Trends and risk factors of in-hospital mortality of patients with COVID-19 in Germany

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Background: Unselected data of nationwide studies of hospitalized patients with COVID-19 is still sparse, but these data are of outstanding interest not to exceed hospital capacities and to avoid overloading of national health-care systems.

Purpose: Thus, we sought to analyze seasonal/regional trends, predictors of in-hospital case-fatality and mechanical ventilation (MV) in patients with COVID-19 in Germany.

Methods: We used the German nationwide inpatient sample to analyze all hospitalized patients with confirmed COVID-19 diagnosis in Germany between January 1st and December 31st in 2020 (source: RDC of the Federal Statistical Office and the Statistical Offices of the federal states, DRG Statistics 2020, own calculations). Covid-19-inpatients with MV vs. without MV and survivors vs. non-survivors were compared. Logistic regression models were calculated to investigate associations between patients' characteristics as well as adverse events and i) necessity of MV and ii) in-hospital death.

Results: We analyzed data of 176,137 hospitalizations of patients with confirmed COVID-19-infection. Among those, 31,607 (17.9%) died, whereby in-hospital case-fatality grew exponentially with age. Cardiovascular comorbidities were common in hospitalized patients with confirmed COVID-19-infections: Overall, almost half of the patients (46.8%; n=82,480) had arterial hypertension and 25,574 (14.4%) had a diagnosis of coronary artery disease. In 60.7% (n=106,913) of the hospitalizations, pneumonia was reported, 8.6% (n=15,061) had an acute infection of the upper or lower airways other than pneumonia, and 6.6% (n=11,594) suffered from an acute respiratory distress syndrome (ARDS) during hospitalization

Age $\geq$70 years (OR 5.91, 95% CI 5.70–6.13, P$<$0.001), pneumonia (OR 4.58, 95% CI 4.42–4.74, P$<$0.001) and acute respiratory distress syndrome (OR 8.51, 95% CI 8.12–8.92, P$<$0.001) were strong predictors of in-hospital death. Most COVID-19-patients were treated in hospitals in urban areas (n=92,971) associated with lowest case-fatality (17.5%) as compared to hospitals in suburban (18.3%) or rural areas (18.8%). MV demand was highest in November/December 2020 (32.3%, 20.3%) in patients between 6th and 8th age-decade. In the first age-decade, 78 of 1861 children (4.2%) with COVID-19-infection were treated with MV and five of them died (0.3%).

Conclusion: The results of our study indicate seasonal and regional variations concerning number of COVID-19-patients, necessity of MV and case-fatality in Germany. These findings may help to ensure flexible allocation of intensive care (human) resources, which is essential for managing enormous societal challenges worldwide to avoid overloaded regional health-care systems.