0.001$, $VS-MPR^* = 2.135 \times 10^{+22}$).

Conclusion: The study showed that the number of women who fell ill prevailed over the number of men who fell ill, although the number of deaths among men prevailed over the number of deaths among women. In the study, there was no significant difference in the duration of stay for men and women in home care, compared to patients under 24-hour observation.

Keywords: COVID-19, coronavirus, Sex differences, morbidity, pandemic.

Резюме

АНАЛИЗ ЭПИДЕМИОЛОГИЧЕСКИХ ОСОБЕННОСТЕЙ COVID-19 В ПАВЛОДАРСКОЙ ОБЛАСТИ

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Введение. Коронавирусная инфекция (COVID-19), о которой впервые было сообщено в конце 2019 года, которая перетекла в пандемию мирового масштаба и затронула все аспекты нашей современной жизни.

Цель: изучить и проанализировать эпидемиологические особенности COVID-19 в Павлодарской области.

Материалы и методы исследования. Дизайн исследования – описательное ретроспективное исследование. Данные получены из официальных источников «Республиканского центра электронного здравоохранения» Министерства здравоохранения Республики Казахстан. В исследование включены пациенты за период с 30.06.2020 года по 31.10.2021 года, получавшие амбулаторное и стационарное лечение в медицинских учреждениях Павлодарской области по поводу коронавирусной инфекции. Материалы исследования – отчеты, предоставленные Республиканским центром электронного здравоохранения.

Результаты: В статье приведены эпидемиологические данные по заболеваемости коронавирусной инфекцией населения в Павлодарской области. Число выявленных случаев заболевания с 30 июня 2020 года по 31 октября 2021 года по поводу COVID-19 составило 29 443 человек. Распределение пациентов по полу преобладало женщин – 17 831 (60,56%), чем мужчин – 11 612 (39,44%). Основная часть случаев заболевания приходится на возрастную категорию от 61 до 70 лет, при этом соотношение мужчин и женщин составил 1:1.54. Была найдена статистическая значимость между продолжительностью пребывания и вида стационарной помощи ($p < 0.001$, $VS-MPR^* = 2.135 \times 10^{+22}$).

Вывод. Проведенное исследование показало, что количество заболевших женщин преобладало, над количеством заболевших мужчин, несмотря на это количество смертей среди мужского пола преобладало над количеством смертей женщин. В исследовании не было существенной разницы в продолжительности пребывания мужчин и женщин на домашнем лечении, по сравнению нахождения пациентов под круглосуточным наблюдением.

Ключевые слова: COVID-19, коронавирус, половые различия, заболеваемость, пандемия.

Түйіндеме

ПАВЛОДАР ОБЛЫСЫНДАҒЫ COVID-19 ЭПИДЕМИОЛОГИЯЛЫҚ ЕРЕКШЕЛІКТЕРІН ТАЛДАУ

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Кіріспе: Алғаш рет 2019 жылдың соңында хабарланған коронавирустық инфекция (COVID-19) әлемдік пандемияға ұласып, біздің қазіргі өміріміздің барлық аспектілеріне әсер етті.

Зерттеу мақсаты: Павлодар облысындағы COVID-19 эпидемиологиялық ерекшеліктерін зерделеу және талдау.

Материалдар мен әдістер. Зерттеу дизайны сипаттамалық ретроспективті зерттеу болып табылады. Мәліметтер Қазақстан Республикасы Денсаулық сақтау министрлігінің Республикалық электрондық денсаулық сақтау орталығының ресми көздерінен алынды. Зерттеуге 30.06.2020 және 31.10.2021 аралығындағы кезеңде коронавирустық инфекция бойынша Павлодар облысының емдеу мекемелерінде амбулаторлық және стационарлық ем қабылдаған науқастар таңдалды. Зерттеу материалдары Республикалық электрондық денсаулық сақтау орталығының есептері.

Нәтижелері. Мақалада Павлодар облысында халықтың коронавирустық инфекциясымен сырқаттануы бойынша эпидемиологиялық деректер келтірілген. 2020 жылғы 30 маусымнан 2021 жылғы 31 қазанға дейін COVID-19 ауруының анықталған жағдайларының саны 29 443 адамды құрады. Егер пациенттерді жынысы бойынша қарастыратын болсақ, әйелдер (17 831 (60,56%)) ер адамдардан (11 612 (39,44%)) қарағанда едәуір көп болды. Науқастардың негізгі бөлігі 61 жастан 70 жасқа дейінгі жас категориясына жатады, ал ерлер мен әйелдердің арақатынасы 1:1.54 құрады. Стационарда болу ұзақтығы мен көрсетілетін стационарлық көмек түрі арасында статистикалық маңыздылығы табылды ($p < 0.001$, $VS-MPR^* = 2.135 \times 10^{+22}$).

Қорытынды. Жүргізілген зерттеуде COVID-19 ауруына шалдыққан әйелдердің саны ер адамдардан қарағанда басым болды, осыған қарамастан, ерлер арасындағы өлім-жітім әйелдер өлімінің санынан басым болды. Зерттеуде пациенттердің тәулік бойы бақылауда болуымен салыстырғанда ерлер мен әйелдердің үйде емделу ұзақтығында айтарлықтай айырмашылықтар болған жоқ.

Түйінді сөздер: COVID-19, коронавирус, гендерлік айырмашылықтар, сырқаттанушылық, пандемия.

Bibliographic citation:

Omarbekov Ye.D., Tokanova Sh.E., Baibussinova A.Zh., Ospanov E.A., Krykpayeva A.S. Analysis of epidemiological features of COVID-19 in Pavlodar region // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2023, (Vol.25) 1, pp. 26-32. doi 10.34689/SH.2023.25.1.003

Омарбеков Е.Д., Токанова Ш.Е., Байбусинова А.Ж., Оспанов Е.А., Крыкпаева А.С. Анализ эпидемиологических особенностей COVID-19 в Павлодарской области // *Наука и Здравоохранение*. 2023. 1 (Т.25). С. 26-32. doi 10.34689/SH.2023.25.1.003

Омарбеков Е.Д., Токанова Ш.Е., Байбусинова А.Ж., Оспанов Е.А., Крыкпаева А.С. Павлодар облысындағы COVID-19 эпидемиологиялық ерекшеліктерін талдау // *Ғылым және Денсаулық сақтау*. 2023. 1 (Т.25). Б. 26-32. doi 10.34689/SH.2023.25.1.003

Introduction

In today's world, humanity is faced with a new, rapidly spreading infection that has been causing worldwide unrest. For many decades the world has not seen such large-scale outbreaks of infectious disease [7].

According to the World Health Organization (WHO), a new coronavirus infection (COVID-19) was reported in Wuhan, Hubei Province, China, in December 2019. Despite the close proximity of China, the first cases in the Republic of Kazakhstan were registered on March 13, 2020, with two Kazakh citizens flying from Germany to the city of Almaty [1].

Since January 26, 2020, the country's leadership took preventive measures against coronavirus infection, including strengthened sanitary and epidemiological control in the border areas, provided medical monitoring of persons arriving from China, suspended the 72-hour visa-free stay for Chinese citizens in Kazakhstan [2].

To prevent the spread of the coronavirus infection, a state of emergency was declared in the country from March 16 to May 11, 2020. Restrictions were imposed on entry and exit from the country, quarantine or other restrictive measures were introduced in all regions, and activities of large non-food trade facilities, cinemas and other places with mass gatherings of people were suspended [3].

Aim: to study and analyze epidemiological features of COVID-19 in Pavlodar region.

Materials and methods of research. Based on data from the electronic registry of the "Republican Center for E-

Health" of the Ministry of Health of the Republic of Kazakhstan, we conducted a retrospective study of morbidity and mortality from COVID-19 patients of Pavlodar region.

For statistical analysis of the data we took the period from June 30, 2020 to October 31, 2021. Case fatality rates (CFR, %) were calculated using the number of officially registered incidences. To describe the quantitative data, median and interquartile range (Quartiles) were used, and maximum Vovk-Sellke p-ratios (VS-MPR) were used to analyze quantitative variables: based on the p -value, the maximum possible odds in favor of H_1 over H_0 are $1/(e^{-p} \log(p))$ for $p \leq 0.37$, where \log is the natural logarithm and e is its constant base. The VS-MPR represents the highest probability in favor of the alternative hypothesis compared to the null hypothesis, which is consistent with the observed data, which helps to interpret the p -values. The data set was processed using JASP (Journal of Statistical Software) 0.16.4.0 statistical software. Differences were considered statistically significant at $p \leq 0.05$.

Results

The number of cases detected between June 30, 2020, and October 31, 2021, for COVID-19 was 29,443. Distribution of patients by sex: 17,831 (60.56%) were female and 11,612 (39.44%) were male. The mean age of all patients was 59 years (Q1=44, Q3=68), and the gender distribution is shown in Figure 1.

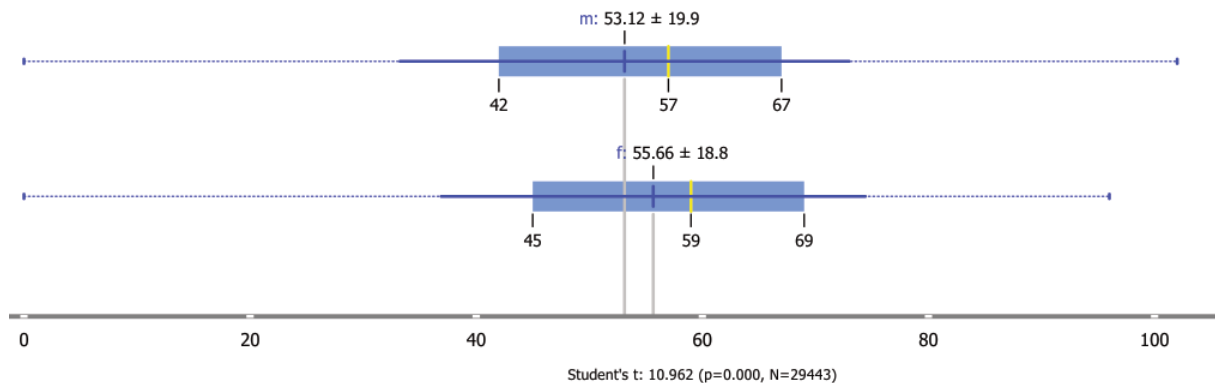


Figure 1 Average age of men and women with a diagnosed case of COVID-19.

As can be seen from Figure 1, the average age of women was 57 years and that of men was 59 years.

The majority of cases were in the age group from 61 to 70 years, with a male to female ratio of 1:1.54 (Figure 2).

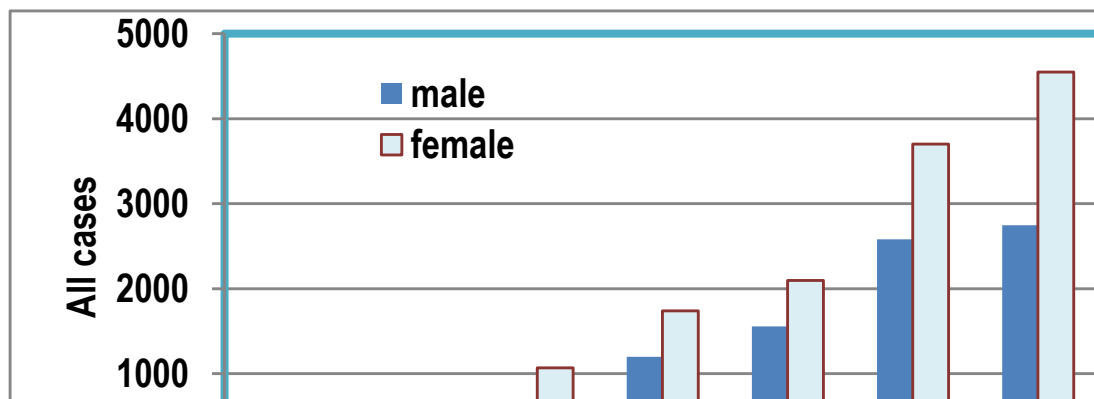


Figure 2. Distribution of cases among men and women in each age group.

Thus, the high frequency of COVID-19 infection among men and women was observed in the age group of 61-70 years (24.78%).

There were a total of 793 deaths during the study period. Our results showed that men died from COVID-19 in almost all age groups, CFR = 3.04%, while among women the mortality was not observed in all age groups, CFR = 2.47% (Table 1).

As shown in Table 1, only 0.6% of all deaths occurred in the first three age groups (0-10, 11-20, and 21-30 years).

Figure 3 clearly shows that the CFR increased with age in each of the four oldest age groups (51-60, 61-70, 71-80, 81-90 years), reaching 17.65% (140), 33.67% (267), 24.46% (194), and 13.62% (108), respectively.

Table 1.

COVID-19 fatality rate (CFR) among men and women of different age groups.

| Variable | Subgroups | Male | | Female | | Total |
|--------------|------------|----------------------------|-------------------|----------------------------|-------------------|--------------------|
| | | All cases N (% within row) | CFR, % | All cases N (% within row) | CFR, % | |
| Age | 0-10 | 615 (55.16) | 1 (1,16) | 500 (44.84) | 0 (0.00) | 1115 (3.77) |
| | 11-20 | 305 (44.33) | 0 (0.00) | 383 (55.67) | 0 (0.00) | 688 (2.34) |
| | 21-30 | 579 (35.13) | 3 (0.52) | 1069 (64.87) | 1 (0,09) | 1648 (5.60) |
| | 31-40 | 1199 (40.81) | 14 (1,17) | 1739 (59.19) | 11 (0,63) | 2938 (9.98) |
| | 41-50 | 1555 (42.57) | 21 (1,35) | 2098 (57.43) | 32 (1,53) | 3653 (12.41) |
| | 51-60 | 2581 (41.09) | 73 (2,83) | 3701 (58.91) | 67 (1,81) | 6282 (21.34) |
| | 61-70 | 2748 (37.66) | 115 (4,18) | 4549 (62.34) | 152 (3,34) | 7297 (24.78) |
| | 71-80 | 1466 (35.80) | 82 (5,59) | 2629 (64.20) | 112 (4,26) | 4095 (13.91) |
| | 81-90 | 533 (32.56) | 43 (8,07) | 1104 (67.44) | 65 (5,89) | 1637 (5.56) |
| | 91-100 | 30 (33.71) | 1 (3,33) | 59 (66.29) | 0 (0.00) | 89 (0.30) |
| ≥100 | 1 (100.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (100.00) | |
| Total | - | 11612 (39.44) | 353 (3.04) | 17831 (60.56) | 440 (2.47) | 29443 (100) |

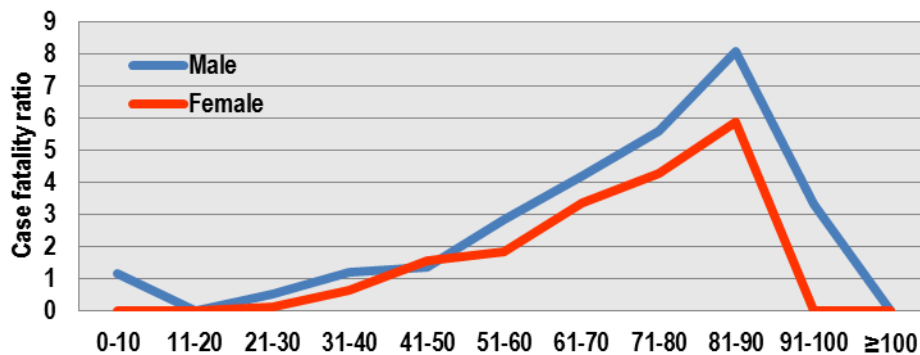


Figure 3. Distribution of deaths among men and women in each age group.

Thus, in this study, 89.41% (709/793) of all COVID-19-induced deaths occurred in the age group older than 50 years.

The next step of our study was to examine the duration of stay of patients from hospitalization to discharge or patient death according to gender (Table 2, 3).

Table 2.

Results of an analysis of the duration of stay from admission to discharge or death.

| ANOVA - Day | | | | | | |
|---------------------------------|----------------|-------|-------------|------------------------|--------|-------------------------|
| Cases | Sum of Squares | df | Mean Square | F | p | VS-MPR* |
| Gender | 0.004 | 1 | 0.004 | 1.212×10 ⁻⁴ | 0.991 | 1.000 |
| Type of inpatient care | 3457.452 | 1 | 3457.452 | 107.947 | <0.001 | 2.135×10 ⁺²² |
| Gender * Type of inpatient care | 24.373 | 1 | 24.373 | 0.761 | 0.383 | 1.000 |
| Residuals | 942908.630 | 29439 | 32.029 | | | |

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based on the p -value, the maximum possible odds in favor of H₁ over H₀ equals 1/(-e p log(p)) for p ≤ .37 (Sellke, Bayarri, & Berger, 2001).

Analysis of gender and duration of hospital stay showed no apparent difference (p=0.991, VS-MPR*=1.000), and there was also no significant difference between gender and type of

inpatient care (p=0.383, VS-MPR*=1.000). Statistical significance was found between duration of stay and type of inpatient care (p<0.001, VS-MPR*=2.135×10⁺²²).

Table 3.

Marginal Means - Gender * Type of inpatient care.

| Gender | Type of inpatient care | Marginal Mean | 95% CI for Mean Difference | | SE |
|--------|--------------------------|---------------|----------------------------|--------|-------|
| | | | Lower | Upper | |
| f | Hospital at Home | 7.773 | 7.009 | 8.536 | 0.390 |
| m | | 7.503 | 6.595 | 8.412 | 0.464 |
| f | Round-the-clock hospital | 10.672 | 10.589 | 10.756 | 0.043 |
| m | | 10.935 | 10.831 | 11.039 | 0.053 |

Patients in home care had a significantly shorter duration of stay compared to patients in 24-hour inpatient care. In addition, there was no significant difference in duration of stay in home care (men, 7.773 days (95% CI:

7.009-8.536), women, 7.503 days (95% CI: 6.595-8.412), compared with patients being under 24-hour care (men, 10, 672 days (95% CI: 10.589-10.756), women, 10.935 days (95% CI: 10.831-11.039) (Table 3, Figure 4 A, B).

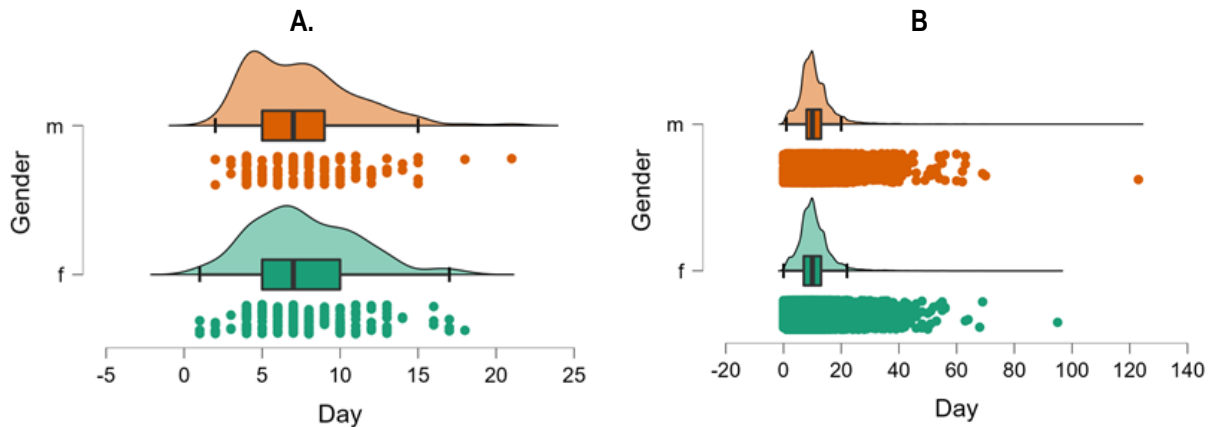


Figure 4. Duration of stay and type of inpatient care.

(A. Day: Type of inpatient care: Hospital at Home; B. Day: Type of inpatient care: Round-the-clock hospital).

As part of COVID-19 surveillance and notification of cases with positive laboratory results, PCR testing was organized to make the main diagnosis. Biomaterials were collected from patients admitted to an infectious disease

hospital and outpatients treated for COVID-19 with signs of acute respiratory infections and pneumonia. Table 4 shows the distribution of diagnosis results based on PCR testing.

Table 4.

Results of the analysis of patient outcomes depending on the main diagnosis.

| Patient treatment outcome | The main diagnosis | | | Total | X ² , p | VS-MPR* |
|-----------------------------------|--------------------------------|------------------------------------|--|-------|--------------------|-------------------------------------|
| | COVID-19, virus identified (%) | COVID-19, virus not identified (%) | Coronavirus infection, unspecified (%) | | | |
| Death | 646 (81.46) | 147 (18.54) | 0 (0.00) | 793 | 180.579 < 0.001 | 2.746×10 ⁺³ ₀ |
| Improvement | 18964 (72.53) | 7182 (27.47) | 0 (0.00) | 26146 | | |
| No change | 1176 (83.17) | 237 (16.76) | 1 (0.07) | 1414 | | |
| Recovery | 841 (82.45) | 179 (17.55) | 0 (0.00) | 1020 | | |
| Transferred to a 24-hour hospital | 9 (90.00) | 1 (10.00) | 0 (0.00) | 10 | | |
| Worsening | 55 (91.67) | 5 (8.33) | 0 (0.00) | 60 | | |
| Total | 21691 (73.67) | 7751 (26.32) | 1 (0.003) | 29443 | | |

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H₁ over H₀ equals 1/(-e p log(p)) for p ≤ .37 (Sellke, Bayarri, & Berger, 2001).

As shown in Table 4, the most frequent PCR results were positive (COVID-19, Virus identified (U07.1)) – 73.67% of the total number of patients registered (21691/29433), less frequently negative (COVID-19, Virus not identified (U07. 2)) – 26.32% (7751/29433), 1 case of coronavirus infection reported of unclear etiology (Coronavirus infection, unspecified (B34.2)) – 0.003%.

According to the table, the results of the analysis showed a statistically significant relationship between treatment outcome parameters and the incidence of coronavirus infection (p<0.001, VS-MPR=2.746). Improvement after treatment was observed in all PCR-

positive, PCR-negative, diagnosis unspecified groups – 18964 (72.53%), 7182 (27.47%), 0 (0.00%) respectively; no change in overall patient condition – 1176 (83.17%), 237 (16.76%), 1 (0.07%) respectively; recovered after treatment – 841 (82. 45%), 179 (17.55%), 0 (0.00%) respectively; transferred to a 24-hour hospital – 9 (90.00%), 1 (10.00%), 0 (0.00%) respectively; worsened – 55 (91.67%), 5 (8.33%), 0 (0.00%) respectively; fatal outcomes – 646 (81.46%), 147 (18.54%), 0 (0.00%) respectively.

Discussion of results

With the increasing negative impact of the COVID-19 pandemic, many authors have studied the biological and

clinical impact of coronavirus infection in men and women. Data in the literature on morbidity and mortality from COVID-19 show that males were the most frequent cases and deaths by gender. The results of our study are consistent with those of many authors [6, 10, 12, 15, 18].

According to the Global Health 50/50 project "The Sex, Gender and Covid-19", the ratio of morbidity and mortality among men and women corresponds to the results of our study. In 60.11% (110/183) of countries, there are more women than men ill, while in 86.43% (121/140) of countries, there are more men than women ill (Table 5) [11].

Table 5.

Incidence of COVID-19 illness and death by gender and age (Excerpt from The Sex, Gender and COVID-19 Project).

| Country | Total (Confirmed cases/Mortality) | Male (Confirmed cases/Mortality, %) | Female (Confirmed cases/Mortality, %) |
|---------------------|--------------------------------------|--|--|
| Turkey | 13973559/88517 | 47,54/56,36 | 52,46/43,64 |
| Iceland | 413652/239 | 47,42/56,07 | 52,58/43,93 |
| Chile | 10280592/107257 | 47,42/55,46 | 52,58/44,54 |
| Jersey | 51792/131 | 47,4/59,54 | 52,6/40,46 |
| Switzerland | 8082294/27296 | 47,28/54,07 | 52,72/45,93 |
| Netherlands | 16780052/22769 | 47,13/54,65 | 52,87/45,35 |
| Spain | 26845868/226172 | 46,14/55,15 | 53,86/44,85 |
| Italy | 44358773/168220 | 46,9/55,8 | 53,1/44,2 |
| Mexico | 13801532/549392 | 46,86/61,52 | 53,14/38,48 |
| Sweden | 5110076/34849 | 46,85/54,93 | 53,15/45,07 |
| Slovenia | 2281632/16366 | 46,83/50,12 | 53,17/49,88 |
| Colombia | 6117847/139894 | 46,77/60,77 | 53,23/39,23 |
| USA | 75463792/845385 | 46,76/55,06 | 53,24/44,94 |
| New Zealand | 1253352/1294 | 46,73/52,86 | 53,27/47,14 |
| Republic of Ireland | 3218391/6799 | 46,71/53,64 | 53,29/46,36 |
| Cyprus | 1632383/1170 | 46,67/60,09 | 53,33/39,91 |
| Finland | 2523620/12696 | 46,62/50,93 | 53,38/49,07 |
| Montenegro | 442019/4943 | 46,56/62,05 | 53,44/37,95 |
| Kosovo | 495254/5454 | 46,45/59,92 | 53,55/40,08 |
| Bahamas | 32794/1007 | 46,45/49,75 | 53,55/50,25 |
| Japan | 12679398/1270760 | 46,16/57,86 | 53,84/42,14 |

A study in Canada showed similar results, the overall morbidity in women was higher than in men, particularly among patients aged 20 to 50 years and over 80 years [16]. The authors also studied the effect of estrogen on morbidity and obtained results that this sex hormone affects morbidity in women under 50 years of age, during fertile age, after menopause the hormone content decreases and morbidity in women increases, data are consistent with other studies [4, 5, 8, 10, 13].

The analysis also showed that men were more likely to die compared to women, despite the fact that women were more likely to be infected with COVID-19. Our data are consistent with studies in Germany, where the percent mortality rates in the age group 80 to 89 years were 3.5 times higher in women and 3.6 times higher in men than in the corresponding age group 30 to 39 years [14]. Our data are also consistent with other authors who have found that men are at higher risk of developing severe disease [17, 19].

According to our data, the average duration of stay in a 24-hour hospital was 10 days, which is comparable to the value reported in similar studies [9], but shorter than in a study conducted in China [20]. Differences in duration of stay between countries may be related to different strategies or methods used to control COVID-19, the type of medical facilities in different countries.

Conclusion: The study showed that from June 30, 2020, to October 31, 2021, COVID-19, the mean age of hospitalized women was higher than that of men. The

number of women hospitalized was higher than the number of men hospitalized, while the number of male deaths (CFR=3.03%) was higher than the number of female deaths (CFR=2.47%). There was no significant difference in the duration of stay in home care in the study compared to patients being under 24-hour observation. Further analysis based on other data, such as the effect of risk group on COVID-19, vaccination, and viral mutation, is needed to develop strategies to further reduce infection and mortality.

Authors' Contributions: All authors were equally involved in the research, analysis, and writing of the article.

Conflict of interest: Not declared.

Funding: In carrying out this work funding was carried out in the grant funding of scientific start-up projects of scientific and pedagogical staff of the NCJSC «Semey Medical University», 2022-2025.

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