1 Middle-aged people and the elderly have the similar risk of death from Covid-19:
2 considering background mortality

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4 Short title: Covid-19 death risk in middle-aged people

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Abstract

In USA, middle-aged people might be evaluated as having a low risk of Covid-19 death, but if the natural mortality is considered, the age distribution of death risk from Covid-19 changes. The proportions of Covid-19 deaths in total deaths among middle-aged and elderly people are in the same cluster. This shows that the increase rates in deaths caused by Covid-19 to middle-aged people is similar to that of the elderly, and it is necessary to pay the same attention to the risk of Covid-19 death in middle-aged people.

Word count = 88

Keywords = Middle-aged people, Covid-19 death, all-cause mortality

In USA, although the first death from Covid-19 is a middle-aged (45-64 years old) patient and the cumulative Covid-19 death toll of middle-aged people is at least several times higher than that of the youngers, but the cumulative Covid-19 deaths less than age 65 are clustered in the same group, much lower than the high-age group (Figure 1A and 1B). Moreover, the high number of Covid-19 infections of middle-aged people makes the infection mortality rate much lower than the high-age group (Boehmer et al, 2020); thus, middle-aged people may be evaluated as having a low risk of death from Covid-19 infection.

However, if the natural mortality rate of each age group is considered, the age distribution of risk of death from Covid-19 changes. The age patterns of COVID-19 mortality are close to those of all-cause mortality (Goldstein and Lee, 2020). Compared with middle-aged people, the number of Covid-19 deaths among the elderly is higher, but the natural mortality rate of the elderly is also high. For example, the average number of natural deaths in age group of 45-54, 55-64, 65-74, 75-84, and ≥ 85 from 2015 to 2018 are 402, 883, 1790, 4778, and 13523 per 100,000 resident population in USA, respectively (National Center for Health Statistics, 2017; Xu et al., 2020). The proportion of Covid-19 deaths in total deaths can to some certain extent eliminate the impact of natural deaths. After analyzing the weekly death data of the Centers for Disease Control and Prevention, USA (National Center for Health Statistics, 2020), I found that the proportions of cumulative Covid-19 deaths among middle-aged and elderly people in the cumulative total deaths are in the same cluster, and the proportion among age groups seemed stable from May to September, 2020 (Figure 1C). The weekly dynamics of the proportion of Covid-19 deaths in the overall death in middle-aged and those in elderly people were also clustered in the same group (Figure 1D). The similar clusters by age were obtained when the ratios of Covid-19 deaths to total non-Covid-19 deaths and the ratio of Covid-19 deaths to the mean of total deaths from 2015-2019 were analyzed.

This shows that the increase rates in deaths caused by Covid-19 to middle-aged people is similar to that of the elderly, and it is necessary to pay the same

53 attention to the risk of Covid-19 deaths in middle-aged people.

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56 **Conflict of Interest**

57 The authors declare that they have no conflict of interest.

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109 Figure 1. The proportions of Covid-19 deaths in total deaths by age in USA from
110 February 1 to September 19, 2020

111 The figures on the right are cluster analysis of the data on the left. The original data
112 come from the website of the Centers for Disease Control and Prevention, USA
113 (National Center for Health Statistics, 2020). The data in September, 2020 will be
114 significantly changed in the updated version.

115 A, Cumulative Covid-19 deaths;

116 B, Weekly Covid-19 deaths;

117 C, Ratio of cumulative Covid-19 deaths to Cumulative total deaths;

118 D, Ratio of weekly Covid-19 deaths to weekly total deaths.