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What It Will Take to Achieve a World Without Measles

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The past decade began with a great deal of promise that after nearly 50 years of measles vaccine use to combat one of the major causes of global child mortality, a world without measles was finally in sight [1]. In 1980, before widespread global use of measles vaccine, an estimated 2.6 million measles deaths occurred worldwide. At the beginning of the 21st century, to accelerate the reduction in measles cases achieved by vaccination, a new strategy to deliver at least 2 doses of measles-containing vaccine (MCV) to all children, either through routine immunization services or supplementary immunization activities (SIAs), and to improve measles surveillance was launched by the founding partners of a new global Measles Initiative—the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the Centers for Disease Control and Prevention, the United Nations Foundation, and the American Red Cross (the initiative was renamed the Measles and Rubella Initiative in 2012) [2]. During the first decade of this century, this initiative supported the vaccination of > 900 million children in SIAs and led to a decrease in global mortality attributed to measles by an impressive 78%, from an estimated 733 000 deaths in 2000 to 164 000 in 2008, as well as an increase in MCV first-dose routine immunization coverage (MCV1) from 72% to 85% during 2000–2010 [1]. Moreover, reductions in measles mortality accounted for a remarkable 23% of the overall estimated global decline in all-cause child mortality from 1990 to 2008 [3]. In the United States (US), measles was declared eliminated in 2000 as a result of sustained interruption of transmission.

This remarkable progress resulted in heightened political, technical, and programmatic support to pursue measles eradication by the beginning of the decade of the 2010s. In 2010, an expert advisory panel convened by the WHO concluded that measles can and should be

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eradicated [4]. The WHO Strategic Advisory Group of Experts (SAGE) on Immunization endorsed these conclusions [5] and in 2011, the World Health Assembly (WHA) Executive Board endorsed the SAGE recommendations. In 2012, the WHA endorsed the Global Vaccine Action Plan, which included targets to achieve existing disease eradication and elimination goals for polio, neonatal tetanus, measles, and rubella by 2020. Among these targets was the objective of regional elimination of measles in 5 of the 6 WHO regions by 2020. By 2013, member states of all 6 WHO regions had voted for regional elimination target dates on or before 2020, securing the political commitment of all countries.

Since that time, measles vaccination has continued to have a marked impact on disease, disability, and death worldwide, averting an estimated 23.2 million deaths globally during 2000–2018 [5]. The economic benefits of investing in measles vaccine were demonstrated [6, 7]. When accounting for broad economic benefits, vaccines have an estimated overall 44-fold return on investment [6]. The highest return on investment is for the measles vaccine at 58 times the cost after provision of 2 routine immunization doses and outreach campaigns [6]. In addition, measles eradication feasibility and benefits have been reiterated [8-11].

In this issue of *The Journal of Infectious Diseases*, Patel et al [12] present a summary of global measles epidemiology and surveillance during 2013–2018. This is an important piece of work from the standpoint of illustrating to readers some of the underlying causes for why measles continues to be a substantial cause of morbidity and mortality in the developing world, and why a worldwide measles resurgence occurred during 2018–2019, including in the US [13, 14]. They note that the reasons for the resurgence are multifactorial and vary by country, but all relate to the root cause of failure to vaccinate rather than vaccine failure [12]. Increased measles cases and outbreaks have occurred mostly among unvaccinated persons, including school-aged children and young adults [15]. International travel by infected persons has facilitated international spread of measles, including both unimmunized residents traveling abroad and returning home to undervaccinated communities (the main source of measles cases in the US), and unimmunized foreign visitors [14-16].

The authors conclude that action is needed now to close immunity gaps to achieve measles elimination. Timely vaccination of susceptible cohorts of young children and adolescents is critical as these cohorts are more accessible than adults. In 2019, WHO named vaccine hesitancy as 1 of the 10 biggest threats to health worldwide [17], noting that delays and incomplete vaccination could reverse the progress made in reducing vaccine-preventable diseases. The longer these gaps persist, the harder and the more costly it will be to eliminate measles, as adults are more challenging to vaccinate [12, 18].

Unfortunately, political commitment and momentum at the global level to achieve measles elimination began to dissipate by mid-decade and began a gradual decline through the end of the decade, despite sustained commitment at the regional level. Although MCV second-dose coverage (MCV2) increased globally from 18% in 2000 to 69% in 2018 because of an increase in the number of countries providing MCV2 (from 98 [51%] in 2000 to 171 [88%] in 2018), MCV1 coverage has stagnated between 84% and 86% since 2010 [13]. Despite the frequent warning used by the Measles and Rubella Initiative that “measles moves fast, we must move faster,” delays in implementation of preventive follow-up SIAs often

resulted in breakthrough measles outbreaks requiring emergency measles control efforts that diverted national resources from the necessary planning needed to implement high-quality nationwide preventive SIAs. The number of reported measles cases increased by 167% in 2018 compared with 2016. Measles deaths, after reaching a nadir of 89 780 globally in 2016 (an 84% decrease compared with 2000) [15], have risen to an estimated 142 300 deaths in 2018 [13], the highest level since 2011. Provisional WHO data for 2019 indicate a further 90% increase compared with 2018. Of note, the Democratic Republic of Congo (DRC) had > 300 000 reported measles cases in 2019, and > 6000 measles deaths, far surpassing the deadly toll of the current Ebola virus epidemic in DRC.

In December 2019, a report in *The Lancet* stated that the global surge in measles should be a "wake-up call" [19]. In the report, WHO officials noted that overall globally, political commitment and financial resources are inadequate to assure that at least 95% of children receive 2 doses of MCV and that outbreaks are detected, investigated, and responded to quickly. To respond to this situation, WHO is calling for more investment and attention to measles and the immunization agenda [19]. The 6 chairpersons of the WHO Regional Verification Commissions for Measles and Rubella Elimination have "advocate(d) that the time for courageously accelerating efforts to ensure a world where no child dies of measles, is NOW!"—and have called for an exceptional coordinated global effort [20]. In the August 2019 issue of *The Atlantic*, Peter Beinart reflects on what the measles epidemic really says about the US [21]. He concludes that "the return of a vanquished disease reflects historical amnesia, declining faith in institutions, and a troubling lack of concern for the public good." This is the 21st century, and yet we have become so complacent as to allow an ancient disease easily preventable with a highly effective and inexpensive vaccine—at a price of US$0.25 per dose through UNICEF for developing countries—to continue to rampage around the world while exacting a human cost of > 100 000 lives lost each year. We can and must do better than this.

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