Does solar ultraviolet radiation play a role in COVID-19 infection and deaths? An environmental ecological study in Italy

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Abstract

A significantly stronger impact in mortality and morbidity by COVID-19 has been observed in the northern Italian regions compared to the southern ones. The reasons of this geographical pattern might involve several concurrent factors. The main objective of this work is to investigate whether any correlations exist between the spatial distribution of COVID-19 cases and deaths in the different Italian regions and the amount of solar ultraviolet (UV) radiation at the Earth's surface. To this purpose, in this environmental ecological study a mixed-effect exponential regression was built to explain the incidence of COVID-19 based on the environmental conditions, and demographic and pathophysiologic factors. Observations and estimates of the cumulative solar UV exposure have been included to quantify the amount of radiation available e.g., for pre-vitamin D3 synthesis or SARS-CoV-2 inactivation by the sunlight. The analysis shows a significant correlation (p-value<5×10^{-2}) between the response variables (death percentage, incidence of infections and positive tests) and biologically effective solar UV radiation *(see figures below),* residents in nursing homes per inhabitant (NHR), air temperature, death percentage due to the most frequent comorbidities. Among all factors, the amount of solar UV radiation is the variable contributing the most to the observed correlation, explaining up to 83.2% of the variance of the COVID-19 affected cases per population. Whilst the statistical outcomes of the study do not directly entail a specific cause-effect relationship, our results are consistent with the hypothesis that solar UV radiation impacted on the development of the infection and on its complications, e.g. through the effect of vitamin D on the immune system or virus inactivation by sunlight. The analytical framework used in this study, based on commonly available data, can be easily replicated in other countries and geographical domains to identify possible correlations between exposure to solar UV radiation and the spread of the pandemic.

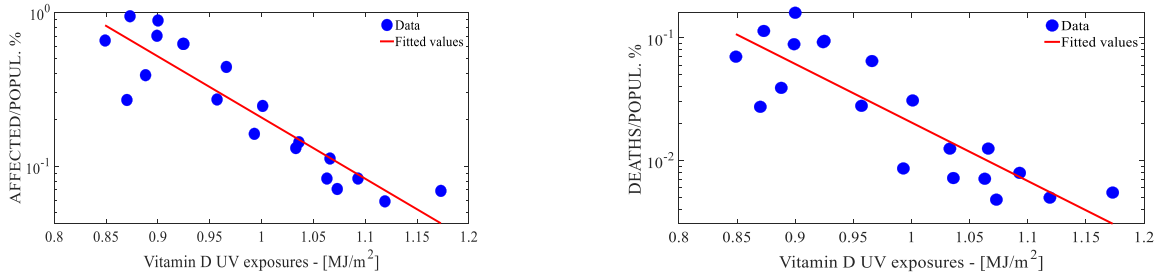

Figure: *Percent of affected cases and mortality per region versus vitamin D UV exposure. Fitted values are derived from linear model of the logarithm of the variable versus vitamin D UV exposure*