




Health and economic benefits of achieving contraceptive and maternal health targets in Small Island Developing States in the Pacific and Caribbean

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ABSTRACT

Introduction Reducing unmet need for modern contraception and expanding access to quality maternal health (MH) services are priorities for improving women's health and economic empowerment. To support investment decisions, we estimated the additional cost and expected health and economic benefits of achieving the United Nations targets of zero unmet need for modern contraceptive choices and 95% coverage of MH services by 2030 in select Small Island Developing States.

Methods Five Pacific (Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu) and four Caribbean (Barbados, Guyana, Jamaica and Saint Lucia) countries were considered based on population survey data availability. For each country, the Lives Saved Tool was used to model costs, health outcomes and economic benefits for two scenarios: business-as-usual (BAU) (coverage maintained) and coverage-targets-achieved, which scaled linearly from 2022 (following COVID-19 disruptions) coverage of evidence-based family planning and MH interventions to reach United Nations targets, including modern contraceptive methods and access to complete antenatal, delivery and emergency care. Unintended pregnancies, maternal deaths, stillbirths and newborn deaths averted by the coverage-targets-achieved scenario were converted to workforce, education and social economic benefits; and benefit–cost ratios were calculated.

Results The coverage-targets-achieved scenario required an additional US\$12.6M (US\$10.8M–US\$15.9M) over 2020–2030 for the five Pacific countries (15% more than US\$82.4M to maintain BAU). This additional investment was estimated to avert 126 000 (40%) unintended pregnancies, 2200 (28%) stillbirths and 121 (29%) maternal deaths and lead to a 15-fold economic benefit of US\$190.6M (US\$67.0M–US\$304.5M) by 2050. For the four Caribbean countries, an additional US\$17.8M (US\$15.3M–US\$22.4M) was needed to reach the targets (4% more than US\$405.4M to maintain BAU). This was estimated to avert 127 000 (23%) unintended pregnancies, 3600 (23%) stillbirths and 221 (25%) maternal deaths and lead to a 24-fold economic benefit of US\$426.2M (US\$138.6M–US\$745.7M) by 2050.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Governments and donors in the Pacific and Caribbean Small Island Developing States need a better understanding of the additional investment required to scale up sexual and reproductive health and maternal health services to improve access in these regions. No global investment cases have been conducted for sexual and reproductive health and maternal health services in these Small Island Developing States, often with small populations and affordability needs.

WHAT THIS STUDY ADDS

⇒ This study showed that zero unmet need for modern contraceptive choices and 95% coverage of maternal health services in the select Small Island Developing States could be achieved with an additional 4%–15% investment.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Reaching these targets in Small Islands and Developing States is likely to be affordable and have a high return on investment; for each US\$1 invested economic returns could range from US\$15 to US\$24, with benefits continuing to accrue over the longer term. Scaling up contraception and maternal health coverage simultaneously, rather than separately, captures the efficiencies and cost savings stemming from a more comprehensive approach.

Conclusion Achieving full coverage of contraceptive and MH services in the Pacific and Caribbean is likely to have a high return on investment.

INTRODUCTION

Health services delivered to women prior to pregnancy, during pregnancy, during

childbirth and during the postnatal period should ensure women, including adolescent girls and their babies reach their full potential for lifelong health and well-being.¹ Most unintended pregnancies and maternal and newborn deaths can be prevented with timely care by skilled health professionals.² Ensuring people have access to modern contraception methods is critical. Globally, the proportion of women who have their need for family planning satisfied with modern methods (Sustainable Development Goals (SDG) indicator 3.7.1) in 2020 was projected at 87%.³

As Small Island Developing States (SIDS) in Pacific and Caribbean SIDS face persistent challenges in universal access to sexual and reproductive health services, countries in these regions were selected as the focus for this study. Only two out of nine countries considered in this study from the Pacific and Caribbean regions have experienced growth in contraceptive prevalence rates over the last decade.⁴ Adolescent birth rates continue to increase in the Pacific (6% increase from 2010 to 2019⁵), with high rates in the Caribbean that are only slowly decreasing (20% decrease from 2010 to 2019).⁶ Due to their small population and communities being spread over vast distances separated by ocean waters, it can be difficult to travel to seek health services, which may have low absorptive capacity and high demands placed on a small number of staff. As well, these health systems have been directly and indirectly impacted by the COVID-19 pandemic since early 2020, which has led to a period of reduced service coverage and access.^{7,8} The pandemic has also had a harsh impact on the economies of these regions, which are heavily reliant on tourism as a major source of revenue and employment,^{9,10} and countries may, therefore, face difficult decisions on how to best invest limited resources.

Increasing the coverage of contraception and maternal health interventions together has synergistic effects. Increased contraceptive prevalence rates can reduce unintended pregnancies, which can in turn result in reduced maternal deaths, stillbirths and newborn deaths.¹¹ Reducing unintended pregnancies can also reduce demand for, and the cost of, maternal health services. Therefore, scaling up contraception and maternal health coverage simultaneously, rather than separately, captures the efficiencies and cost savings stemming from a more comprehensive approach. Despite the knowledge that scale-up is needed, a better understanding of the investment required to do this is needed to assist governments and donors to make the best fiscal decisions in relation to resource allocation.

This study aimed to estimate the potential impact, investment requirements and return on investment for scenarios designed to achieve the United Nations targets of zero unmet need for modern contraceptive choices and 95% coverage of maternal health services by 2030, while reflecting coverage reductions in 2020 and 2021 due to disruptions from the COVID-19 pandemic. This evidence can support Pacific and Caribbean SIDS governments in their investment choices.

METHODS

Mathematical modelling was used to estimate the reduction in unintended pregnancies, maternal deaths, stillbirths and newborn deaths that could be achieved, and the associated economic benefits, if the coverage of the set of evidence-based family planning and maternal health interventions available in the Lives Saved Tool (LiST) were increased. The settings, interventions, specific scenarios and cost and benefits framework are described below.

Settings

Modelling was conducted across five Pacific countries (Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu) and four Caribbean countries (Barbados, Guyana, Jamaica and St Lucia), based on the availability of population surveys and data. They represent small, medium and large island types, with Jamaica representing nearly half of the total population of the English-speaking and Dutch-speaking Caribbean countries.

Annual demographic and epidemiological data that were used as model inputs are shown for each country in online supplemental material tables A1–A4. Among these countries, most recent estimates of maternal mortality ratio ranged from 27 per 100 000 live births in Barbados to 169 per 100 000 live births in Guyana; unmet need for family planning ranged from 10.0% in Jamaica to 34.8% in Samoa; and fertility rates ranged from 1.4 in Saint Lucia to 4.4 in Solomon Islands (online supplemental material tables A3 and A4). In 2019, these countries were estimated to have GDP per capita ranging from US\$1655 in Kiribati to US\$23 267 in Barbados¹²; health spending ranging from 3.4% of GDP in Vanuatu to 10.2% of GDP in Kiribati (compared with 9.8% globally)¹³ and Universal Health Coverage Service Coverage Index ranging from 50 in Solomon Islands to 74 in Barbados and Guyana (compared with 67 globally).¹⁴

While there are differences among SIDS from the Caribbean and the Pacific, there are similarities between countries in their regional geography and relative isolation. They also share common challenges managing health-related workforce across multiple small islands, delivering education and obtaining commodities.^{15,16}

Interventions modelled

Evidence for the impact of family planning and maternal health interventions typically comes from systematic reviews and meta-analyses, which are summarised in WHO guidelines.^{17–20} They have also been presented across multiple Lancet series, including on child survival,²¹ maternal and child undernutrition,^{22,23} maternal health,²⁴ child development²⁵ and the double burden of malnutrition.²⁶ LiST was developed under the guidance of the Child Health Epidemiology Reference Group to estimate the expected impact of the increased coverage of family planning and maternal health interventions on mortality and morbidity outcomes.²⁷ LiST

contains a comprehensive set of these interventions for which there is sufficient evidence for conducting modelling analyses.

This analysis considered all family planning and maternal health interventions from LiST, which includes the provision of modern contraceptive methods and access to complete antenatal care, delivery care and emergency care. The interventions are summarised in online supplemental material tables B1 and B2 along with their baseline coverage values. Coverage of both contraception and maternal health interventions were increased in this study, with estimates of total costs and investment requirements inclusive of direct cost savings from reductions in unintended pregnancies leading to reduced demand for maternal health services.

Scenario design

For a business-as-usual coverage scenario, intervention coverage values for 2019 were maintained over the study period, based on the most recent estimates from major population surveys (eg, Demographic and Health Survey (DHS) and Multiple Indicator Cluster Survey (MICS)). Where estimates were unavailable, regional estimates from the LiST²⁷ were used. For 2020 and 2021, intervention coverage levels were reduced according to country-specific COVID-19 disruption estimates (see online supplemental material section A), which includes estimated reductions of up to 35% service coverage for 2020 and 2021 due to disruptions on both the supply (ie, staff diversions to COVID-related tasks or closures and policy restrictions) and demand sides (ie, due to stay-at-home orders, service aversion due to COVID-19-related exposure concerns). Coverages were then returned to 2019 levels in 2022 and maintained to 2030. Despite the assumed constant coverage from 2022 to 2030, the business-as-usual coverage scenario included projected changes in population size and structure, and some changes in trends for costs and health indicators are evident based on these demographic changes. Except for the modelled COVID-19 disruptions in 2020 and 2021, contraceptive prevalence and the methods mix (ie, traditional and modern methods) in 2019 was assumed to be maintained to 2030.

For the coverage-targets-achieved scenario, coverage values for 2019–2021 were the same as the business-as-usual coverage scenario, including any COVID-19 disruptions. From 2022, modern contraception coverage was scaled up to achieve zero unmet need by 2030, and maternal health services were scaled linearly to achieve 95% coverage by 2030. For the coverage-targets-achieved scenario, the methods mix for contraception use was assumed to transform from the mix applied for 2019 (ie, traditional and modern contraceptive methods) to exclusively modern methods by 2030. Both scenarios assumed the same changes to projected population size and structure, with the exception of changes due to contraceptive intervention.

Costs

For this analysis, economic costs were considered between 2020 and 2030 from a healthcare provider perspective. Costs for commodities and human resource needs were derived from LiST,²⁸ and inflated based on a study from Stenberg *et al*²⁹ to account for the additional financing needs of health service expansion (eg, additional overheads and to increase absorptive capacity). Costs were not validated through consultations with national counterparts in the Ministries of Health. Within this study estimates of investment requirements include direct cost savings from reduced unintended pregnancies (as contraceptive coverage increased) leading to reduced demand for maternal health services. Costs are presented in 2019 US dollars discounted at 3% per year.

Benefits

Health benefits from increased access to modern contraceptive choices included consideration of unintended pregnancies averted, as well as maternal deaths and stillbirths averted due to the reduction in unintended pregnancies (based on country-specific rates of occurrence). Health benefits from maternal health interventions included consideration of maternal deaths, stillbirths and newborn deaths averted.

These health benefits were converted to economic benefits across three domains: (1) workforce participation (increased participation in the workforce due to years of life gained, as well as for women who have unintended pregnancies averted); (2) education (average increase in years of school completed due to unintended pregnancies averted among adolescents, leading to increased productivity and earnings when they enter the workforce) and (3) social (maternal deaths, stillbirths and newborn deaths prevented leading to years of life gained).

Economic benefits were calculated up to 2050 for the cohort of women and girls receiving interventions in the 2020–2030 period, with an uncertainty range reflecting benefits accrued by the end of the investment period in 2030, and if a longer time frame is considered, up to 2070. Detailed methodological frameworks for calculating costs and benefits are provided in online supplemental material section C. Economic benefits are presented in 2019 US dollars discounted at 3% per year.

Reported outcomes

Health impact outcomes are presented for each country, while costs and benefit–cost ratios are presented as regional aggregates for the Pacific and for Caribbean countries, since cost data were not validated at the country level.

Interpretation of results

Due to small population sizes and low numbers of births per year in these countries, projected maternal mortality ratios should be interpreted with caution since a singular maternal death may have a substantial effect.

Therefore, this analysis focuses on cumulative outcomes over 2020–2030. When scaling up contraception and maternal health interventions, the relative reduction in the number of maternal deaths is expected to be greater than the relative reduction in the maternal mortality ratio, because not only is the risk of death per pregnancy lower but there are also fewer pregnancies as a result of scaling up modern contraception. However, because the full coverage scenario includes a gradual increase in intervention coverage, the reduction in cumulative maternal deaths from 2020 to 2030 is often lower than the reduction in the maternal mortality ratio in the year 2030. To emphasise this, we reported the per cent reduction in maternal deaths in 2030 alone to allow comparison with the reduction in the maternal mortality ratio in 2030.

RESULTS

Pacific Island countries

In 2019, the five Pacific Island countries included in this study spent an estimated US\$6.7 million on contraception as part of family planning and maternal health interventions. This amount, however, still leaves a high proportion of women in each country with an unmet need for modern contraceptive methods and a lack of access to maternal health services by 2030 (ranging from 18% in Kiribati to 35% in Samoa). To achieve zero unmet need for modern contraceptive choices by 2030 and achieve 95% coverage of maternal health services, the annual investment requirements would increase over time. By the year 2030, the annual resources needed to achieve coverage targets would be 36% greater than business-as-usual in that year (figure 1A).

Contraceptive and maternal health coverage targets could be achieved by 2030 for Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu if an additional US\$12.6 million (uncertainty interval US\$10.8–US\$15.9 million) was invested between 2020 and 2030, 15% more than the US\$82.4 million required to maintain current business-as-usual coverage over this period. In the model, this additional investment averted 126 000 (40%) unintended pregnancies (17% of all pregnancies), 2200 (28%) stillbirths and 120 (29%) maternal deaths (figure 2A, B with estimates by country shown in figure 3) and led to a 15-fold economic benefit of US\$190.6 million (US\$67.0–US\$304.5 million) (figure 4, top panel). This was disaggregated as a US\$61.6 million benefit from unintended pregnancies averted, US\$60.6 million benefit from stillbirths averted, US\$59.1 million benefit from newborn deaths averted and US\$9.2 million benefit from maternal deaths averted. The benefit–cost ratio was estimated to be 15.

When coverage targets were met by 2030 in the model, all five countries in the Pacific achieved SDG target 3.7 on universal access to sexual and reproductive health services, including modern contraceptive choices, and all except Solomon Islands experienced a two-thirds

reduction in maternal deaths from 2010 levels by 2030. In addition, adolescent access to modern contraceptive choices produced benefits by reducing adolescent and unintended pregnancies. SDG target 3.1, to reduce the maternal mortality ratio to less than 70 maternal deaths per 100 000 live births by 2030, is already being met in Samoa, Tonga and Vanuatu, but when the coverage targets were met by 2030, these countries additionally achieved their country-specific SDG targets for maternal mortality (a two-thirds reduction compared with 2010 levels). If coverage targets were reached by 2030, Kiribati and the Solomon Islands could achieve SDG target 3.1. Major differences in the impacts, incremental investment requirements, benefits and benefit–cost ratios of achieving coverage targets exist among countries due to differences in several factors. These factors include baseline mortality rates, stillbirth rates, unmet need for modern contraceptive choices, intervention coverages, (not validated) estimates for costs, per capita gross domestic product (GDP), work participation rates among women (used to derive economic benefits) and the ratio of estimated healthcare worker costs to per capita GDP.

Caribbean countries

For the countries in the Caribbean included in this study, an estimated US\$34.5 million was spent on contraception and maternal health interventions in 2019. However, this amount still leaves a high proportion of women in each country with an unmet need for modern contraceptive choices and a lack of access to maternal health services by 2030. To achieve zero unmet need for modern contraceptive choices and 95% coverage of maternal health interventions by 2030, annual investment must increase over time. By 2030, annual resources to achieve coverage targets would be 11% greater than the projected business-as-usual coverage scenario for that year (figure 1B).

Contraceptive and maternal health coverage targets were achieved by 2030 if an additional US\$17.8 million (US\$15.3–US\$22.4 million) was invested between 2020 and 2030 in the four Caribbean countries considered in this study, 4% more than the US\$405.4 million required to maintain business as usual. In the model, this additional investment averted 127 000 unintended pregnancies (23% more than business as usual, 10% of all pregnancies), 3600 stillbirths (23% more) and 221 maternal deaths (25% more) (figure 2C, D with estimates by country shown in figure 5) and led to a 24-fold economic benefit of US\$426.2 million (US\$138.6–US\$745.7 million). This was disaggregated as a US\$160.0 million benefit from unintended pregnancies averted, US\$116.0 million benefit from stillbirths averted, US\$125.9 million benefit from newborn deaths averted and US\$24.3 million benefit from maternal deaths averted. The benefit–cost ratio was estimated as 24 (figure 4, bottom panel). For both regions, the additional investment was required for a mix of consumables, human resources, infrastructure and other programme and logistics resources.

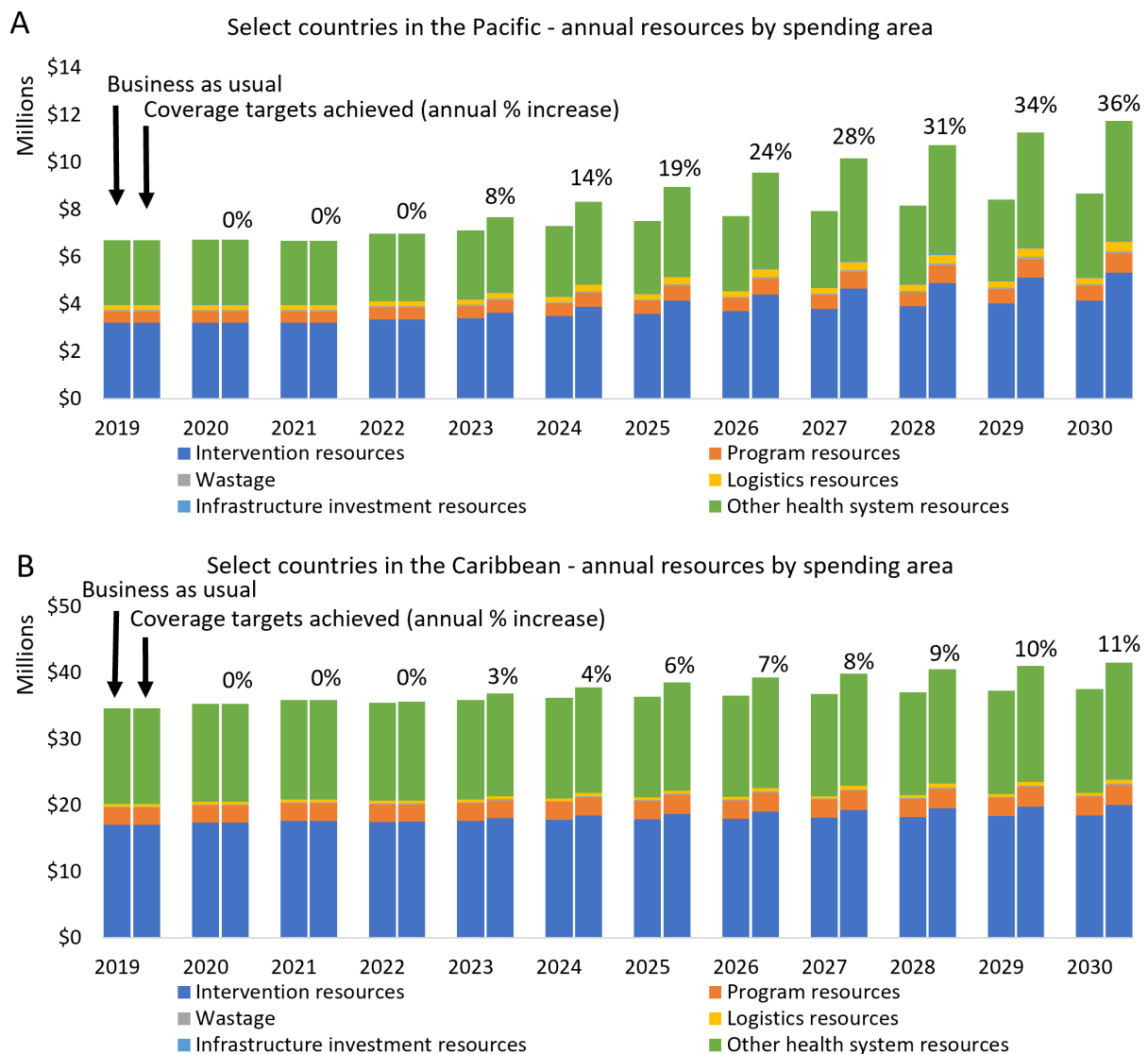


Figure 1 Aggregated annual contraceptive and maternal health resources by spending area. Projections are presented for select countries in (A) the Pacific aggregated for Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu, and (B) for the Caribbean aggregated for Barbados, Guyana, Jamaica and Saint Lucia, for business-as-usual (left bars) and coverage-targets-achieved (right bars) scenarios for 202–2030 in 2019 US dollars (discounted at 3%). In the business-as-usual scenario with intervention coverages maintained, annual costs increased slightly due to population growth.

When coverage targets were met by 2030 in the model, all four Caribbean countries achieved SDG target 3.7 on universal access to sexual and reproductive health services, which includes modern contraceptive choices, and Barbados experienced a two-thirds reduction in maternal deaths from 2010 levels. When coverage targets for contraception and maternal health services were achieved by 2030, the SDG target 3.1, reaching a maternal mortality ratio of less than 70 deaths per 100 000 live births by 2030, was met in Barbados and Jamaica. For Guyana and Saint Lucia, the SDG target 3.1 was not met even if coverage targets were achieved by 2030 given the high estimated maternal mortality ratio in 2019; however, a 31% and 36% reduction in the projected 2030 maternal mortality ratio could be achieved over this period, respectively (figure 5, bottom right panel).

DISCUSSION

Between 2010 and 2020, the satisfied need for modern contraception was estimated to be low in the Caribbean (84%–85%) and even lower in the Pacific (77%–78%) excluding Australia and New Zealand.³ The SDG target 3.1 is to reduce the maternal mortality ratio to less than 70 maternal deaths per 100 000 live births by 2030. In the two regions considered in this study, the Pacific and the Caribbean (including Latin America), the maternal mortality ratio for 2017 was estimated at 129 (uncertainty interval 69–267) and 74 (70–81) per 100 000 live births, respectively.³⁰ Reaching SDG target 3.1 will require ensuring access to appropriate and high-quality maternal health services.

In the five Pacific countries considered, reaching zero unmet need for modern contraceptive choices and 95%

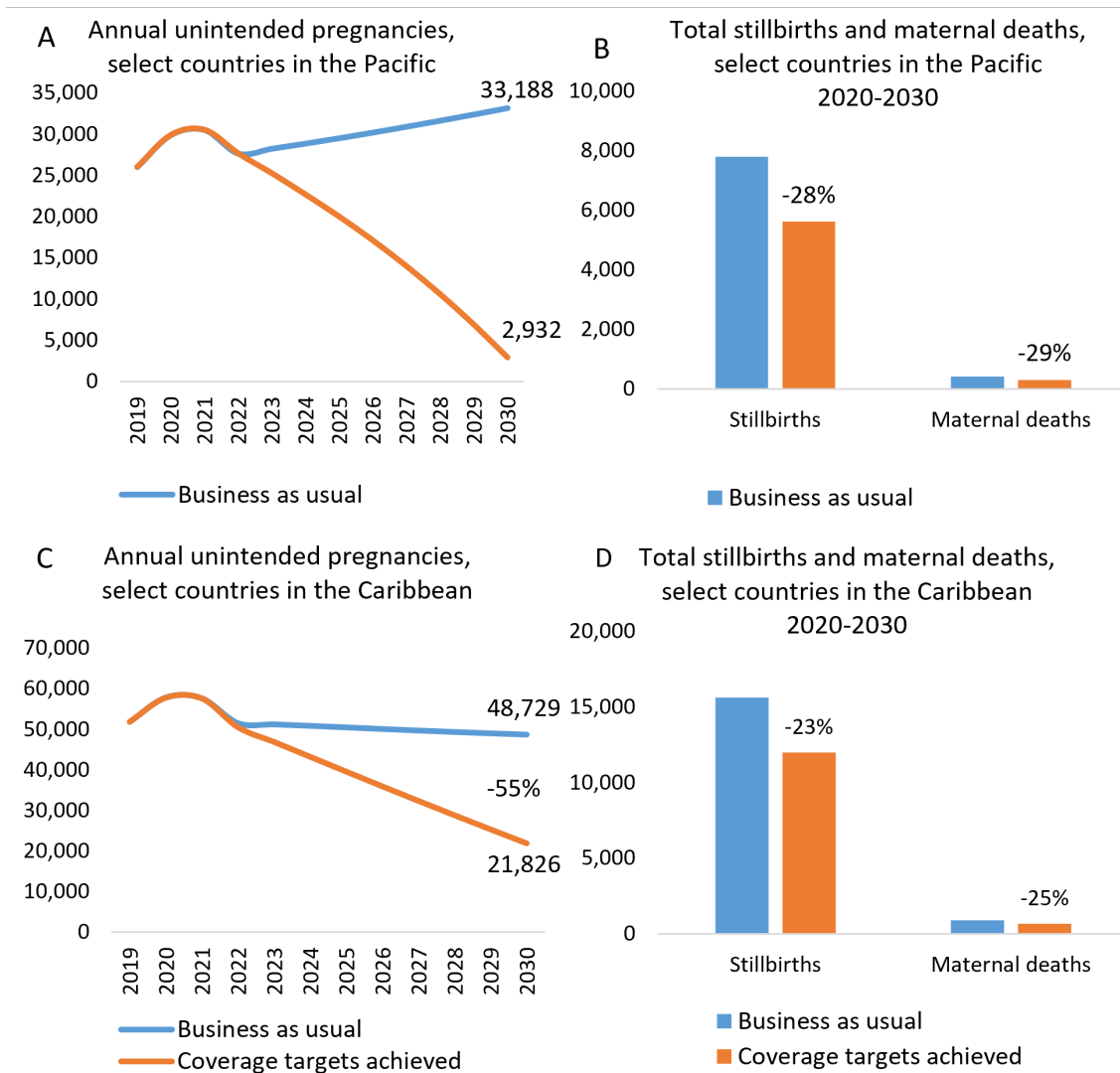


Figure 2 Annual unintended pregnancies (right), and total stillbirths and maternal deaths that could be averted from 2020 to 2030 (left). Values are aggregated for select countries in (A, B) the Pacific aggregated for Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu and (C, D) the Caribbean aggregated for Barbados, Guyana, Jamaica and Saint Lucia.

maternal health intervention coverage by 2030 could prevent an additional 126 000 unintended pregnancies, 2200 stillbirths and 121 maternal deaths over the 2020–2030 period, compared with business as usual. In the four Caribbean countries, reaching the same targets could prevent an additional 127 000 unintended pregnancies, 3600 stillbirths and 221 maternal deaths. The additional US\$12.6 million (US\$10.8–US\$15.9 million) and US\$17.8 million (US\$15.3–US\$22.4 million) needed in the two regions, respectively, represents only 15% more than the business-as-usual scenario for the five Pacific countries considered and 4% more than the business-as-usual scenario for the four Caribbean countries considered. This means the required investment may well be within reach. This investment is estimated to lead to a 15-fold return in economic benefits by 2050 for the five Pacific countries and a 24-fold return in the four Caribbean countries, with benefits continuing to accrue over the longer term.

Increased contraceptive prevalence rates can further reduce the costs of maternal health services and by considering the two targets together, this analysis captures these effects. These cost savings help to explain why only relatively small percentage increases in spending would be required overall to reach the targets; in part, investment in contraception represents a redistribution of funds that can lead to improved outcomes. Reducing unintended pregnancies, particularly among adolescents, has additional benefits not captured in this study. The Pacific and Caribbean are regions undergoing demographic transition, and it is essential for them to harness the demographic dividend of their young populations, by considering an intergenerational perspective and investing in sexual and reproductive health. With access to modern contraceptive choices, adolescent girls will be empowered to choose when and how many children they have, which can reduce poverty and enable them to fully exercise their rights and contribute to their families,

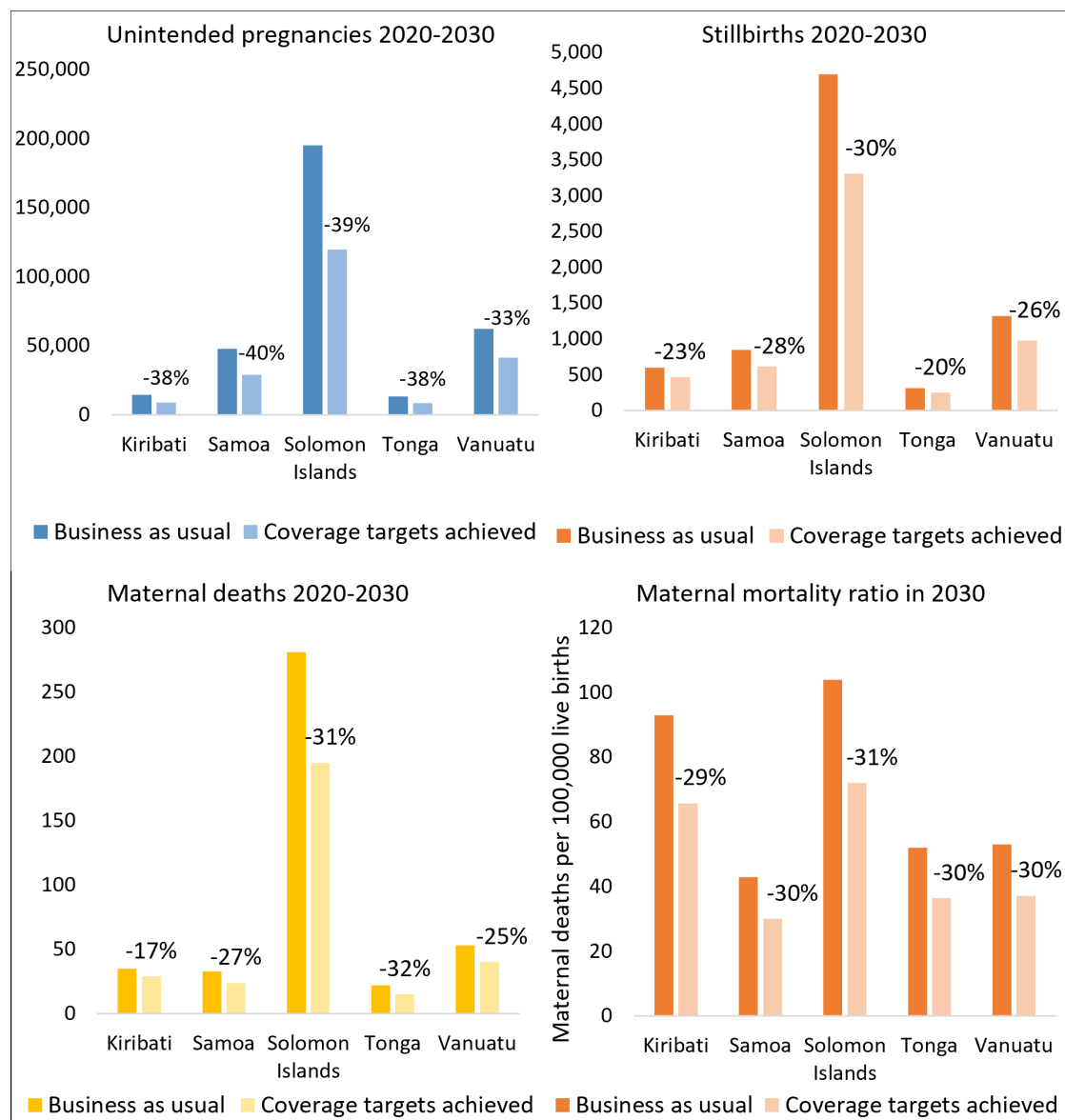


Figure 3 Projected unintended pregnancies (top left), stillbirths (top right) and maternal deaths (bottom left) between 2020 and 2030, and projected maternal mortality ratio in 2030 (bottom right) for the business-as-usual and coverage-targets-achieved scenarios for select countries in the Pacific (Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu). Percentage values show events that could be averted. The cumulative decline in maternal deaths over the 2020–2030 period may show percentages lower than the decline in the maternal mortality ratio, which is given as a snapshot for 2030 comparing the current business-as-usual coverage to achieving coverage targets. Due to small population sizes and low numbers of births per year, maternal mortality ratios should be interpreted with caution.

communities and the economy. Similarly, investment in maternal health can have major benefits beyond those estimated; lower morbidity and health complications associated with childbirth can decrease downstream costs associated with these health conditions and avert complications such as loss of income, although such costs can be difficult to quantify.

Reaching coverage targets is not solely dependent on direct intervention and health system funding, and it will require other supporting factors. Implementers and programme managers need to ensure services are accessible, skilled midwives, nurses and other healthcare providers are available, and services provided are locally

accepted and high in quality.^{31 32} Demand-generation activities may be necessary to increase awareness and change perceptions of contraceptive interventions. Further work is needed to understand the financial requirements beyond direct intervention and health system costs.

Contraception and maternal health intervention costs estimated in this study are consistent with other published estimates, though are specific to SIDS in the Pacific and Caribbean. For example, in 2014, it was estimated that addressing a large proportion of need for maternal and newborn health, child health, immunisation, modern contraceptive choices, HIV/AIDS and malaria services

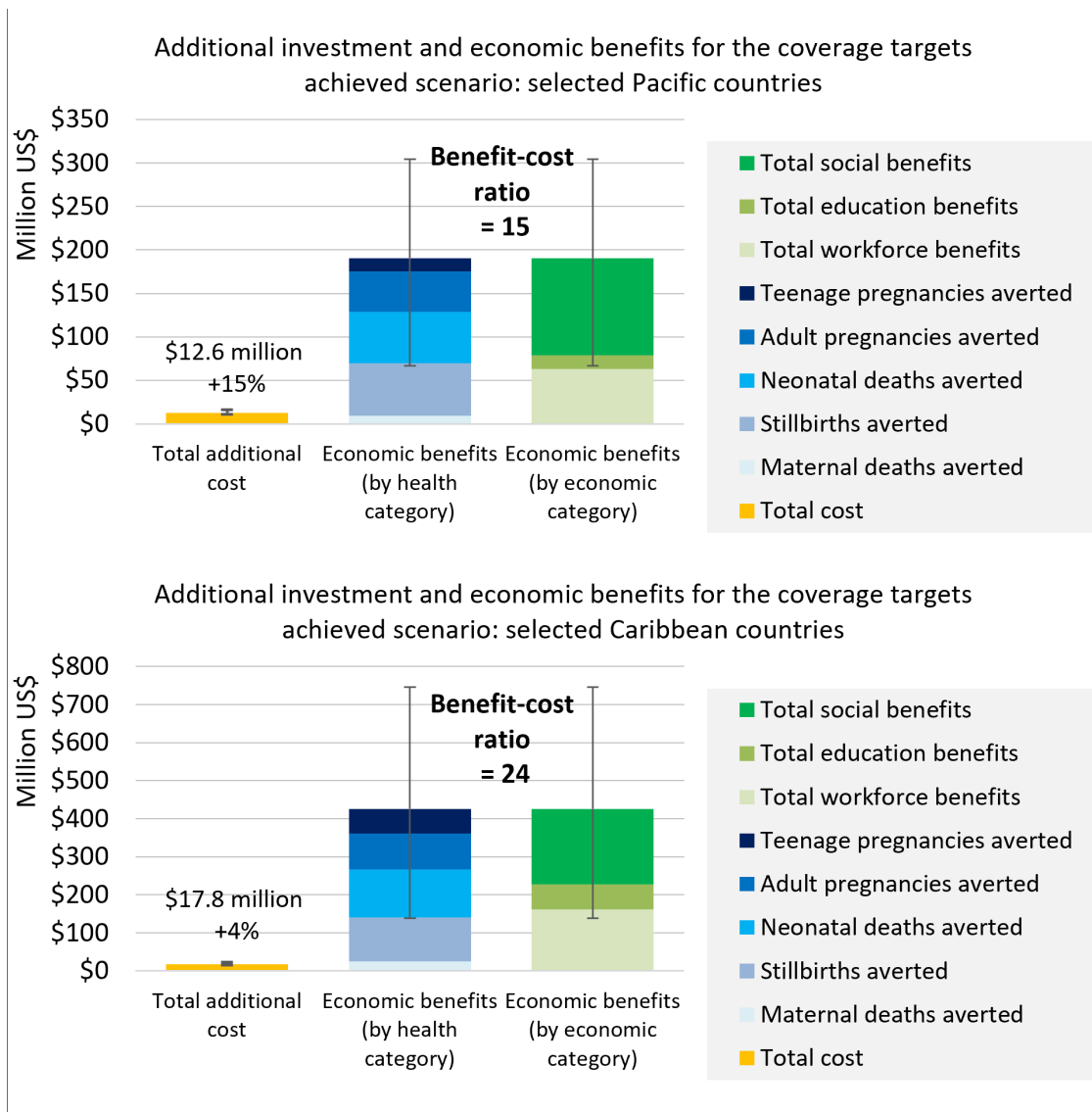


Figure 4 Estimated additional resources and economic benefits of the coverage targets achieved scenario, compared with the business as usual scenario, for selected Pacific (top) and Caribbean (bottom) countries. Left: additional investment required (2022–2030) to reach 95% coverage of maternal health interventions and zero unmet need for family planning by 2030, compared with business as usual (left). Centre: economic benefits that are estimated by 2050, disaggregated by health benefit type (the prevention of maternal and newborn deaths, stillbirths and unintended pregnancies). Right: economic benefits that are estimated by 2050, disaggregated by economic benefit type (workforce, education, social). Values are aggregated for Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu (Pacific) and Barbados, Guyana, Jamaica and Saint Lucia (Caribbean). Error bars represent benefits calculated to 2030 (lower bound) and 2070 (upper bound).

in 74 high-burden countries would require an additional investment of US\$30 billion between 2013 and 2035, 2% more than business as usual or an average of US\$5 more per person per year.³³ This investment was estimated to yield up to a ninefold economic return on investment by 2035. We project an additional 15% in total investment needed for the five Pacific countries considered to reach 2030 coverage targets, and 4% more for the four Caribbean countries considered over 2020–2030. Based on population size projections over this period, to reach these targets, US\$6.50 and US\$8.90 more per capita is needed, with returns on investment of US\$15 and US\$24

projected by 2050 for the Pacific and Caribbean countries, respectively.

There are some limitations to this analysis. First, epidemiological estimates were only sufficiently available for the five Pacific and four Caribbean countries considered in this study as taken from DHS and MICS surveys conducted between 2011 and 2020 and supplemented by regional estimates where it was impractical to measure indicators for these surveys (eg, maternal mortality ratio, due to low population and birth numbers). While these sources represent the best available values, the situation in each country may have changed since the surveys were

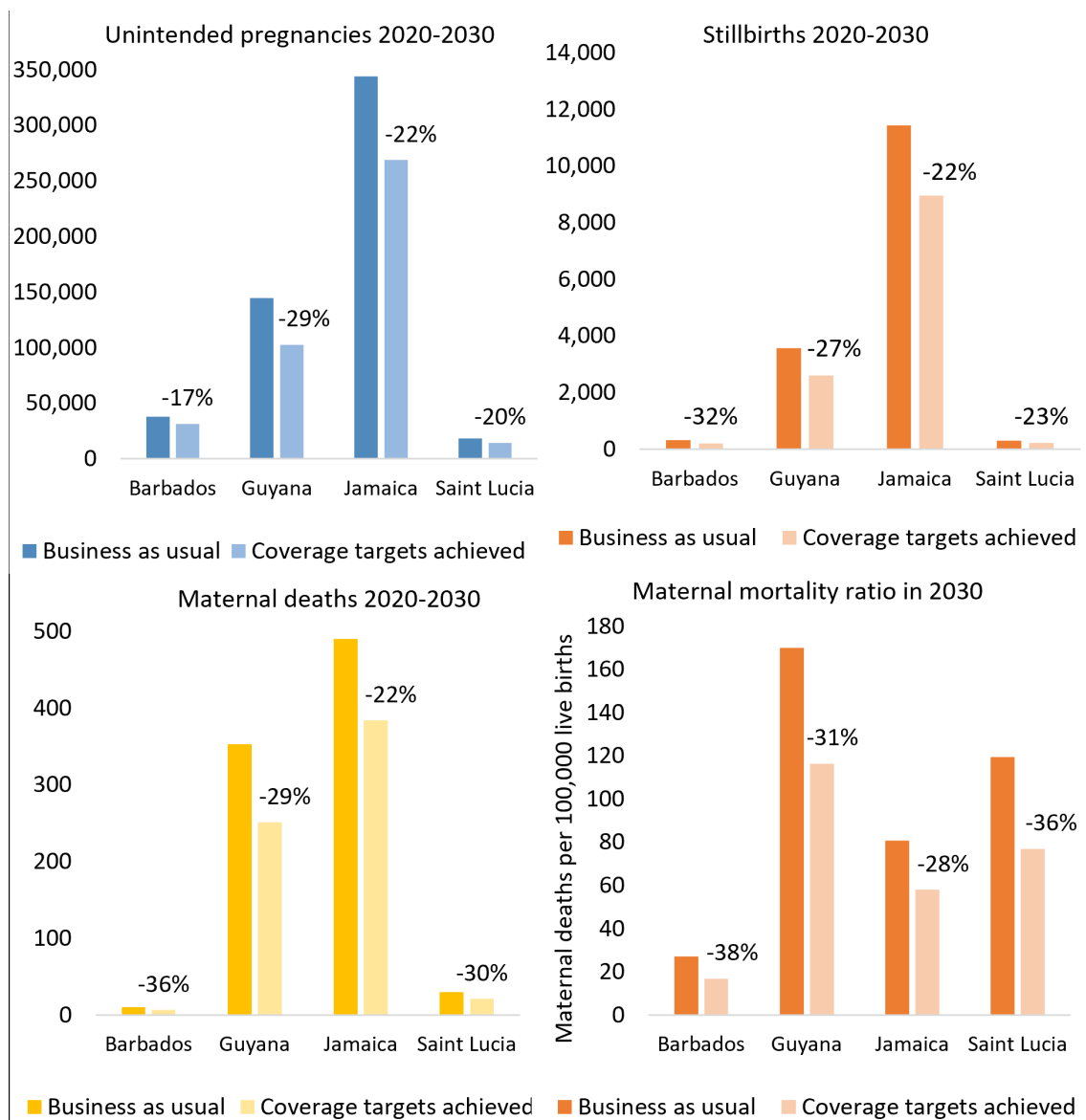


Figure 5 Projected unintended pregnancies (top left), stillbirths (top right) and maternal deaths (bottom left) between 2020 and 2030, and projected maternal mortality ratio in 2030 (bottom right) for the business-as-usual and coverage-targets-achieved scenarios for select countries in the Caribbean (Barbados, Guyana, Jamaica and Saint Lucia). Data for Jamaica follows those estimated by list. Percentage values show events that could be averted. The cumulative decline in maternal mortality ratio over the 2020–2030 period may show percentages lower than the decline in the maternal mortality ratio, which is given as a snapshot for 2030 comparing the current business-as-usual coverage to achieving coverage targets. Due to small population sizes and low numbers of births per year, maternal mortality ratios should be interpreted with caution.

conducted, and the impact of the COVID-19 pandemic on contraceptive and maternal health service coverage also remains uncertain.

Second, cost data were not validated by national teams, and so economic outcomes were deliberately only presented in aggregate at a regional level, and not at a country level. Unit cost estimates were scaled between countries to reflect differences in average wages and service delivery based on per capita GDP but require further work with countries to ensure costs accurately reflect the health system and service delivery constraints. The analysis also took a healthcare provider perspective when considering costs, and as such did not include

societal costs such as individual out-of-pocket expenses to travel to or access services, or additional costs associated with social or cultural barriers to accessing contraception.

Third, the scale-up of the full set of evidence-based family planning and maternal health interventions available in LiST represents a best-case scenario, with all evidence-based interventions available to everyone in need; however, beyond health economic considerations there may be implementation or acceptability barriers that would need to be considered before implementing any new interventions.

Fourth, the effect sizes of interventions were based on global literature, primarily systematic reviews and

meta-analyses of randomised controlled trials. The actual impact of scaling up interventions in each country will depend heavily on both the quality of care and the availability of a well-trained health workforce. Without an educated and supported health workforce that is situated within an enabling environment, implementation of these interventions is not possible. Unintended pregnancies and maternal deaths may also be averted by interventions not included in this analysis, including education, social protection, health security and interventions to improve gender equity and women's empowerment. These are difficult to quantify. Similar issues apply to addressing underlying health conditions and comorbidities that may contribute to excess mortality.

Fifth, due to the smaller population sizes of most of the SIDS, the impact of increased intervention coverage on some indicators, such as maternal mortality ratio, might appear large. Therefore, reductions in maternal deaths are considered in total over the 2020–2030 period, alongside whether coverage targets are achieved. For this reason, averted maternal deaths have not been attributed to contraceptive or maternal health interventions.

Last, the methods used to capture the economic benefits of averted mortality only consider years of life lost up to 2050, with bounds estimated for 2030 and 2070, and are hence likely to underestimate the benefit–cost ratio over longer time horizons. Moreover, the economic benefits of averting unintended pregnancies among adults are based on a 3-month gain to the labour force, scaled for women's rates of participation and do not account for the benefits of a reduced dependency ratio. Alternate assumptions for the benefits calculations are explored in the sensitivity analyses, but overall they indicate that investing in modern contraception and maternal health services is likely to have significantly greater benefit than projected.

CONCLUSIONS

The high demand for modern contraceptive options across the SIDS has yet to be satisfied, and equitable access to maternal health interventions is needed. This study provides evidence to support the prioritisation of investment for sexual and reproductive health interventions. As well as reducing the costs of maternal health services, these interventions can improve maternal health outcomes, ensure adolescent girls can continue their education and develop their professional skills, and increase women's participation in the economy and in society. Zero unmet need for modern contraceptive choices and 95% coverage of maternal health interventions in select SIDS could be achieved with as little as an additional 4%–15% investment, and for each US\$1 invested economic returns could range from US\$15 to US\$24.

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Collaborators Not applicable.

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REFERENCES

- 1 Organization WH. *SDG target 3.1: fact sheets on sustainable development goals: health targets*. Geneva: WHO, 2017.
- 2 Organization WH. *Maternal mortality: fact sheets*. Geneva: WHO, 2021.
- 3 United Nations Department of Economic and Social Affairs (UNDESA). *Estimates and projections of family planning indicators 2020*. New York: United Nations; 2020. Available: https://www.un.org/en/development/desa/population/theme/family-planning/cp_model.asp [Accessed 18 Oct 2021].
- 4 The World Bank. *Contraceptive prevalence, modern methods (% of women ages 15–49)*. Washington DC: World Bank; 2020. Available: <https://data.worldbank.org/indicator/SP.DYN.CONM.ZS> [Accessed 18 Oct 2021].
- 5 The World Bank. *Adolescent fertility rate (births per 1,000 women ages 15–19) - pacific island small states*. Washington DC: World Bank; 2020. Available: <https://data.worldbank.org/indicator/SP.ADO>.

- TFRT?end=2019&locations=S2&start=1960&view=chart [Accessed 18 Oct 2021].
- 6 The World. Adolescent fertility rate (births per 1,000 women ages 15-19) - caribbean small states. Washington DC: World Bank; 2020. Available: <https://data.worldbank.org/indicator/SP.ADO.TFRT?end=2019&locations=S3&start=1960&view=chart> [Accessed 18 Oct 2021].
 - 7 Bell L, van Gemert C, Merilles OE, *et al*. The impact of COVID-19 on public health systems in the pacific island countries and territories. *Lancet Reg Health West Pac* 2022;25:100498.
 - 8 Schwab A, Armyra E, Méndez-Aranda M, *et al*. COVID-19 in Latin America and the Caribbean: two years of the pandemic [epub ahead of print]. *J Intern Med* 2022;292:409–27. 10.1111/joim.13499 Available: [wdoi:10.1111/joim.13499](https://doi.org/10.1111/joim.13499)
 - 9 Cannonier C, Burke MG. The economic growth impact of tourism in small island developing states—evidence from the Caribbean. *Tourism Economics* 2019;25:85–108.
 - 10 Westoby R, Loehr J, Fleming C. Pacific islands tourism during covid-19: time for a rethink. 2020. Available: https://www.griffith.edu.au/_data/assets/pdf_file/0036/1197189/Pacific-islands-tourism-during-COVID-19.pdf [Accessed 21 Dec 2022].
 - 11 Institute of Medicine (US) Committee on Unintended Pregnancy. The best intentions: unintended pregnancy and the well-being of children and families. chapter 3, consequences of unintended pregnancy. Washington (DC): National Academies Press (US); 1995. Available: <https://www.ncbi.nlm.nih.gov/books/NBK232137> [Accessed 21 Dec 2022].
 - 12 The World Bank. World development indicators. 2021. Available: <https://databank.worldbank.org/source/world-development-indicators> [Accessed 29 Nov 2021].
 - 13 The World Bank. Current health expenditure (% of GDP). 2019. Available: <https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS> [Accessed 21 Dec 2022].
 - 14 The World Bank. UHC service coverage index. 2019. Available: <https://data.worldbank.org/indicator/SH.UHC.SRVS.CV.XD> [Accessed 21 Dec 2022].
 - 15 Craig AT, Beek K, Gilbert K, *et al*. Universal health coverage and the Pacific islands: an overview of senior leaders' discussions, challenges, priorities and solutions, 2015-2020. *Int J Environ Res Public Health* 2022;19:4108.
 - 16 World Health Organization. SIDS summit for health policy brief. health systems challenges: workforce and medicines. 2021. Available: https://cdn.who.int/media/docs/default-source/sids-summit/sids-health-systems-policy-brief.pdf?sfvrsn=b57828e8_5 [Accessed 21 Dec 2022].
 - 17 World Health Organization (WHO). *WHO recommendations on postnatal care of the mother and newborn*. Geneva: WHO, 2013.
 - 18 World Health Organization (WHO). *WHO recommendations on maternal health: guidelines approved by the WHO guidelines review committee*. Geneva, 2017.
 - 19 World Health Organization (WHO). *WHO recommendations on child health: guidelines approved by the WHO guidelines review committee*. Geneva, 2017.
 - 20 World Health Organization (WHO). *WHO recommendations intrapartum care for a positive childbirth experience*. Geneva, 2018.
 - 21 Jones G, Steketee RW, Black RE, *et al*. How many child deaths can we prevent this year? *Lancet* 2003;362:65–71.
 - 22 Bhutta ZA, Ahmed T, Black RE, *et al*. What works? interventions for maternal and child undernutrition and survival. *Lancet* 2008;371:417–40.
 - 23 Bhutta ZA, Das JK, Rizvi A, *et al*. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013;382:452–77.
 - 24 Miller S, Abalos E, Chamillard M, *et al*. Beyond too little, too late and too much, too soon: a pathway towards evidence-based, respectful maternity care worldwide. *Lancet* 2016;388:2176–92.
 - 25 Britto PR, Lye SJ, Proulx K, *et al*. Nurturing care: promoting early childhood development. *Lancet* 2017;389:91–102.
 - 26 Popkin BM, Corvalan C, Grummer-Strawn LM. Dynamics of the double burden of malnutrition and the changing nutrition reality. *Lancet* 2020;395:65–74.
 - 27 Walker N, Tam Y, Friberg IK. Overview of the lives saved tool (list). *BMC Public Health* 2013;13(Suppl 3):S1.
 - 28 Hopkins J. Lives saved tool (list). 2022. Available: <https://www.livessavedtool.org>
 - 29 Stenberg K, Hanssen O, Edejer T-T, *et al*. Financing transformative health systems towards achievement of the health sustainable development goals: a model for projected resource needs in 67 low-income and middle-income countries. *Lancet Glob Health* 2017;5:e875–87.
 - 30 World Health Organization. *Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, world bank group and the united nations population division*. Geneva: WHO, 2019.
 - 31 Wilson AN, Spotswood N, Hayman GS, *et al*. Improving the quality of maternal and newborn care in the pacific region: a scoping review. *Lancet Reg Health West Pac* 2020;3:100028.
 - 32 Nove A, Friberg IK, de Bernis L, *et al*. Potential impact of midwives in preventing and reducing maternal and neonatal mortality and stillbirths: a lives saved tool modelling study. *Lancet Glob Health* 2021;9:e24–32.
 - 33 Stenberg K, Axelson H, Sheehan P, *et al*. Advancing social and economic development by investing in women's and children's health: a new global investment framework. *Lancet* 2014;383:1333–54.