



## **Social bias in mortality of poor compared to affluent people in earthquakes**

Max Wyss, Philippe Rosset, and Stavros Tolis

International Centre for Earth Simulation Foundation, Geneva, Switzerland

That poor people live in buildings constructed with lower quality than those of affluent people is a generally accepted fact. That buildings of low quality collapse in earthquake shaking more readily than those of high quality is also obvious. It follows that lower income families are more likely to die or be injured in earthquakes than well to do people. Here we estimate quantitatively what the difference in earthquake mortality may be as a function of affluence. Because mortality in earthquakes is much higher in developing countries than in highly advanced ones, and the above assumptions are more correct in the former, we concentrate on the former. We have validated our algorithms and data sets available in the tool QLARM in detail in the following countries: China, India, Mexico, Iran and Greece. This means that the overall numbers of fatalities in earthquakes are estimated correctly within a factor of about 2.5 in these countries. That does not mean that we have separate knowledge of mortality in specific communities. Nevertheless, it allows us to propose that our technique to estimate fatalities is approximately correct in these countries. A critical and limiting assumption is that we model the distribution of buildings into classes of resistance to shaking in three classes only: villages (population < 2,000), towns ( $2,000 \leq \text{pop} < 20,000$ ) and cities ( $\text{pop} \geq 20,000$ ), according to the single publication on this topic. Subject to the aforementioned assumptions, we estimate that in countries like China, India and Iran the mortality in the rural population is 4 to 10 times larger than that in city dwellers. In Latin American countries the differences are in the range of factors of 2 to 4. Our data also suggest that in highly developed countries the mortality due to strong shaking is an order of magnitude less than in developing countries. We emphasize that the results presented here are based on approximate models for the built environment of settlements of different sizes. Therefore, our results are not the final ones. Quantitative information on building quality by communities should be developed to allow more precise estimates of the social bias in earthquake disasters. Nevertheless, based on the presented first order approximations of the higher earthquake risk for poor people, governments should consider means to better protect the population at the low end of the income curve.