



Letter to the Editor

Factors that influenced the historical trends of tetanus and diphtheria



The paper of Pezzotti et al. [1] reports that the mortality and incidence of diphtheria and tetanus decreased significantly during the twentieth century (Fig. 1). To estimate the impact of vaccination, the authors have applied a model which projects the trends before the introduction of vaccination to the subsequent years. As for tetanus, the projected estimates after 1963 show an increase in mortality, which points towards a plateau of about 1.5 cases/100,000 (Fig. 1C), which means about 900 deaths/year in Italy. However, the resulting projection seems strange enough in light of the fact that mortality was already decreasing before the introduction of the vaccine and that the average number of deaths reported in Italy is 21 [2]. This difference of 30 times between projections and reality cannot be explained by vaccination alone, since in Italy 19.2% of the population is susceptible to tetanus (ie about 12,000,000 people) and a further 10.1% have inadequate levels of antibodies [2]. Therefore, it is conceivable that the dramatic decrease of tetanus mortality after the world war II is accounted for by further factors, such as advancements in antisepsis, wound disinfection and hygienic conditions of environment, particularly in urban areas (spores are spread by horses and farm animals). As for diphtheria, Pezzotti et al. [1] calculate that as many as 1,832,142 cases were prevented by vaccination (Table 1). This estimate is based on the assumption that all the decrease of incidence was due to vaccination, and on the projection of a stationary trend of 60 cases/100,000 from 1939 onwards (Fig. 1B). This assumption can be questioned: (A) while mortality rates halved from 1900 to 1939 (Fig. 1A), morbidity rates (Fig. 1B) oscillated from 30 to 80 cases/100,000 and doubled between 1920 and 1930: an unexplained time series, that could have affected projected estimates. (B) Pharyngitis symptoms are easily detected, leading to antibiotic treatment, isolation and antitoxin, all procedures that in a post-war improving health system could have minimized the risk of spread. As a matter of facts, scarlet fever – a highly contagious disease – declined in industrialised nations as living conditions improved, then continued to fall with the advent of the antibiotic era [3]. (C) *Corynebacteria* exist in toxigenic and non-toxigenic strains, according to the infection by a converting phage. If the vaccine would have limited the diffusion of toxigenic strains, this should have exerted a selection pressure favouring the non-toxigenic strains. On the contrary, even non-toxigenic *Corynebacteria* almost disappeared from Italian clinical scenery [4]. (D) The

immunity provided by vaccination is against the toxin, not the bacterium, which means that vaccinated persons are protected from the lethal consequences of the disease, not from the infection [5], and that the causal agent is eliminated by phagocytes and antibiotics. (E) Population dynamics in Italy have changed considerably throughout the second half of twentieth century, with a marked decline in birth rates, a factor that certainly affected the spread of childhood infectious diseases. In a small sentence of Discussion [1], it is admitted that also sanitation and antibiotics might have played a role in the declining trend, but quantitative analysis (Table 1) and the conclusions did not take it into account, as the other factors reported here were not accounted for. Accurate forecasting of pathogen dynamics calls for the integration of epidemiological and evolutionary processes [6]. In conclusion, estimates of the temporal trends of infectious diseases must not overlook important elements of the fight against infectious diseases (nutrition, lifestyle, disinfection, living/working/school environment, early diagnosis, isolation procedures, antibiotics, antitoxins for emergency cases), which should implement public health interventions and information to citizens.

Conflict of interest

The author has no conflicts of interest.

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