ORIGINAL ARTICLE

Hospitalizations for COVID-19 in Poland: a study based on data from a national hospital register

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KEY WORDS

infectious disease, mortality, nationwide registers, SARS-CoV-2

ABSTRACT

INTRODUCTION COVID-19 has been identified by the World Health Organization as a pandemic. Poland introduced extensive antiepidemic measures relatively early in order to slow down the spread of the disease.

OBJECTIVES The study aims to present recent data on COVID-19 hospitalizations during the first months of the disease outbreak in Poland.

PATIENTS AND METHODS This is a retrospective, population-based study conducted using hospital discharge records that included a diagnosis of COVID-19. Data were obtained from the National Institute of Public Health, where they had been originally collected for a Polish hospital morbidity study. They included 8840 hospitalization records from the period between February and September 2020.

RESULTS Overall, there were 8252 records of patients hospitalized for COVID-19 for the first time, which accounted for 93% of all hospitalizations. The study group consisted of 4161 men (50.4%) and 4091 women (49.6%). Significantly more patients from urban than rural areas were hospitalized (21.8 per 100 000 vs 20.5 per 100 000; $P < 0.02$). In the period subject to analysis, 1073 in-hospital deaths were observed (13% of all patients), 965 of which occurred during first-time hospitalizations (11.7% of all patients). In the study group, patients who died during hospitalization compared with those who survived hospitalization were significantly older, more frequently lived in urban areas, and had more comorbidities.

CONCLUSIONS The findings of our study, especially the differences between survivors and nonsurvivors with COVID-19, may be helpful in recognizing patients requiring special medical care and preventive measures during hospitalization.

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INTRODUCTION COVID-19 has been identified by the World Health Organization (WHO) as a pandemic. It is a viral disease that can affect every age group, from infants to the elderly, and may result in a wide spectrum of clinical manifestations.[1]

The most common clinical symptoms observed in COVID-19 patients include fever (88.5%), cough (68.6%), myalgia or fatigue (35.8%), expectoration (28.2%), and dyspnea (21.9%).[2] Among adults infected with SARS-CoV-2, fever and cough have been reported as dominant symptoms. Nonetheless, a substantial number of infected individuals may not be identified during screening for SARS-CoV-2 infection based on the symptoms alone.[3] It has been suggested that SARS-CoV-2 infection does not only affect the lungs, but also other organs.[4-7]

Comorbidities may play an important role in the prognosis of COVID-19 patients. It was shown that hypertension, cardiovascular diseases, diabetes mellitus, smoking, chronic obstructive pulmonary disease, malignancy, and chronic kidney disease were the most commonly observed underlying diseases among patients hospitalized for COVID-19.[8]

WHAT'S NEW?

Poland introduced extensive antiepidemic measures relatively early in order to slow down the spread of COVID-19. We presented recent data on COVID-19 hospitalizations in the first months of the pandemic in Poland, which were obtained from a Polish hospital morbidity study carried out by the National Institute of Public Health. The analysis of COVID-19 hospitalizations may be helpful in further studies focused on the identification of risk factors related to fatal or nonfatal hospitalizations. Data on the structure of COVID-19–related deaths and comorbidities may be helpful in recognizing patients who require special medical care and preventive measures.

In the time of the COVID-19 pandemic, timely and accurate diagnosis of the disease is particularly important. Information obtained from the patient, physical examination, and results of additional tests allow to assign patients to a group with either confirmed or probable COVID-19 diagnosis. The definitions of suspected, probable, and confirmed cases of COVID-19 were published by the WHO in October 2020. According to the organization, it might be necessary for all countries to adapt these definitions to local epidemiological situation and certain epidemic-related factors. Therefore, publication and continuous updating of country-specific definitions of COVID-19 and regular presentation of situation reports that could have an influence on the interpretation of the surveillance data are highly encouraged.[9]

On December 31, 2019, the Chinese government first reported an outbreak of COVID-19 in Wuhan, Hubei Province, China. The outbreak spread into all provinces of China and many other countries. As of February 6, 2020, 31 481 cases of the disease were officially confirmed in mainland China.[10] The COVID-19 pandemic spread quickly in Europe; on March 20, 2020, Italy reported the second highest number of confirmed disease cases, following China.[11] There was a time-lag of only a few weeks between Italy and other countries in Europe. The WHO data showed a continuous increase in the number of new cases in Europe. According to data from October 2020, the highest incidence was observed in France, the Russian Federation, the United Kingdom, Spain, and Israel.[12]

Poland introduced extensive antiepidemic measures relatively early in order to slow down the spread of the disease.[13] As many as 1862 laboratory-confirmed cases of COVID-19 and 22 COVID-19–related deaths had been reported in Poland by March 29, 2020.[12] According to the data provided by the Polish Ministry of Health on October 10, 2020, 39 684 cases of COVID-19 were reported, 78 982 persons recovered, and 2972 deaths were registered among those diagnosed with COVID-19, whereas the number of infections since March 4, 2020 reached 121 638.[14]

Considering the high number of COVID-19–related deaths and substantial economic loss incurred worldwide, it is highly needed to monitor the ongoing situation related to COVID-19 hospitalizations and to collect data that may be helpful for building an effective strategy to reduce the spread of the disease in Poland.

The aim of this study is to present recent data on COVID-19 hospitalizations in the first phase of the epidemic in Poland. To our best knowledge, this is the first evaluation of COVID-19 hospitalizations in Poland based on the hospital morbidity database.

PATIENTS AND METHODS This is a retrospective, population-based study conducted using hospital discharge records that included a diagnosis of COVID-19. Data were obtained from the National Institute of Public Health in Poland and covered 8840 cases of hospitalization reported between February and September 2020. It was assumed that the time of the patient's admission to hospital was the onset of COVID-19. It is possible that in some cases the patients were admitted to hospital in February 2020, but the disease was confirmed later. We analyzed the records of patients hospitalized for COVID-19, with the diagnosis of primary or secondary disease. All hospitals in Poland, except for psychiatric facilities, are legally required to submit discharge data to the National Institute of Public Health. The data are anonymous and contain information on diagnosis codes according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (*ICD-10*), hospital admission and discharge data, sex, date of birth, and place of residence of the patient. We assumed that in all hospitals COVID-19 was diagnosed according to the most current and widely used criteria. Patients included in this study were hospitalized for an emergency *ICD-10* diagnosis code "U07.1 COVID-19, virus identified," which is attributable to the diagnosis of laboratory-confirmed COVID-19, or an *ICD-10* diagnosis code "U07.2 COVID-19, virus not identified," corresponding to a clinical or epidemiological diagnosis of COVID-19, for which there is no conclusive laboratory confirmation or no such confirmation is available.

The local Bioethics Committee was informed about the study; however, its approval was not required due to the retrospective and noninvasive design of the research.

Statistical analysis To perform the statistical analysis, the Statistica software[15] and WINPEPI[16] freeware were used. Continuous variables were presented as means with SDs and medians with interquartile ranges, and categorical variables as numbers and percentages. For the comparison of age between fatal and nonfatal subgroups of hospitalized patients, the nonparametric Mann–Whitney test was used, and for comparison of nominal variables we used the χ^2 test. A 2-sided P value of less than 0.05 was considered significant. Data on the general Polish population as of December 31, 2019 were obtained from Statistics Poland.[17,18]

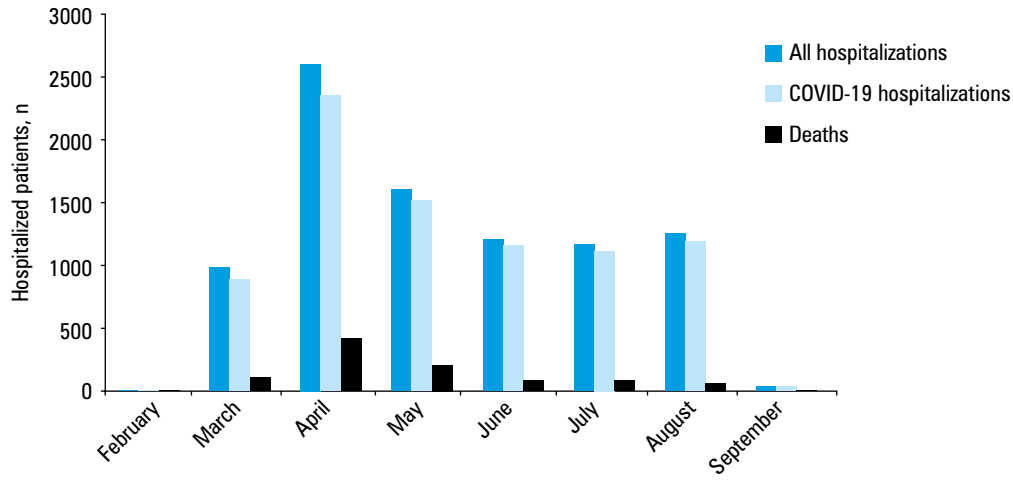

FIGURE 1 Number of all hospitalizations, COVID-19 hospitalizations, and deaths during hospitalization for COVID-19 in the period from February to September 2020

TABLE 1 Percentage of men by age groups among hospitalized patients with COVID-19

Parameter	Male patients included in the study, n (% of all cases)	Men in the general population, %	*P* value
All	4161 (50.4)	48.4	<0.001
Age groups[a], y			
0–9	93 (55)	51	0.35
10–19	86 (53)	51	0.64
20–29	314 (54)	51	0.15
30–39	513 (78)	51	<0.001
40–49	538 (51)	50	0.79
50–59	607 (50)	49	0.75
60–69	869 (57)	46	<0.001
70–79	645 (51)	41	<0.001
80–89	404 (38)	32	<0.001
≥90	87 (26)	25	0.6

a Age was not available for 6 patients.

RESULTS There were 8252 records of first-time hospitalizations for COVID-19, which accounted for 93% of all analyzed cases. The study group of patients hospitalized for COVID-19 for the first time consisted of 4161 men (50.4%) and 4091 women (49.6%). A total of 588 patients were hospitalized more than once during the analyzed period of time. In relation to the general population of Poland, patients hospitalized for COVID-19 were predominantly male, regardless of age (TABLE 1).

In the study group, the mean and median age was 57.5 and 60 years, respectively (SD, 21.2; interquartile range [IQR], 42–73; range, 0–106 years). Men were significantly younger than women (mean [SD], 55.4 [20.4] years; median [IQR], 59 (40–71) years vs mean [SD], 59.5 [21.7] years; median [IQR], 61 (45–78) years; P <0.001).

Patients from urban regions were hospitalized significantly more often than those from rural areas (21.8 per 100 000 vs 20.5 per 100 000; P <0.02).

The most common comorbidities among hospitalized patients in the study group were cardiovascular diseases (19.1% of patients), diseases of the respiratory system (18.7%), endocrine, nutritional, and metabolic diseases (7.7%), and diseases of the genitourinary system (5%). Overall, 34% of patients from the study group had at least one of the abovementioned diseases. Most of the first-time hospitalizations for COVID-19 occurred in Hospital Emergency Departments (36%), Departments of Infectious Diseases (16.6%), Departments of Observation and Infectious Disease (11.3%), or Departments of Internal Medicine (10%).

Among all cases of hospitalization that took place during the analyzed period, 1073 in-hospital all-cause deaths were reported (13% of all patients), 965 of which occurred during first-time hospitalizations (11.7% of all patients). Data on the number of patients and deaths in the study group by months, with additional information about all hospitalizations are presented in FIGURE 1. Death rates by age groups among the study group of hospitalized COVID-19 patients are presented in TABLE 2. In the study group, 853 deaths (88%) were observed among patients with the *ICD-10* diagnosis code "U07.1 COVID-19, virus identified" and 112 cases (12%) were reported among those with the *ICD-10* diagnosis code "U07.2 COVID-19, virus not identified." Comparative characteristics of the subgroups of hospitalized patients with COVID-19 are presented in TABLE 3. Study patients who died during hospitalization in comparison with those who survived hospitalization were significantly older, more frequently lived in urban areas, and had more comorbidities.

DISCUSSION COVID-19 has been identified by the World Health Organization as a global epidemic. This paper presents an analysis of the epidemiological situation in Poland in the first phase of the COVID-19 pandemic.

The highest number of hospitalizations for COVID-19 was observed in patients aged 60 to 69 years, but the highest death rate was observed in patients aged 80 to 89 years. By contrast, in one of the first Polish studies on COVID-19, based on data from a sample of 1389

TABLE 2 Case-fatality rates by age groups among hospitalized patients with COVID-19

Parameter	Deaths, n	Cases, n	Death rate[b], %
All	965	8252	11.7
Age groups[a], y			
0–9	0	169	0
10–19	2	162	1.2
20–29	1	581	0.2
30–39	7	886	0.8
40–49	30	1060	2.8
50–59	56	1222	4.6
60–69	161	1514	10.6
70–79	267	1255	21.3
80–89	327	1059	30.9
90–99	114	335	34
≥100	0	3	0

a Age was not available for 6 patients.

b Death rate was calculated as number of deaths/number of COVID-19 cases.

TABLE 3 Comparison of fatal and nonfatal subgroups of hospitalized patients with COVID-19

Parameter	Fatal subgroup (n = 965)	Nonfatal subgroup (n = 7287)	*P* value
Men	52.8	50.1	0.11
Women	47.2	49.9	
Age[a], y, mean (SD); median (IQR)	76 (12.7); 78 (69–86)	55 (20.9); 57 (40–71)	<0.001
Inhabitants of urban areas[b]	64.7	60.9	<0.02
Endocrine, nutritional, and metabolic diseases	10.5	7.3	<0.001
Diabetes mellitus	8.6	4.7	<0.001
Cardiovascular diseases	41.6	16.1	<0.001
Hypertension	12.7	11.3	0.19
Other respiratory diseases	45.3	15.2	<0.001
Genitourinary diseases	9.2	4.4	<0.001

Data are presented as percentage, unless otherwise indicated.

a Data not available for 6 patients.

b Data not available for 88 patients.

Abbreviations: IQR, interquartile range

laboratory-confirmed COVID-19 cases and data obtained from epidemiological reports collected by the Chief Sanitary Inspectorate in Poland, the highest incidence of COVID-19 was reported in younger patients.[19] In our study, significantly more COVID-19 hospitalizations were observed in men than in women, compared with the general Polish population. In another Polish study, covering data on 169 patients, more than half of them were aged 65 years or over and 51.5% were male.[20] Additionally, a meta-analysis by Li et al[2] showed that men accounted for 60% of COVID-19 patients. In a large study from China, a total of 72 314 patient records were analyzed, 44 672 of which (61.8%) were confirmed disease cases, and most patients in this subgroup (86.6%) were aged 30 to 79 years.[21]

No significant sex-related differences were observed in the study group with regard to fatal and nonfatal hospitalizations. According to a study by Raciborski et al,[22] during the first months of the COVID-19 pandemic in Poland (March and April 2020) there was an increase in the incidence rate in women rather than men, whereas COVID-19–related mortality was more frequent in men.[22] A systematic review and meta-analysis by Espinosa et al[23] showed that men predominated among COVID-19 patients admitted to the intensive care unit.

The death rate in our study group seems to be rather high (11.7%); however, it may have been caused by the fact that it was estimated based on hospitalization data alone. In an Italian study based on a surveillance system collecting information on all people with COVID-19 throughout the country, the overall reported case-fatality rate was 7.2%.[24] Other studies reported different mortality rates. In a systematic review and meta-analysis including 44 peer-reviewed studies with 14 866 COVID-19 patients, the overall all-cause mortality rate was 10%.[25] A systematic review and meta-analysis of 73 studies and 10 402 patients reported a mortality rate of 7%.[3] A single-arm meta-analysis by Li et al[2] showed a fatality rate of 5%.[2] In a study from China, a total of 1023 deaths were noted among the confirmed cases, with an overall case-fatality rate of 2.3%.[21] Bonanad et al[26] analyzed a total of 611 583 individuals and reported an overall mortality rate of 12.1%. Mortality was below 1.1% in patients under the age of 50 years.

In comparison with those who survived hospitalization, patients who died during hospitalization were significantly older, more frequently lived in urban areas, and had more comorbidities (TABLE 3). Other studies reported similar results. A Chinese study reported the territorial factor (place of residence: Wuhan) and showed that elderly patients as well as those with medical comorbidities tended to show more severe clinical symptoms and were characterized by a higher case-fatality rate.[27] Results of another study indicated that older age was associated with greater severity of COVID-19.[28] Similarly, in a large cohort of COVID-19 patients of European origin it was observed that older age and comorbidities were main risk factors for mortality.[29] Yet another study reported that patients with severe disease outcomes were elderly and predominantly male, as compared with individuals with nonsevere course of the disease.[30] In a systematic review and meta-analysis by Figliozzi et al,[31] advanced age and comorbidities were also related to adverse clinical outcome. Moreover, it was reported that men showed significantly greater disease severity. The severity of COVID-19 was found to be strongly associated with old age.[32]

Age may be an important risk factor for death from COVID-19; however, the presence of comorbidities may also increase the mortality risk. A Polish study conducted in a group of 169 patients showed that 78.3% of them had comorbidities.[20] We observed selected groups of comorbidities that were significantly more frequent in fatal than nonfatal hospitalizations. Similar data were reported in other studies—certain diseases of the respiratory system[32-34] and selected cardiovascular diseases[32-37] were found to be associated with the prognosis of COVID-19, as were diabetes mellitus[32-34,36,38-40] and chronic kidney diseases.[32,36] Similarly, in a prospective observational cohort study from the United Kingdom, older age, male sex, and comorbidities such as chronic cardiac disease, nonasthmatic chronic pulmonary disease, chronic kidney disease, liver disease, and obesity were associated with higher in-hospital mortality.[41]

Limitations The present study has several limitations. In general, the risk of bias may be high, because the analysis included hospitalizations that occurred during the first months (the first wave) of the COVID-19 pandemic in Poland. As presented in **FIGURE 1**, most cases of hospitalization were observed in April and May 2020, which may be due to the limited efficiency of reporting hospitalizations to the national registers in the first period of the pandemic. The database used in the study was a source of general information on COVID-19 hospitalizations, and thus it allowed the authors to perform the present analysis. Nevertheless, it did not enable a wide examination of risk factors and other correlates in individual patients. Furthermore, coding practices for COVID-19–related hospitalizations were not assessed. This may have resulted in an imprecise estimation of incident cases. However, a long observation period and large amount of data obtained from the national register of hospital morbidity may be the strengths of this study.

Conclusions Risk of fatal hospitalization among patients hospitalized for COVID-19 may be related to age, place of living, and comorbidities. The findings of this study, especially the differences observed between patients who survived hospitalization and those who did not, may be helpful in recognizing individuals that require special medical care and preventive measures during hospitalization.

ARTICLE INFORMATION

CONTRIBUTION STATEMENT All authors conceived the idea for the study and contributed to the design of the research. PG, BW, and GJ were involved in data collection. KK, PG, and PT analyzed the data. KK edited the manuscript. All authors approved the final version of the manuscript.

CONFLICT OF INTEREST None declared.

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