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Commentary

Focusing COVID-19 vaccinations on elderly and high-risk people

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The COVID-19 pandemic poses an unprecedented challenge to health care systems and societies in the 21st century in many countries. Cumulative numbers of deaths from COVID-19 infections have been rapidly rising throughout the second half of 2020, reaching more than 1.8 million globally by the end of 2020 [1]. There are big hopes that the toll of the pandemic can be overcome to a large extent by highly effective vaccinations that have been developed and admitted within unprecedentedly short time windows. e.g. [2]. On the other hand, there are concerns about delayed availability of sufficient vaccine doses, and there are ongoing scientific and political debates on the target population, prioritisation, advocacy and voluntariness of vaccinations [3–8], including potential incentives for participants and discrimination against non-participants. The aim of this comment is to inform such debate by relevant epidemiological data, using Germany as the country with the largest population within the European Union as an example.

Based on a review of the literature, Ioannidis provided estimates of the COVID-19 infection case fatality rate by risk group [9] as shown in Table 1, ranging from 25% in institutionalised frail elderly to 0.01% in low-risk people <65 years of age. There is general consensus that people aged 65 years or older and upper-risk people below age 65 represent high-risk groups which should be offered vaccination with priority. According to population statistics from Germany, these groups made up one third (33%) of the total population in 2019. Without vaccination, approximately 60% of the population would be expected to be infected in a full cycle of the pandemic before herd immunity is reached, which would be expected to result in a total of 290 thousand COVID 19 deaths given the assumed risk group specific case fatality rates. The vast majority of these deaths (99%) would be expected to occur in the high-risk third of the population.

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Vaccination started in Germany using the Biontech-Pfizer vaccine [2] at the end of 2020. Assuming that timely offer of vaccination of the entire population (except children below age 16 and pregnant women for whom COVID-19 vaccination is currently not recommended and in whom COVID-19 deaths are very rare) could prevent 75% of the otherwise expected deaths (with remaining 25% of deaths being due to already occurred deaths, nonadherence, contraindications or lack of effect), vaccination could save 217.9 thousand deaths, again 99% in the one third of the population at high risk due to age or other reasons. In the high-risk population, approximately 95 people would have to be vaccinated to prevent one COVID-19 death. In the low-risk population (excluding children and pregnant women), this number would be almost 13,000, approximately 135 times higher.

Notwithstanding simplifying assumptions inherent in model calculations, these calculations illustrate the extremely strong difference in expected impact of vaccination on reducing COVID-19 deaths (and related hospitalisations) in older and high-risk people compared to low-risk people below age 65, the two-third-majority of the population in Germany and other European countries. Results therefore strongly support prioritisation of vaccination offers to older and high-risk people. Given the remaining uncertainties regarding long-term safety of the novel lipid nanoparticle-formulated, nucleoside-modified RNA vaccine [10] and the shortage of available vaccines at least in the short run on a global scale, the results even question the need, justification and ethics of full population roll-out of the vaccination and suggestions of incentives for participants and discrimination against non-participants among the majority of low-risk people in particular. Official COVID-19 vaccination recommendations in Germany (<https://www.rki.de/DE/Content/Infekt/Impfen/ImpfungenAZ/COVID-19/Impfempfehlung-Zusfassung.html>, accessed 21 January 2021) suggest starting vaccinations in the oldest and most vulnerable population groups along with their medical and nursing care givers and gradually enrolling vaccinations to younger and less vulnerable or exposed groups.

Reserving the limited vaccines to high-risk people on a global scale and achieving timely completion of vaccination campaigns in these groups may prevent the vast majority of COVID-19 deaths well before herd immunity on the level of entire populations is achieved. Upon completion of the vaccination campaign in the high-risk population, which could be accomplished within weeks to few months in most countries including Germany, the severe lock-down measures that have strongly affected social and economic life of many societies and that may go along with severe adverse health effects could be alleviated. Low-risk people could then still be offered vaccination as

Table 1

Estimated COVID-19 deaths during full cycle of the pandemic under different vaccination scenarios in Germany.

Population group	Infection case fatality rate ^a	Population in 2019 in Germany in millions (%) ^b	Deaths according to vaccination (thousands)		Saved deaths in thousands (%)	Vaccinated persons per saved death ^e
			No ^c	Yes ^d		
Institutionalized frail elderly	25%	0.8 (1)	120.0	30.0	90.0 (41)	7
Other > 75 y	2%	8.7 (10)	104.4	26.1	78.3 (36)	83
Other 65–74 y	1%	8.6 (10)	51.6	12.9	38.7 (18)	167
Upper-risk <65y	0.2%	9.3 (11)	11.2	2.8	8.4 (4)	833
High-risk total	1.75%	27.4 (33)	287.2	71.8	215.4 (99)	95
Lower-risk <65y	0.01%	55.8 (67)	3.3	0.8	2.5 (1)	12,873
Total population	0.58%	83.2 (100)	290.5	72.6	217.9 (100)	243

^a according to age/risk group specific estimates summarised by Ioannidis [9].^b according to population statistics for Germany, assuming a 1:6 relation of high:low risk in age group <65 y as in Ioannidis [9].^c assuming 60% of population in each group are infected before herd immunity is reached.^d assuming vaccination prevents 75% of deaths expected without vaccination (remaining 25% due to already occurred deaths, nonadherence, contraindications or lack of effect).^e assuming vaccination of 75% of the population aged 16 years or older, excluding pregnant women.

far as available but would not have to be and should not be urged to get vaccinated, as herd immunity may develop without major public health concerns once the high risk groups have had the opportunity of almost complete protection.

Declaration of Competing Interest

There are no conflicts of interests.

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