

# Impact of COVID-19 by sex and age on two countries 2020-2022.

## The cases of Mexico and Spain and its impact on mortality risk for life insurance products

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### Abstract

This work analyses the impact of COVID-19 on the mortality rates of two countries belonging to two different geographical and economic areas. In particular, the cases of Spain and Mexico are studied and compared.

To carry out this analysis, graduation techniques are applied using non parametric methods for estimating mortality rates. In particular, we proceed to apply cubic splines to graduate mortality rates using a battery of tests to check the quality of the graduation under the assumption that the number of deaths follow a binomial distribution.

This procedure allows us to more clearly visualize the impact of the pandemic and, above all, to quantify the consequences of COVID-19 age by age, and always differentiating by sex. Focusing on mortality rates rather than on the number of deaths or life expectation provides new insights into the impact of COVID-19 on populations. For example, the impact of COVID-19 in terms of the number of deaths on a young populations may be lower than in aging populations even if the impact of COVID-19 is stronger in the former. This fact is illustrated by comparing the incidence of COVID-19 of two different populations such as México and Spain. These two populations have a very different age structure that must be taken into when measuring the impact of a pandemic such as COVID-19. Furthermore, a different economic and social context can have a clear effect of pandemics on populations.

The results clearly show how the impact of COVID-19 differs considerable in both the intensity and the persistence of the disease in both countries. Not only that but the impact of COVID-19 on mortality rates has affected age groups very differently as a consequence of the differences in labor market and health systems.

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For instance, the impact of COVID on the male population of México mainly affected the age group between 45 and 75 years with increments in mortality rates of more than 60 % during both 2020 and 2021. On the contrary, in the case of the Spanish male population, the increase in mortality rates was maximum in the age range between 65 and 95 years with increments in mortality rates between 10 % and 15 % during 2020. Also, the generalization of vaccination had an important effect in Spain during 2021 with mortality rates for people over 75 returning to levels close to pre-pandemic figures. An other difference appeared in infant mortality rates that experienced a dramatic drop in Spain during 2020 probably due to confinement measures taken by authorities.

In the case of the female Mexican population the pattern of the impact of COVID-19 during 2020 and 2021 was very similar to that of men with a maximum increase of 60 % in mortality rates around 60 years. On the contrary, in the case of the Spanish female population we observe that greatest increases correspond to woman around 35 years old where mortality rates increased around 15 % and also in the age range between 70 and 90 years . During 2021 the impact of COVID-19 in Mexico was even higher than during 2020 with increments of more than 60 % in mortality rates for women between 40 and 65 years old. In the case of Spain, the impact during 2021 was smaller than 10 % for all ages and disappeared for women older than 80 years.

Additionally, this way of approaching the measurement the impact of the pandemic provides new evidences about the adequacy of stress test usually applied in the life insurance industry to measure mortality risk in life products suggesting that these test should be different for countries with different levels of development of their health systems and the structure of their labor markets.