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Postneonatal mortality impacts following grants from the Gavi Vaccine Alliance: an econometric analysis from 2000 to 2014

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ABSTRACT

We completed a retrospective multivariate panel study to evaluate the effect of Gavi Vaccine Alliance grants on vaccine-preventable disease (VPD) postneonatal mortality. We separately tested a composite VPD mortality rate and five vaccine-preventable mortality rates: pertussis, meningitis, measles, diarrhea, and pneumonia (lower-respiratory infection) as dependent variables. All 77 countries eligible for Gavi assistance from 2000 to 2014 were included in the study. To isolate the effect of Gavi funding in our primary model, we controlled for known and likely predictors of child mortality. We found evidence that, among other factors, Gavi investment, antenatal care access, and girls' primary education are important elements to reduce vaccine-preventable mortality rates. For every \$1 per capita invested by the Gavi Vaccine Alliance, there are statistically significant effects decreasing the VPD postneonatal mortality rate by 1.848 per 1000 live births. We also found Gavi investments to be significantly associated with reductions in three VPD-specific rates: pertussis, meningitis, and pneumonia. We conclude that Gavi investments in developing country immunization programs have measurably contributed to reductions in postneonatal VPD mortality rates.

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Introduction

The United Nations Development Goals aim to end preventable child death by 2030.¹ The World Health Organization (WHO) estimates that immunization averts at least two to three million deaths every year in all age groups.²

Furthermore, vaccinations are among the most cost-effective public health interventions.^{3,4} The Gavi Vaccine Alliance is an international public–private partnership that aims to create equal access to new and under-used vaccines for children living in the world's poorest countries.⁵ Since its inception in 2000, the Gavi Alliance has become a major health development donor: providing more than \$9.43 billion

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(current US\$) to 77 countries from 2000 to 2014.⁶ Gavi aims to (1) accelerate equitable uptake and coverage of vaccines; (2) increase effectiveness and efficiency of immunization delivery as an integrated part of strengthened health systems; (3) improve sustainability of national immunization programs; and (4) shape markets for vaccines and other immunization products.⁵ Fig. 1 illustrates the reduction in postneonatal (children aged 1–59 months) mortality rates (per 1000 live births) for vaccine-preventable disease (VPD) overall and its component mortality rates for five specific VPDs: pertussis, meningitis, measles, diarrhea, and pneumonia among the 77 countries that received any Gavi assistance from 2000 to 2014. The average annual postneonatal VPD decrease from 2000 to 2014 is 1.67 per 1000 live births; the average annual Gavi funding increase over the period is \$102.4 million.

The Gavi Alliance focuses its financial support on the world's poorest countries, eligibility is based on national income. From 2000 to 2006, the gross national income (GNI) per capita eligibility threshold was US\$ 1000 (based on 1998 World Bank data). Seventy-four countries were initially eligible to apply for Gavi support (eligibility to apply for assistance does not presuppose that a country applied for and/or received financial support). Since 2000, three additional countries have become eligible for and received support: Timor-Leste (2002), Kiribati (2007), and South Sudan (2011). Presently, countries are eligible to apply for Gavi financing when their GNI per capita is below or equal to US\$ 1580 on average over the past

three years. Among the 77 countries that have received Gavi financial support, 31 are currently classified as low-income economies, 38 as lower middle income, and eight as upper middle income (low-income economies are defined as those with a GNI per capita, calculated using the World Bank Atlas method, of \$1045 or less in 2014; lower middle-income economies are those with a GNI per capita of more than \$1045 but less than \$4125 and upper middle-income countries are those with a GNI per capita of \$4125 to \$12,736;⁴⁸ per 2016 World Bank income groupings). Fig. 2 illustrates the geographic distribution of countries that have received Gavi financing, color-graded by total disbursements (in 2016 US dollars) from 2000 to 2014.

Over the period 2000–2014, the average total country disbursement is \$122.5 million, with range of \$713,511 (Kiribati) to \$928,030,656 (Pakistan). Ten countries have received a combined total of \$4.969 billion representing 53% of total disbursements: Pakistan, Ethiopia, Democratic Republic of the Congo, Nigeria, Bangladesh, Kenya, Tanzania, Sudan, Uganda, and Ghana.

Gavi reports that this support has assisted countries to vaccinate 500 million children from 2000 to 2014.⁷ The three-dose diphtheria, pertussis (whooping cough), and tetanus (DTP3) vaccination coverage rate serves as a proxy indicator for fully immunized children as there is no standard definition for the later.⁸ A study that evaluated the impact of Gavi funding on DTP3 vaccination coverage rates from 2001 to 2005

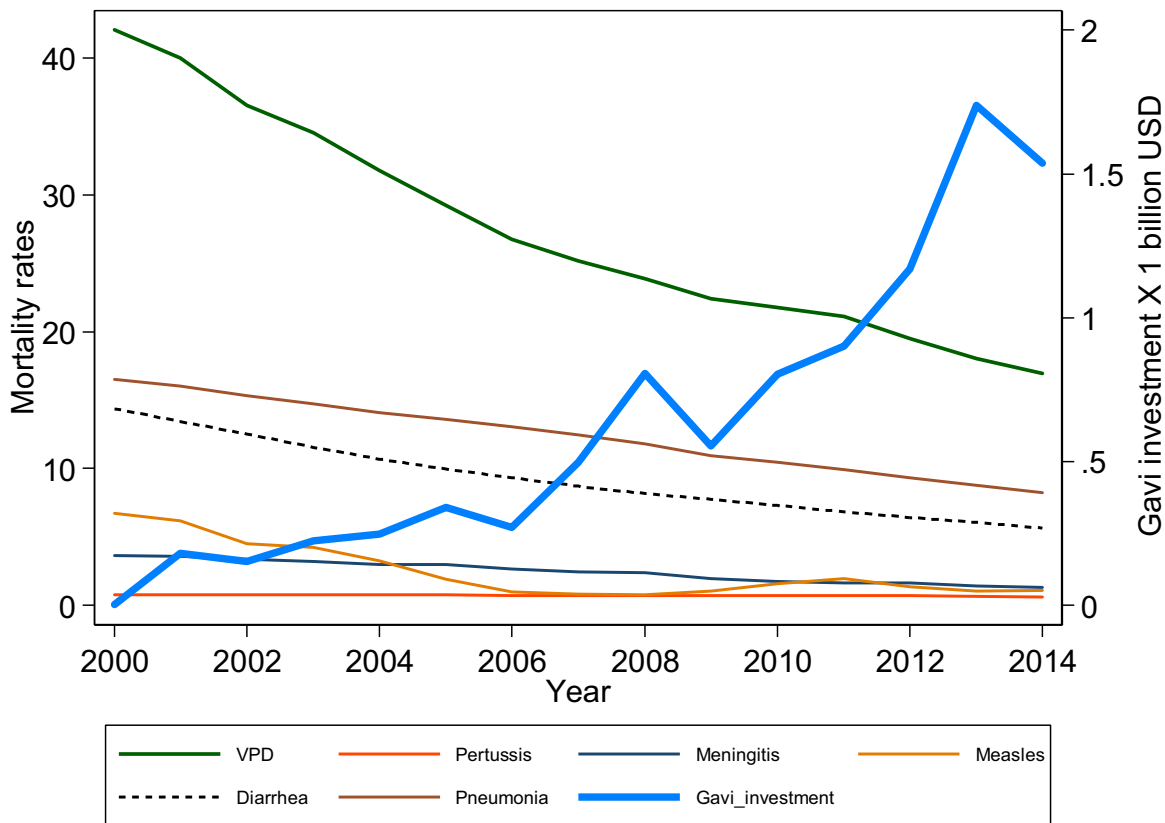


Fig. 1 – Annual postneonatal mortality rates for vaccine-preventable diseases and Gavi investment from 2000 to 2014 in 77 Gavi-supported countries. VPD, vaccine-preventable disease. Data sources: World Health Organization and Institute for Health Metrics and Evaluation.

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