

MODELING THE INFLUENCE OF MALNUTRITION ON MEASLES EPIDEMIOLOGY IN ETHIOPIA

V. Veronesi^{*1},
P. Poletti², V. Marziano², A. Tsegaye³,
F. Manenti⁴, G. Putoto⁴, S. Merler²

¹University of Trento, Trento, Italy

²Center of Information Technology,
Fondazione Bruno Kessler, Trento, Italy

³Doctors with Africa CUAMM,
Addis Ababa, Ethiopia

⁴Doctors with Africa CUAMM,
Padova, Italy

valentina.veronesi@studenti.unitn.it (*corresponding author)

Measles and severe acute malnutrition (SAM) represent two of the major causes of deaths in children under 5 years of age in Ethiopia. In recent years, recurrent measles outbreaks have been reported in several areas of the country, including the Oromia Region. The majority of cases was reported among under-5 children. According to the World Health Organization, every month over 25,000 children in this age group are admitted to Ethiopian hospitals due to SAM. The aim of this study is to investigate measles spread between 2015 and 2018 in five different districts of the South West Shoa Zone, in the Oromia region, and to understand the potential role of malnutrition in determining the current burden of measles disease.

We analyzed patient records related to measles and different diagnosis of SAM as collected at the Woliso hospital between 2015 and 2018 to estimate: i) the prevalence of SAM across the different districts; ii) the case fatality rate (CFR) among measles patients in the presence and in the absence of an additional diagnosis of SAM. We developed a multi-patch ordinary-differential equations model for measles transmission to estimate the measles infection incidence across the different districts and evaluate possible spatial heterogeneity driven by local prevalence of SAM. The model is calibrated by means of a Markov Chain Monte Carlo approach applied to the monthly measles case patients recorded at the Woliso hospital between 2015 and 2018.

We found that the prevalence of SAM in the main hospital catchment area ranges from 1.5% in Woliso Town to 14.2% in Amaya. The estimated CFR of measles patients also affected by SAM is 11.6% (95%CI: 3.9-25.1), which is significantly higher than the one estimated for measles patients not affected by SAM: 1.7% (95%CI: 1.1-2.5). Modeling results show that the measles attack rate in the considered period ranges between 0.94% in the Woliso Town woreda to 2.57% in the Woliso Rural woreda. Our results suggest that, as SAM increases the measles CFR among severe cases, SAM might have caused indirectly about 34.16%

*11th Conference on Dynamical Systems Applied
to Biology and Natural Sciences DSABNS 2020
Trento, Italy, February 4-7, 2020*

of measles deaths.

References

- [1] World Health Organization. Regional Office for Africa. Ethiopia sets new standards for the management of acute malnutrition. Available at: <https://www.afro.who.int/pt/node/1434>
- [2] Poletti P, Parlamento S, Fayyisaa T, Feyyiss R, Lusiani M, Tsegaye A, et al. (2018). *The hidden burden of measles in Ethiopia: how distance to hospital shapes the disease mortality rate*. BMC Medicine, Article number: 177