Clinical Infectious Diseases
BRIEF REPORT

Disparities in Age-specific Morbidity and Mortality From SARS-CoV-2 in China and the Republic of Korea

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We analyzed age-/sex-specific morbidity and mortality data from the SARS-CoV-2 pandemic in China and Republic of Korea (ROK). Data from China exhibit a Gaussian distribution with peak morbidity in the 50–59-year cohort, while the ROK data have a bimodal distribution with the highest morbidity in the 20–29-year cohort.

Keywords. SARS-CoV-2; age-specific; confirmed cases; China; Korea.

There are many uncertainties regarding the clinical epidemiology of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that is currently spreading worldwide in a global pandemic whose ultimate impacts are still uncertain but which appears, based on observed impacts, to have the potential to overwhelm the medical surveillance and medical treatment infrastructure of even the world's most affluent countries. There is a need to gain greater understanding of the highest-risk populations for infection and serious disease from SARS-CoV-2 to support the development and implementation of effective public health surveillance and mitigation efforts, and minimize the adverse effects of the current coronavirus disease 2019 (COVID-19) pandemic in countries worldwide [1].

METHODS

We used data on age and sex of SARS-CoV-2 cases published by the Korea Centers for Disease Control and Prevention [2], and the China Centers for Disease Control [3] to compare the age-specific rates of morbidity and mortality from recent epidemics in China and the Republic of Korea (ROK) and gain insights into the potential for variation in public health impacts of the COVID-19 pandemic in different countries.

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RESULTS

We identified major disparities in the age-specific and sex-specific rates of mortality from SARS-CoV-2 in China and the ROK.

Data from China (n = 44 672 as of 11 February 2020) exhibit a symmetrical Gaussian configuration, with peak morbidity among individuals in the 50- to 59-year age cohort (Figure 1). The sex-specific morbidity ratio among confirmed cases was near parity, with a slight male bias (males, 51%; females, 49%). There was a high degree of difference in sex-specific case fatality rates (CFRs), with fatality rates much higher among males (2.8% CFR) than females (1.7% CFR).

Data from the ROK (n = 7755 as of 11 March 2020) exhibited a skewed bimodal distribution, with the highest rate of confirmed SARS-CoV-2 infections among individuals in the 20- to 29-year age cohort (30%) and a second peak in the 50- to 59-year age cohort (19%) (Figure 1). There is a high degree of difference in the sex-specific rates of infection from SARS-CoV-2 in the ROK, with female cases (62%) outnumbering males by a factor of nearly 2:1 (females, 62%; males, 38%). The data on fatalities from confirmed SARS-CoV-2 infections in the ROK exhibit a reversed-bias ratio to that among cases, with the CFR among males more than twice as high as that among females (CFR: males, 1.19%; females, 0.52%).

DISCUSSION

Investigations of age-specific and sex-related differences in morbidity and mortality from emerging diseases can provide important tools for identifying populations at highest risk for surveillance, monitoring, and intensive medical interventions and provide insights into geographic, genetic, or cultural factors that may influence the spread of pandemic disease viruses such SARS-CoV-2, within and among different countries and continents [4, 5].

The age-specific and sex-specific profiles of the SARS-CoV-2 pandemic in the ROK are quite different from those of the Middle East respiratory syndrome coronavirus (MERS-CoV) epidemic that occurred during May–June 2015, which was the largest outbreak of the MERS-CoV virus outside of the Middle East region, and involved a total of 186 confirmed cases including 38 fatalities (20% CFR). The Korea MERS-COV epidemic lasted for 2 months, and the ROK government quarantined 16 993 individuals for 14 days to control the outbreak. The 2015 MERS-CoV outbreak in the ROK was almost entirely nosocomial, through intrahospital and hospital-to-hospital nosocomial transmission rather than community transmission. Only 1 of the 186 confirmed cases from the 2015 MERS-CoV outbreak occurred through community transmission [6].

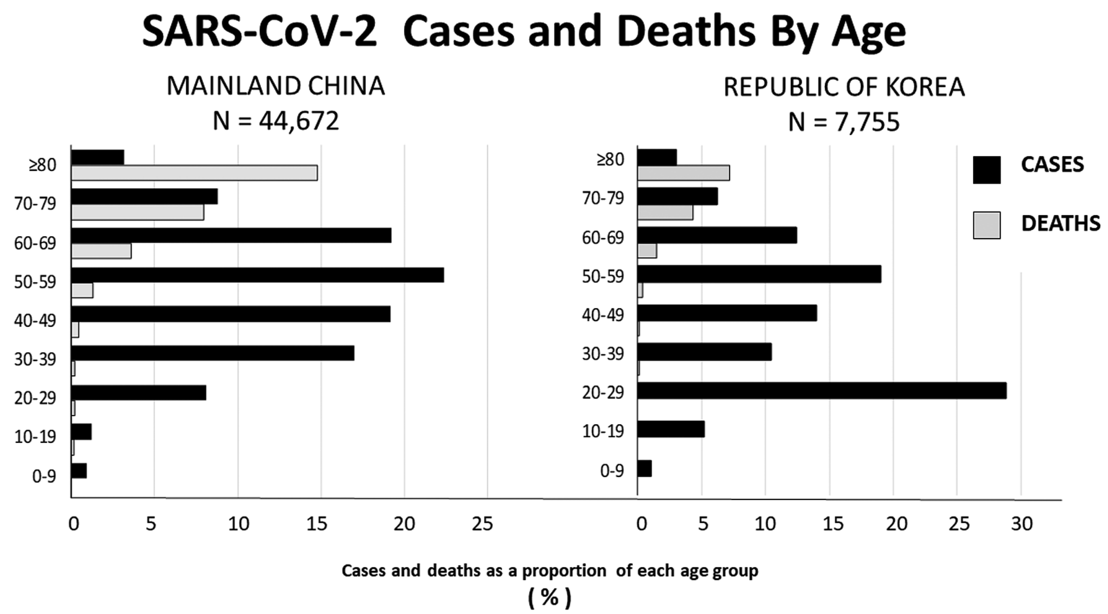

Figure 1. Comparison of age-specific morbidity and mortality rates among reported confirmed cases from China and the Republic of Korea. Abbreviation: SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

The age-specific morbidity and mortality rates from the 2015 MERS-CoV epidemic in the ROK are different in certain respects from those of the SARS-CoV-2 pandemic in China and the ROK. The general shape of the epidemic curve is a standard unimodal Gaussian curve, with peak morbidity in the 50- to 59-year age cohort, similar to that of the SARS-CoV-2 outbreak for China shown in Figure 1. The sex ratio among confirmed cases from the 2015 Korea MERS-CoV epidemic in the ROK was male biased, with a 60:40 ratio of males to females, the reverse of that observed in the current SARS-CoV-2 pandemic, which has a 40:60 male to female ratio among confirmed cases reported as of 11 March 2020 [6].

Although nosocomial transmission has been an important factor in the SARS-CoV-2 pandemic in both China and the ROK, community transmission has been the predominant driving factor for the SARS-CoV-2 epidemic in the ROK. Improvements in hospital-infection-control policies and practices, coupled with the development and implementation of more sophisticated infectious disease surveillance and response training programs, are believed to be important factors in the apparent relatively low rate of nosocomial transmission in the ROK during the current outbreak.

The available data indicate that the epidemiological characteristics of SARS-CoV-2 infections appear to be distinctly different from those of typical human coronaviruses and the recently emerged zoonotic coronaviruses (SARS-CoV, MERS-CoV), zoonotic influenza viruses (eg, H5N1, H7N9, H792), seasonal influenza viruses, and recent pandemic influenza viruses [7]. While many patients develop influenza-like illness that progresses to pneumonia or acute respiratory distress syndrome (ARDS) resulting in hospitalization and/or death, a large spectrum of clinical presentations have been documented, including a growing number of reported cases with mild symptoms and asymptomatic infections [8]. Asymptomatic infection has been reported from adults and children, but the proportion of truly asymptomatic infections remains uncertain [9, 10]. A recent report documented reverse transcriptase–polymerase chain reaction detection of SARS-CoV-2 in fecal samples from an asymptomatic child, which persisted for 26 days following the estimated date of exposure [11].

The most commonly reported symptoms in order of relative frequency include fever and dry cough (>70%) and fatigue (>35%), dyspnea (<20%), sore throat (<15%), headache (<15%), myalgia or arthralgia (<15%), chills (<15%), nausea or vomiting (5%), nasal congestion (<5%), diarrhea (<4%), and conjunctivitis (<1%). People with symptomatic COVID-19 infections usually become symptomatic within 1–2 weeks following infection (mean incubation period, 5–6 days; range, 1–14 days). The majority of people infected with COVID-19 virus have mild disease and recover. Approximately 15% of patients with laboratory-confirmed disease develop severe disease with pneumonia and/or dyspnea, of whom about 7% progress to respiratory failure, septic shock, or multiple organ failure. Individuals at highest risk of severe disease and death include people aged over 60 years and individuals with chronic disease. Symptomatic disease appears to be relatively rare and typically mild in children and adolescents [7].

We hypothesize that differences in public health intervention practices and age-related sociocultural factors may be significant factors mediating the observed marked disparities in the age-specific and sex-specific rates of infection from confirmed cases in China and the ROK. The most striking anomaly in the ROK data appears to be the relatively high proportion of cases among the 20- to 29-year age group (29% of all cases), which may be attributable, in part, to lower rates of compliance among individuals in this age group with social distancing and self-quarantine recommendations issued by Korean health authorities. Religious affiliations and practices have been an important factor for the SARS-CoV-2 epidemic in the ROK, because approximately 61% of all confirmed cases as of 11 March 2020 have epidemiological links to the Shincheonji religious community, a Korean-based sect with satellite churches in China and at least 24 other countries, with some 200 000 members in the ROK (~0.3% of the ROK population of 51.5 million persons) [12]. Lack of adherence to social-distancing and self-quarantine recommendations also appears to be a key factor in the high ratio of confirmed SARS-CoV-2 infected individuals associated with the Shincheonji religious community. Observational data collected throughout the course of the epidemic in the ROK indicate much lower rates of compliance with ROK government social-distancing recommendations by the young adults and teenagers in the 15- to 29-year age cohorts, which could help explain the relatively higher rates of infection among the 10- to 19- and 20- to 29-year age cohorts in the ROK data.

CONCLUSIONS

The reported data on confirmed cases and fatalities from SARS-CoV-2 indicate highly significant differences in the age-specific and sex-specific rates of morbidity and mortality from the COVID-19 pandemic in the ROK and China. Closer study of the factors underlying the initiation and early proliferation of the SARS-CoV-2 outbreak in China and the ROK may provide valuable insights into the development of more effective strategies for predicting and mitigating the spread of the COVID-19 pandemic in other countries worldwide.

Improvements in hospital-infection-control policies and practices, and the development and implementation of cross-sectoral civilian and military infectious disease outbreak surveillance and response training programs by the ROK government in coordination with international partner organizations such as the World Health Organization and US Centers for Disease Control and Prevention, are believed to be important factors in the apparent relatively low rate of nosocomial transmission in the ROK during the current outbreak and the effectiveness of disease outbreak surveillance and monitoring programs.

The available epidemiological and observational data from the ROK suggest that reduced rates of compliance with social distancing and self-quarantine recommendations among different sectors of the population—especially the younger adult and juvenile age cohorts—may have a significant impact on the age-specific rates of morbidity and mortality within the population as a whole.

Notes

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