Supplemental Material for the article: Health and economic benefits of achieving contraceptive and maternal health targets in Small Island Developing States in the Pacific and Caribbean

Sherrie L Kelly,[1] Tom Walsh,[1] Dominic Delport,[1] Debra ten Brink,[1] Rowan Martin-Hughes,[1] Caroline SE Homer,[1] Jennifer Butler,[2] Olanike Adedeji,[2] Davide De Beni,[3] Federica Maurizio,[3] Howard S Friedman,[4] Doretta Di Marco,[4] Federico Tobar,[5] Pilar de la Corte Molina,[6] Andre S Richards,[6] Nick Scott[1,7]

[1] Burnet Institute, Melbourne, Australia
[2] UNFPA Pacific Sub Regional Office, Suva, Fiji
[3] UNFPA Asia and Pacific Regional Office, Bangkok, Thailand
[4] UNFPA Technical Division, New York NY, USA
[5] UNFPA Latin America and the Caribbean Regional Office, Panamá, Panama
[6] UNFPA Sub-regional Office for the Caribbean, Jamaica
[7] Monash University, Melbourne, Australia

Correspondence to: Dr Nick Scott at Burnet Institute, Melbourne, Australia nick.scott@burnet.edu.au

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A. Demographic and epidemiological estimates and sources

Table A1. Estimates for population size, women of reproductive age, and number of births for select countries in the Pacific, 2019

Key indicator, 2019	Kiribati	Samoa	Solomon Islands	Tonga	Vanuatu
Population size	119,000	201,000	656,000	109,000	299,000
Women of reproductive age	30,000	46,000	156,000	27,000	75,000
Births	3,200	6,000	21,000	3,000	7,500

Source: LiST v5.88.

Table A2. Estimates for population size, women of reproductive age, and number of births for select countries in the Caribbean, 2019

Key indicator, 2019	Barbados	Guyana	Jamaica	Saint Lucia
Population size	301,000	851,000	3,071,000	186,000
Women of reproductive age	70,000	223,000	820,000	52,000
Births	3,400	19,000	57,000	2,400

Source: LiST v5.88.

Table A3. Key epidemiological data inputs and respective data sources for select countries in the Pacific

Key indicator	Kiribati (SDIS 2018-2019 unless noted)	Samoa (MICS 2019-2020 unless noted)	Solomon Islands (DHS 2015 unless noted)	Tonga (MICS 2019 unless noted)	Vanuatu (DHS 2013 unless noted)
Maternal mortality ratio[1]	92	43	104	52	72
Tetanus toxoid vaccination	45%[2]	37.5%	22.8%	5.9%	29.8%
Skilled birth attendant	91.9%	88.9%	86.2%	100%	89.4%
Health facility delivery	86.1%	88.6%	84.5%	97.6%	88.5%
Contraceptive prevalence rate, all methods	25%	16.6%	29.3%	29.3%	37.7%
Unmet need for family planning	17.3%	34.8%[4]	34.7%	21.8%	24.2%
Total fertility rate	3.3	3.9	4.4	3.5	3.2
Percentage of women in union	69%	59.8%[4]	55.8%	54.2%	68.3%
Percentage of pregnant women with anaemia	36%[3]	42.5%[3]	54.1%	28.8%[3]	27.8%[3]

[1]Internationally comparable maternal mortality ratio estimates by the Maternal Mortality Estimation Inter-Agency Group (1).

[2] LiST v5.88.

[3] Anaemia in pregnant women of reproductive age (2017) is from the WHO Global Health Observatory data repository available from https://apps.who.int/gho/data/view.main.ANAEMIAWOMENPREVANEMIAv?lang=en.

[4] Samoa DHS 2014.

DHS: Demographic and Health Surveys. MICS: Multiple Indicator Cluster Survey. SDIS: Social Development Indicator Survey. WRA: women of reproductive age.

Table A4. Key epidemiological data inputs and respective data sources for select countries in the Caribbean

Key indicator	Barbados (MICS 2012 unless noted)	Guyana (MICS 2014 unless noted)	Jamaica (MICS 2011 unless noted)	Saint Lucia (MICS 2012 unless noted)
Maternal mortality ratio[1]	27	169	80	117
Tetanus toxoid vaccination	0%[2]	99%	91%	0%[2]
Skilled birth attendant	99%	92%	99%	99%
Health facility delivery	100%	93%	99%	100%
Contraceptive prevalence rate, all methods	59%	34%	40%	55%
Unmet need for family planning	20%	28per cent	10%	17%
Total fertility rate	1.70	2.6	2.2	1.4[3]
Percentage of women 15-49 years in union	65%	68per cent	35%	39%
Percentage of pregnant women with anaemia[4]	26%	29%	27%	27%

[1]Internationally comparable maternal mortality ratio estimates by the Maternal Mortality Estimation Inter-Agency Group (1).

[2] LiST v5.88

[3] World Bank indicators, 2018 available from https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?view=chart.

[4] Anaemia in pregnant women of reproductive age (2017) from the WHO Global Health Observatory data repository available from https://apps.who.int/gho/data/view.main.ANAEMIAWOMENPREVANEMIAv?lang=en.

Table A5. Assumed reductions in intervention coverage due to COVID-19 disruptions for 2020 and 2021

Country	Maternal health intervention coverage reduction (health facility delivery), percentage Estimate	Family planning intervention coverage reduction (short-acting contraceptive methods), percentage Estimate
Barbados	0	0
Guyana	5	0
Jamaica	5	5
Saint Lucia	0	5
Kiribati	35	35
Samoa	10	20
Solomon Islands	10	20
Tonga	10	20
Vanuatu	35	35

Source: Derived by the UNFPA Regional teams and the Burnet Institute based on assumptions from select data sources (2, 3) and other global health models (4-6).

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B. Interventions

Table B1. Intervention list and baseline coverage for 2019 using Spectrum version 5.88 (November 2020) for countries in the Pacific included in this analysis

Maternal health interventions	Baseline, 2019				
	Kiribati	Samoa	Tonga	Vanuatu	Solomon Islands
Folic acid supplementation/fortification	0.0	0.0	0.0	0.0	0.0
Safe abortion services	85.0	85.0	85.0	85.0	85.0
Post-abortion case management	0.0	0.0	0.0	0.0	0.0
Ectopic pregnancy case management	0.0	0.0	0.0	0.0	0.0
Blanket iron supplementation/fortification	0.0	0.0	0.0	0.0	0.0
Tetanus toxoid vaccination	90.0	0.0	71.2	78.0	95.0
Intermittent preventive treatment of malaria during pregnancy	0.0	0.0	0.0	0.0	0.0
Syphilis detection and treatment	21.9	14.4	24.3	19.1	19.8
Calcium supplementation	0.0	0.0	0.0	0.0	0.0
Micronutrient supplementation (iron and multiple micronutrients)	0.0	3.4	0.0	0.0	0.0
Balanced energy supplementation	0.0	0.0	0.0	0.0	0.0
Hypertensive disorder case management	16.1	14.0	21.3	12.4	15.5
Diabetes case management	12.6	10.9	16.6	9.7	12.1
Malaria case management	51.9	45.3	68.6	40.2	50.1
MgSO4 management of pre-eclampsia	31.8	27.8	42.1	24.6	30.7
Clean birth environment	70.6	72.7	80.0	72.6	69.3
Manual removal of placenta	32.2	33.1	36.5	33.1	31.6
Parenteral administration of anti-convulsants	61.6	63.4	69.8	63.3	60.4
Antibiotics for preterm or prolonged PROM	64.4	66.3	73.0	66.2	63.2
Parenteral administration of antibiotics	64.4	66.3	73.0	66.2	63.2
Assisted vaginal delivery	21.8	22.4	24.7	22.4	21.4
Parenteral administration of uterotonics	76.9	79.2	87.2	79.1	75.5
Removal of retained products of conception	28.5	29.4	32.3	29.3	28.0
Induction of labour for pregnancies lasting 41+ weeks	1.5	1.6	1.7	1.6	1.5
Caesarean section delivery	7.5	7.7	8.5	7.7	7.4
Blood transfusion	10.8	11.2	12.3	11.1	10.6
Maternal sepsis case management	0.0	0.0	0.0	0.0	0.0
Family planning interventions					
Contraceptive prevalence rate	25.0	21.0	17.0	37.7	29.0
Modern contraceptive prevalence ratio	80.8	92.7	82.1	74.4	82.6
Unmet need for family planning	18.0	34.7	21.8	24.2	34.7
Family planning demand satisfied with modern methods	66.3	60.5	64.2	56.39	53.9
Family planning methods mix					
Condoms	2.0	0.7	4.7	4.3	6.1
Female sterilization	18.4	23.3	40.8	22.5	29.5
Male sterilization	0.8	0.0	0.0	1.1	1.9
Injections	23.2	47.7	19.6	19.9	27.2
Implants (3.8 years)	31.2	0.0	0.0	0.0	0.0
Intrauterine devices (4.6 years)	2.4	0.7	10.9	4.9	14.1
Pills	2.8	20.2	6.2	21.5	3.8
Vaginal ring	0.0	0.0	0.0	0.0	0.0
Withdrawal	5.6	2.1	7.3	9.6	9.4
Standard days method	1.2	4.2	9.1	13.3	6.1
Emergency contraception	0.0	0.0	0.0	0.0	0.0
Other	12.4	1.0	1.5	2.7	1.9

Table B2. Intervention list and baseline coverage for 2019 using Spectrum version 5.88 (as of November 2020) for countries in the Caribbean included in this analysis

Maternal health interventions	Baseline, 2019			
	Barbados	**Guyana**	**Jamaica**	**Saint Lucia**
Folic acid supplementation/fortification	0.0	0.0	0.0	0.0
Safe abortion services	53.7	0.0	0.0	0.0
Post-abortion case management	0.0	0.0	0.0	0.0
Ectopic pregnancy case management	0.0	0.0	0.0	0.0
Blanket iron supplementation/fortification	0.0	0.0	0.0	0.0
Tetanus toxoid vaccination	0.0	99.0	91.0	0.0
Intermittent preventive treatment of malaria during pregnancy	0.0	0.0	0.0	0
Syphilis detection and treatment	23.1	22.4	24.1	24.5
Calcium supplementation	0.0	0.0	0.0	0.0
Micronutrient supplementation (iron and multiple micronutrients)	0.0	34.2	0.0	0.0
Balanced energy supplementation	0.0	0.0	0.0	0.0
Hypertensive disorder case management	21.1	20.8	20.6	21.7
Diabetes case management	16.5	16.2	16.0	16.9
Malaria case management	0.0	0.0	0.0	0.0
MgSO4 management of pre-eclampsia	41.8	41.2	40.7	42.9
Clean birth environment	82.0	76.3	80.8	82.0
Manual removal of placenta	37.4	34.8	73.8	37.4
Parenteral administration of anti-convulsants	71.5	66.5	70.0	71.5
Antibiotics for preterm or prolonged PROM	74.8	69.6	73.8	74.8
Parenteral administration of antibiotics	74.8	69.6	73.8	74.8
Assisted vaginal delivery	25.3	23.5	24.9	25.3
Parenteral administration of uterotonics	89.4	83.1	88.1	89.4
Removal of retained products of conception	33.1	30.8	32.7	33.1
Induction of labour for pregnancies lasting 41+ weeks	1.8	1.6	1.7	1.8
Caesarean section delivery	8.7	8.1	8.6	8.7
Blood transfusion	12.6	11.7	12.4	12.6
Maternal sepsis case management	0.0	0.0	0.0	0.0
Family planning interventions				
Contraceptive prevalence rate	59.2	34.1	72.5	55.0
Modern contraceptive prevalence ratio	91.2	93.5	93.7	92.8
Unmet need for family planning	19.9	28.0	7.9	17.0
Family planning demand satisfied with modern methods	73.1	67.3	86.3	77.0
Family planning methods mix				
Condoms	32.9	26.5	36.6	25.4
Female sterilization	7.9	9.7	15.8	12.8
Male sterilization	0.2	0.3	0.0	0.0
Injections	8.4	14.4	16.3	8.8
Implants (3.8 years)	1.3	2.9	0.5	0.5
Intrauterine devices (4.6 years)	5.2	17.1	2.3	5.9
Pills	35.8	22.6	22.3	39.3
Vaginal ring	0.8	0.0	0.0	0.4
Withdrawal	3.4	1.2	4.8	2.0
Standard days method	1.7	1.2	0.5	0
Emergency contraception	0.0	0.0	0.0	0.0
Other	0.8	4.2	1.0	0.9

C. Methodological framework

C.1. Costs

For family planning and maternal health interventions with available evidence on effectiveness (Tables B1 and B2), costs were calculated for the business-as-usual and coverage-targets-achieved scenarios. These costs for 2020 to 2030 were derived using LiST v5.88 (7) country models (for commodities and human resources needs) and based on the literature (4), but were not validated by national teams. LiST estimates costs for the following seven components, which were included in this analysis: capital costs, drugs and supply costs, labour costs, logistics and wastage, other health system costs, other recurrent costs, and programme costs.

Drug and supply costs and labour costs were calculated using an ingredients-based approach, estimated intervention coverages (Tables B1 and B2), and unit costs, including labour time and health-care worker salary estimates from LiST (Tables C1 and C2).

Capital and other recurrent costs were calculated using estimates of the number and costs of inpatient days and outpatient visits (8).

Logistics and wastage, other health system costs and programme costs were estimated as a percentage mark-up on commodity costs. This is calculated in the model such that the resulting distribution of total costs among each cost component approximates global estimates (4) for scaled-up health system resource needs to achieve universal health care. This result of this is that the following mark-up percentages are applied to commodity costs:

- 5% for drugs and supply costs to account for wastage, as well as country specific percentage mark-ups of drugs and supply costs to account for logistics costs (ranging from 8% in Jamaica and Vanuatu to 22% in Kiribati, Guyana, Solomon Islands and Tonga).
- 15% for programme costs, comprising 1% programme-specific human resources; 1% training; 2% supervision; 2% monitoring and evaluation; 2% infrastructure; 2% transport; 1% communication, media and outreach; 1% advocacy; 2% general programme management; 1% community health worker training.
- 85% for other health system costs. These other costs would include things like facilities and infrastructure that might be required, and are not specified in LiST but have this value such that when suites of interventions are scaled up in the model, their total costs aligns with estimates of scale-up needs for achieving universal health care from Stenberg et al. (4).

For the countries considered in this analysis, additional funding would likely be required for health systems to absorb services and investments (e.g., for capacity building). We assume that the investment in health system strengthening to reach the coverage targets would need to be between equal and twice as much as global averages (4). Therefore, a lower bound for the additional investment requirements was based on health system strengthening costs described in the paragraphs above. An upper bound for additional investment requirements was calculated by doubling the non-intervention components. A point estimate for total annual costs was calculated as the midpoint between the upper and lower bounds (9).

Costs are presented in 2020 dollars and are discounted at 3% per annum unless stated otherwise.

Additional costs are outside the scope of this investment case, for example, demand generation costs, as they are unknown and difficult to quantify.

Table C1. Health-care worker annual salaries in dollars for countries in the Pacific

Country	Range
Generalists, primary care doctors	$3,024 - $6,532
Obstetricians, gynaecologists, paediatricians and other specialist doctors	$4,540 - $9,805
Nurses, midwives, clinical officers, surgical technicians, laboratory technicians/assistants, pharmaceutical technicians/assistants, radiographers, X-ray technicians, emergency medical technicians	$1,868 - $4,034
Assistant nurses and midwives, nursing aides	$1,862 - $3,056

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Community health workers	$1,085 - $3, 056
Other	$1,415 - $2,343

Source: LiST v5.88, values were not validated by national teams.

Table C2. Health-care worker annual salaries in dollars for countries in the Caribbean

Country	Range
Generalists, primary care doctors	$7,991 - $19,288
Obstetricians, gynaecologists, paediatricians and other specialist doctors	$11,995 - $28954
Nurses, midwives, clinical officers, surgical technicians, laboratory technicians/assistants, pharmaceutical technicians/assistants, radiographers, X-ray technicians, emergency medical technicians	$4,935 - $11,913
Assistant nurses and midwives, nursing aides	$3,738 - $9,023
Community health workers	$2,867 - $6,920
Other	$3,738 - $9,023

Source: LiST v5.88. Values for specific countries are supressed as they were not validated by national teams, and costs, benefits and benefit cost ratios are provided in aggregate.

C.2. Benefits calculations overview

Using LiST, it is possible to quantify expected reductions in unintended pregnancies, maternal deaths, stillbirths and newborn deaths when coverage of interventions is increased. These health outcomes were them converted to economic benefits across three domains, described in more detail in the following sections:

1. **Workforce**: increased participation in the workforce due to (a) years of life gained; and (b) 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
3. **Social**: maternal deaths, stillbirths and newborn deaths prevented leading to years of life lost.

Economic benefits were considered up to 2050, but only for the population cohort receiving the interventions over 2020-2030. The reason for the longer time frame for calculating benefits is that some benefits are not captured immediately; for example, unintended pregnancies averted among adolescents lead to greater education and increased earnings, but only once they enter the workforce.

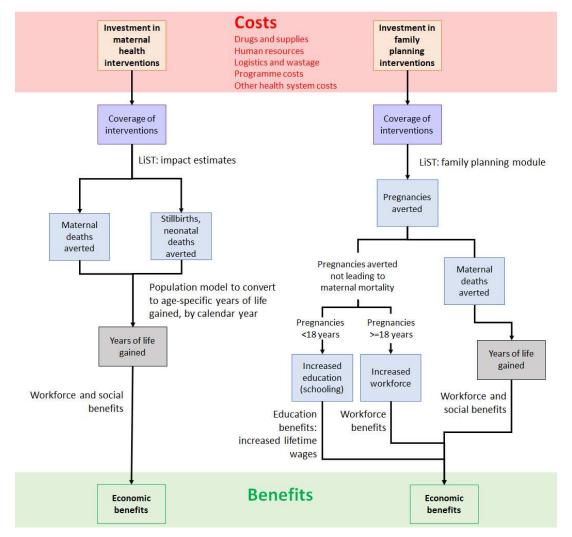Economic benefits were discounted at 3% per annum and are presented in 2019 USD.

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Figure C1. Overview of the methodological framework for family planning and maternal health interventions

C.3. Calculating years of life gained

Maternal deaths, stillbirths and child deaths prevented in each year over 2020-2030 due to increased coverage of maternal health interventions were derived from LiST. Increased coverage of family planning was also assumed to result in maternal deaths averted, which were calculated according to the maternal mortality rates among current pregnancies.

However, the economic benefit calculations are based on total years of life gained in each calendar year, rather than from the number of deaths averted in each calendar year. Therefore, a population model was constructed to convert annual deaths averted to annual age-specific years of life gained.

The population model was stratified in single year age brackets, and each year people could enter the model if their death was averted, turn a year older, and be removed due to all-cause mortality. Stillbirths and newborn deaths averted entered the model at age zero, and maternal deaths averted entered the model according to the age-distribution of all pregnancies. There is some debate about years of life gained from averting stillbirths (more specifically disability-adjusted life years gained) (10), and for this analysis years of life gained were considered for 50% of the stillbirths averted, which is the global estimated percentage that are intrapartum (11).

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The total number of people in this population model, in each year, represents the age-specific years of life gained (in the year they would otherwise have been lived) and is used to calculate workforce and social benefits. Note that this population model can be run for an arbitrary duration to capture longer term benefits of deaths averted in the 2020-2030 window.

C.4. Workforce participation economic benefits

Economic benefits from increased workforce participation can be calculated from years of life gained. For years of life gained among people aged 18-65 years, average salary is estimated as GDP per worker, and then scaled for workforce participation rates among women (for maternal deaths averted) or the whole population (for child deaths averted).

Unintended pregnancies averted among women >18 years were also assumed to lead to an increase in workforce participation. Pregnancy was assumed to remove a woman from the labour force for 3 months, based on maternity leave policies (12). Hence, the economic benefit was calculated as 0.25 multiplied by the GDP per worker, scaled for workforce participation rates among women.

C.5. Education economic benefits

Reductions in unintended pregnancies as a result of family planning services were assumed to lead to increases in the average level of schooling obtained by girls (13). A percentage of all unintended pregnancies averted were assumed to be among girls <18 years, based on estimates of the age distribution of pregnancies, and were assumed to lead to an average 1.1 years increased education, based on the median age of adolescent pregnancy relative to expected years of schooling across the countries being considered. Length of schooling is known to lead on average to an increased lifetime earnings, with each additional year in education associated with an 8.8% increase in per capita income (14). GDP per worker was used as a proxy for average wage, which was multiplied by the percentage income increase to obtain an economic benefit for each working year. These benefits were applied from the year girls turned 18 years until retirement age, scaled for workforce participation rates among women.

C.6. Social economic benefits

Social economic benefits can be calculated from years of life gained following methods from Stenberg et al. (13). These social benefits are based on the statistical value of a life year from Jamison et al(15)., which is estimated to be 2.3 times GDP per capita in LMICs, and to vary between 1.4 and 4.2 depending on world region. Stenberg et al (13) use a conservative estimate of 1.5 times GDP per capita, assumed to comprise 1.0 times GDP per capita for workforce benefits and 0.5 times GDP per capita for social benefits. For this analysis, we follow these methods and use 0.5 times GDP per capita to estimate the economic social benefit for any year of life saved, regardless of age. The social benefit computation used the average GDP per capita across all countries in this analysis, to avoid implicitly valuing life differently across settings.

GDP per capita was assumed to increase at 1.5 per cent per year.

C.7. Limitations and exclusions from benefit calculations

There are significant additional benefits from family planning and maternal health interventions that are outside the scope of this analysis. In particular, empowering women to choose when and how many children they have can reduce poverty and reducing the fertility rate can increase the proportion of working-age adults relative to dependent children, which can increase productivity (16, 17). This is known as the "Demographic Dividend", and has been approximated in models previously as increased rates of GDP growth. It is not clear how many of the assumptions in these calculations translate to Small Islands and Developing States, and so this was not included in the main benefit calculations; however, a sensitivity analysis has been run where increased rates of GDP growth are assumed (5% versus 1.5% in the main analysis).

Other factors not accounted for in this analysis are the benefits of women's empowerment, gender equity, social cohesion and protection, diversification, and health security benefits. These are difficult to quantify, and minimal evidence currently exists to support their inclusion. In addition, higher-quality maternal and newborn health is likely to result in reduced demand for other health interventions.

Table C3. Economic indicators used for benefit calculation for countries in the Pacific

Economic indicator	Kiribati	Samoa	Solomon Islands	Tonga	Vanuatu
GDP per capita (average across Pacific and Caribbean countries considered)[1]	$5,752.27	$5,752.27	$5,752.27	$5,752.27	$5,752.27
GDP per capita[2]	$1,655.10	$4,315.90	$2,127.50	$4,443.10[5]	$3,058.10
GDP per worker	$4,597.50	$9,382.39	$2,502.94	$9,067.56	$4,307.18
Education gained due to teenage pregnancy averted[3]	1.1 year	1.1 year	1.1 year	1.1 year	1.1 year
Additional earnings per year of education gained[4]	8.8%	8.8%	8.8%	8.8%	8.8%
Workforce participation rate[5]	36%	46%	85%	49%	71%
Workforce participation rate (women)[6]	29%	34%	84%	41%	62%
Time out of workforce due to pregnancy[7]	3 months	3 months	3 months	3 months	3 months
Proportion of stillbirths that are intrapartum[8]	0.5	0.5	0.5	0.5	0.5
Social value of a life year gained[9]	0.5 average GDP per capita	0.5 average GDP per capita	0.5 average GDP per capita	0.5 average GDP per capita	0.5 average GDP per capita
Discounting per annum	3%	3%	3%	3%	3%

[1] World Development Indicators database (18). Indicator of 'GDP per capita (current US$)'; value in 2020, or most recent available value were used where data in 2020 were unavailable. Non-weighted average across Pacific and Caribbean countries included in this analysis.

[2] World Development Indicators database (18).

[3] The difference between the expected years of schooling (UN Human Development Index) and the median age of first birth among women reporting a first birth <18 years (MICS data). This was calculated for each country, but due to small numbers an average was taken across the nine Pacific and Caribbean countries in this study.

[4] Psacharopoulos and Patrinos (19)

[5] World Development Indicators database (18). Indicator of 'Labor force participation rate, total (% of total population ages 15-64) (modeled ILO estimate)'; value in 2019.

[6] World Development Indicators database (18). Indicator of 'Labor force participation rate, female (% of female population ages 15-64) (modeled ILO estimate)'; value in 2019.

[7] Assumption based on maternity leave policies.

[8] Lawn et al 2016 (11)

[9] Stenberg et al (13)., based on 1.5 times GDP per capita for statistical value of a life year, subtracting 1.0 times GDP per capita assumed to be workforce benefits.

Table C4. Economic indicators used for benefit calculation for countries in the Caribbean

Economic indicator	Barbados	Guyana	Jamaica	Saint Lucia
GDP per capita (average across Pacific and Caribbean countries considered)[1]	$5,752.27	$5,752.27	$5,752.27	$5,752.27
GDP per capita[2]	$18,148.00	$5,468.40	$5,582.30	$11,611.40
GDP per worker	$23,267.00	$9,268.47	$7,862.39	$14,697.97
Education gained due to teenage pregnancy averted[3]	1.1 year	1.1 year	1.1 year	1.1 year
Additional earnings per year of education gained[4]	8.8%	8.8%	8.8%	8.8%
Workforce participation rate[5]	78%	59%	71%	79%
Workforce participation rate (women)[6]	75%	46%	66%	76%
Time out of workforce due to pregnancy[7]	3 months	3 months	3 months	3 months
Proportion of stillbirths that are intrapartum[8]	0.5	0.5	0.5	0.5
Social value of a life year gained[9]	0.5 average GDP per capita	0.5 average GDP per capita	0.5 average GDP per capita	0.5 average GDP per capita
Discounting per annum	3%	3%	3%	3%

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[1] World Development Indicators database (18). Indicator of 'GDP per capita (current US$)'; value in 2020, or most recent available value were used where data in 2020 were unavailable. Non-weighted average across Pacific and Caribbean countries included in this analysis.

[2] World Development Indicators database (18).

[3] The difference between the expected years of schooling (UN Human Development Index) and the median age of first birth among women reporting a first birth <18 years (MICS data). This was calculated for each country, but due to small numbers an average was taken across the nine Pacific and Caribbean countries in this study.

[4] Psacharopoulos and Patrinos (19)

[5] World Development Indicators database (18). Indicator of 'Labor force participation rate, total (% of total population ages 15-64) (modeled ILO estimate)'; value in 2019.

[6] World Development Indicators database (18). Indicator of 'Labor force participation rate, female (% of female population ages 15-64) (modeled ILO estimate)'; value in 2019.

[7] Assumption based on maternity leave policies.

[8] Lawn et al 2016 (11)

[9] Stenberg et al (13)., based on 1.5 times GDP per capita for statistical value of a life year, subtracting 1.0 times GDP per capita assumed to be workforce benefits.

C.8. Sensitivity analyses for cost and benefit calculation assumptions

Sensitivity analyses were run to test the impact of different modelling assumptions on total costs, total benefits and benefit-cost ratios. This included:

- The impact of benefits as of 2050, with a lower bound by 2040 and an upper bound by 2060 (20), as benefits need longer-term time frames to be better captured.
- Annual increase in GDP per capita of 0% or 5%, compared with 1.5%.
- Average wage estimated as 75% or 125% GDP per worker, compared with 100% GDP per worker
- Increase in earnings per additional year of education of 3% or 35%, compared with 8.8%.
- The value of social benefits of 0 or 1 times GDP per capita, compared with 0.5.
- Workforce participation of zero months or six months for pregnancies averted among women, compared with 3 months
- Education gains of zero months (i.e., no benefit) or two years, compared with 1.1 years for unintended teenage pregnancies are averted.
- Proportion of stillbirths counted of 20% or 100%, compared with 50%.
- Discounting of 0% or 6% discounting, compared with 3%.

D.   Results for countries in the Pacific

D.1. *Kiribati*

In 2019, Kiribati had a population of 119,000, including 30,000 women of reproductive age, and an estimated 3,200 births, 86% of which occurred in health facilities. The 2018-2019 Social Development Indicator Survey suggested that Kiribati has an estimated 25% contraceptive prevalence rate (modern and traditional methods), 17% unmet need for family planning and a total fertility rate of 3.3. The maternal mortality ratio for 2019 was an estimated 92 per 100,00 live births (1).

A commitment to enhancing access to quality family planning services, made as part of Kiribati's 2016-2019 Health Strategic Plan (21), was renewed in the 2020-2023 Health Strategic Plan (22). Targets for 2023 include a contraceptive prevalence rate of 25% for modern family planning methods and no maternal deaths.

The business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19, predicted 14,382 unintended pregnancies, 603 stillbirths, and 35 maternal deaths between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 91 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Kiribati could prevent an additional 5,422 unintended pregnancies (38% more, 10% of all pregnancies), 137 stillbirths (23% more), and 6 maternal deaths (17% more) between 2020 and 2030 (Figure D1), with the projected 2030 maternal mortality ratio falling to 66 deaths per 100,000 live births (Figure D2).

If coverage targets were reached, Kiribati could achieve SDG target 3.7 on universal access to sexual and reproductive health services, SDG target 3.1 on reducing maternal deaths to less than 70 per 100,000 live births (Figure D1 and Figure **D2**) as well as the country-specific SDG target of reducing the maternal mortality ratio by two thirds from 2010 levels by 2030. A small population size and a low number of births per year, however, mean the maternal mortality ratio should be interpreted with caution.
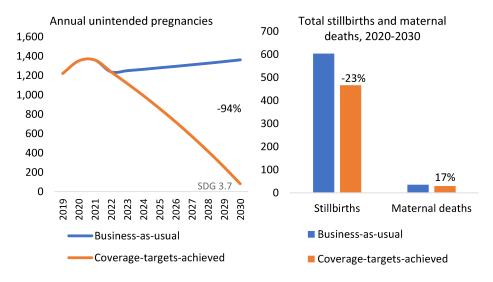

Figure D1. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for modern contraception through family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right)
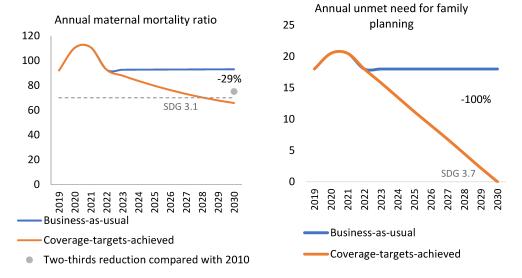
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Figure D2. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to a small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

D.2. Samoa

In 2019, Samoa had a population of 201,000, including 46,000 women of reproductive age, and an estimated 6,000 births, 89% of which occurred in health facilities. The 2019-2020 Multi-Indicator Cluster Survey found that Samoa has an estimated 17% contraceptive prevalence rate (for both modern and traditional methods), 35% unmet need for family planning and a total fertility rate of 3.9. In addition, the maternal mortality ratio was an estimated 43 deaths per 100,00 live births in 2019 (1), already surpassing SDG target 3.1 on reducing maternal deaths to less than 70 per 100,000 live births.

The Samoan National Sexual Reproductive Health Policy for 2018-2023 aims to achieve safe, effective, affordable and acceptable delivery of sexual and reproductive health services for all Samoans. Since 2011, Samoa has developed policies to improve ongoing issues of low levels of modern contraceptive use, an increase in adolescent pregnancies, and rising perinatal and child mortality (23).

The business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19, predicted 47,918 unintended pregnancies, 852 stillbirths and 33 maternal deaths between 2020 and 2030, with the 2030 maternal mortality ratio projected to remain the same as in 2019 at 43 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Samoa could prevent an additional 18,933 unintended pregnancies (40% more, 18% of all pregnancies), 236 stillbirths (28% more), and 9 maternal deaths (27% more) between 2020 and 2030 (Figure D3), with the projected 2030 maternal mortality ratio falling to 30 deaths per 100,000 live births (Figure D4).

If the coverage targets were reached, Samoa could achieve SDG target 3.7 on universal access to sexual and reproductive health services, as well as the country-specific target of reducing the maternal mortality ratio by two thirds from 2010 levels by 2030 (Figure D3 and Figure **D4**). Its small population size and low number of births per year mean the maternal mortality ratio should be interpreted with caution.

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Annual unintended pregnancies

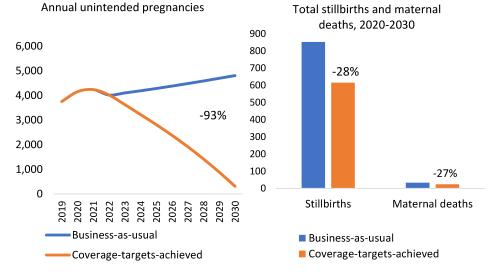## Total stillbirths and maternal deaths, 2020-2030

Figure D3. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right)
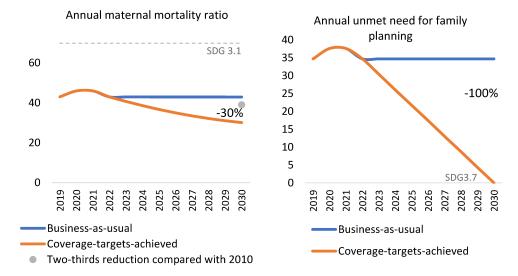
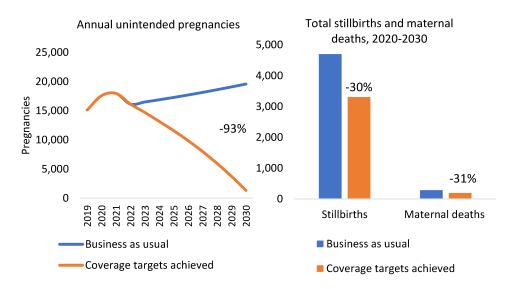## Annual maternal mortality ratio

Annual unmet need for family planning

Figure D4. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

D.3. Solomon Islands

In 2019, Solomon Islands had a population of 656,000, including 156,000 women of reproductive age, and an estimated 21,000 births, 85% of which occurred in health facilities. The 2015 Demographic Health Survey estimated a 29% contraceptive prevalence rate (modern and traditional methods), 35% unmet need for family planning and a total fertility rate of 4.4 births per woman. In addition, the maternal mortality ratio was estimated to be 104 deaths per 100,00 live births in 2019 (1).

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A review of the Solomon Islands 2016-2020 National Health Strategic Plan is in progress to inform development of a new National Health Strategic Plan 2022-2026. Notable goals from the existing plan include increasing the contraceptive prevalence rate to 55%, as well as improving maternal health for mothers in hard-to-reach communities, thereby aiming for 100% health facility-based deliveries (24).

The business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19, predicted 195,337 unintended pregnancies, 4,679 stillbirths and 281 maternal deaths between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 104 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Solomon Islands could prevent an additional 75,491 unintended pregnancies (39% more, 19% of all pregnancies), 1,391 stillbirths (30% more), and 86 maternal deaths (31% more) between 2020 and 2030 (Figure D5), with the projected 2030 maternal mortality rate falling to 72 deaths per 100,000 live births (Figure D6).

If the coverage targets are reached by 2030, then the Solomon Islands could achieve the SDG target 3.7 on universal access to sexual and reproductive health services, as well as the SDG 3.1 target on reducing maternal deaths to less than 70 per 100,000 live births. In addition, the country would experience a 31% reduction in the projected 2030 maternal mortality ratio (Figure D5 and Figure **D6**). A small population size and a low number of births per year mean the maternal mortality ratio should be interpreted with caution.

Figure D5. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right)
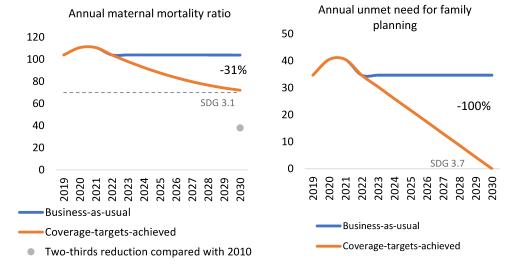
Figure D6. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

D.4.   Tonga

In 2019, Tonga had a population of 109,000, including 27,000 women of reproductive age, and an estimated 3,000 births, 98% of which occurred in health facilities. The 2019 Multiple Indicator Cluster Survey estimated a 29% contraceptive prevalence rate (modern and traditional methods), 22% unmet need for family planning and a total fertility rate of 3.5. The maternal mortality ratio for 2019 was an estimated 52 per 100,00 live births (1), already surpassing SDG target 3.1 on reducing maternal deaths to less than 70 per 100,000 live births.

In its 2015-2025 Strategic Development Framework, Tonga has committed to a "more progressive Tonga", including to empower human development and gender equality (25). The framework outlines strategies for improving family planning and maternal and child health.

The business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19, predicted 13,396 unintended pregnancies, 311 stillbirths and 22 maternal deaths between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 52 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Tonga could prevent an additional 5,060 unintended pregnancies (38% more, 11% of all pregnancies), 61 stillbirths (20% more), and 7 maternal deaths (32% more) between 2020 and 2030 (Figure D8), with the projected 2030 maternal mortality ratio falling to 36 deaths per 100,000 live births (Figure D9).

If coverage targets were reached, Tonga could achieve SDG target 3.7 on universal access to sexual and reproductive health services, as well as the additional target of reducing the maternal mortality ratio by two thirds from 2010 levels by 2030 (Figure D8 and Figure D9). A small population size and low number of births per year mean the maternal mortality ratio should be interpreted with caution.
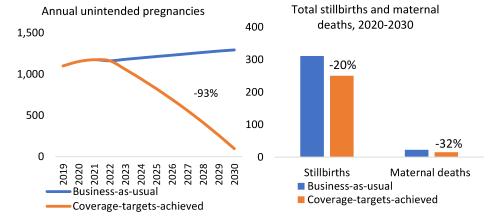
Figure D7. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right)
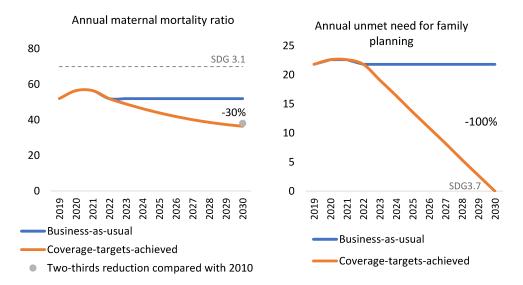

Figure D8. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

D.5. Vanuatu

In 2019, Vanuatu had a population of 299,000, including 75,000 women of reproductive age, and an estimated 7,500 births, 89% of which occurred in health facilities. The 2013 Demographic and Health Survey estimated a 38% contraceptive prevalence rate (modern and traditional methods), 24% unmet need for family planning and a total fertility rate of 3.2. The maternal mortality ratio for 2019 was an estimated as 72 deaths per 100,00 live births (1), almost meeting SDG target 3.1 on reducing maternal deaths to less than 70 per 100,000 live births.

Vanuatu's population growth rate of 2.4% is the highest in the Pacific region (26). This, combined with a high fertility rate, results in a relatively large number of adolescent girls and adult women leaving the workforce during

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childbearing and rearing periods, which imposes significant burdens on Vanuatu's economy, according to its 2017-2020 Reproductive, Maternal, Newborn Child and Adolescent Health Policy and Implementation Strategy (27). Improved access to family planning could ease this burden and increase (young) female participation in the workforce.

The business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19, predicted 62,190 unintended pregnancies, 1,324 stillbirths and 53 maternal deaths between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 53 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Vanuatu could prevent an additional 20,681 unintended pregnancies (33% more, 15% of all pregnancies), 346 stillbirths (26% more), and 13 maternal deaths (25% more) between 2020 and 2030 (Figure D9), with the projected 2030 maternal mortality ratio falling to 37 deaths per 100,000 live births (Figure D10).

If the coverage targets were reached, Vanuatu could achieve SDG target 3.7 on universal access to sexual and reproductive health services, as well as the additional target of reducing the maternal mortality ratio by two thirds from 2010 levels by 2030 (Figure D9 and Figure **D10**). A small population size and a low number of births per year mean the maternal mortality ratio should be interpreted with caution.
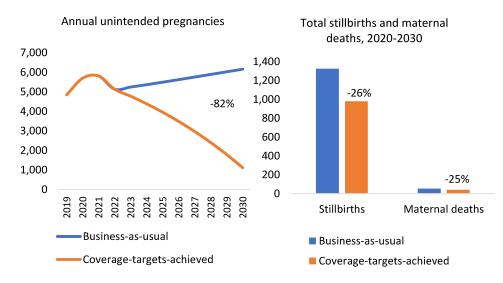

Figure D9. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right)
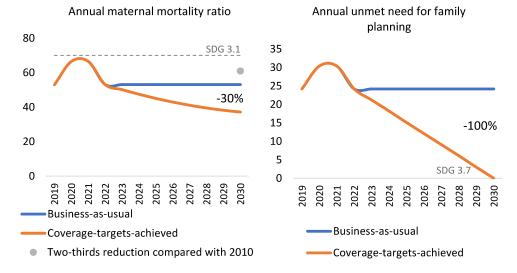
Figure D10. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to a small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

E. Results for countries in the Caribbean

E.1. Barbados

In 2019, Barbados had a population of 301,000, including 70,000 women of reproductive age, and an estimated 3,400 births, all of which occurred in health facilities. In the 2012 Multiple Indicator Cluster Survey it was reported that there was an estimated 59% contraceptive prevalence rate (modern and traditional methods), 20% unmet need for family planning, and a total fertility rate of 1.7 for Barbados. The maternal mortality ratio for 2019 was an estimated 27 deaths per 100,00 live births (1).

For the business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19-related disruptions, 37,964 unintended pregnancies, 309 stillbirths, and 10 maternal deaths were predicted between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 27 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Barbados could prevent an additional 6,447 unintended pregnancies (17% more, 10% of all pregnancies), 99 stillbirths (32% more), and 3 maternal deaths (36% more) between 2020 and 2030 (Figure E1), with the projected maternal mortality ratio falling to 17 deaths per 100,000 live births (Figure E2).

If the coverage targets were reached, Barbados could achieve SDG target 3.7 on universal access to sexual and reproductive health services, as well as the target for reducing the maternal mortality ratio by two thirds from 2010 levels by 2030 (Figure E1 and Figure **E2**). A small population size and a low number of births per year means the maternal mortality ratio should be interpreted with caution.
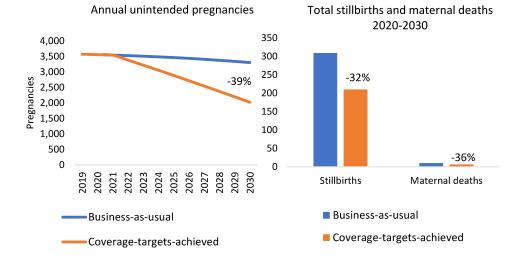
Figure E1. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right)
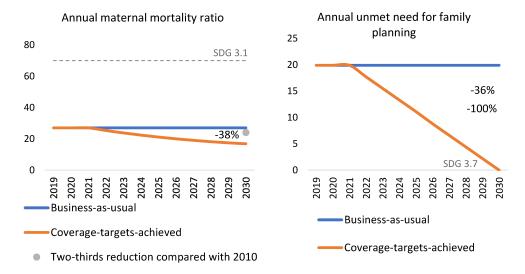

Figure E2. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right). Due to small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

E.2.   Guyana

In 2019, Guyana had a population of 851,000, including 223,000 women of reproductive age, and an estimated 19,000 births, 93% of which occurred Lin health facilities. The 2014 Multiple Indicator Cluster Survey estimated a 34% contraceptive prevalence rate (modern and traditional methods), 28% unmet need for family planning and a total fertility rate of 2.6. The Maternal Mortality Estimation Inter-Agency Group (1) estimated that the maternal mortality ratio was 169 deaths per 100,00 live births in 2019.

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For the business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19, 144,510 unintended pregnancies, 3,562 stillbirths, and 353 maternal deaths were predicted between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 170 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Guyana could prevent 41,793 unintended pregnancies (29% more, 12% of all pregnancies), 955 stillbirths (27% more), and 102 maternal deaths (29% more) between 2020 and 2030 (Figure E3), with the projected 2030 maternal mortality ratio falling to 116 deaths per 100,000 live births (Figure E4).

If the coverage targets were reached, Guyana could achieve SDG target 3.7 on universal access to sexual and reproductive health services. While Guyana is not projected to reach SDG target 3.1 even if the coverage targets are achieved (because of a high estimated maternal mortality ratio in 2019), a 31% reduction in the projected 2030 maternal mortality ratio could be achieved (Figure E3 and Figure **E4**). A small population size and a low number of births per year mean the maternal mortality ratio should be interpreted with caution.
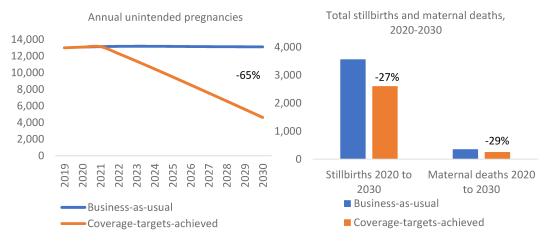

Figure E3. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right)
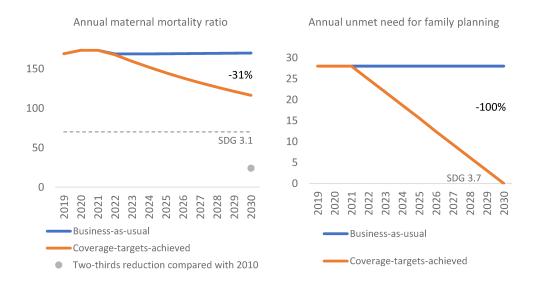
Figure E4. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to a small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

E.3.   Jamaica

In 2019, Jamaica had a population of 3,071,000, including 820,000 women of reproductive age, and an estimated 57,000 births, 99% of which occurred in health facilities. The 2011 Multiple Indicator Cluster Survey estimated a 40% contraceptive prevalence rate (modern and traditional methods), 10% unmet need for family planning and a total fertility rate of 2.2. The Maternal Mortality Estimation Inter-Agency Group (1) estimated the maternal mortality ratio at 80 deaths per 100,000 live births in 2019.

The business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19, predicted 343,719 unintended pregnancies, 11,436 stillbirths, and 490 maternal deaths between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 81 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Jamaica could prevent 75,003 unintended pregnancies (22% more, 9% of all pregnancies), 2,487 stillbirths (22% more), and 106 maternal deaths (22% more) between 2020 and 2030 (Figure E5), with the projected 2030 maternal mortality ratio falling to 58 deaths per 100,000 live births (Figure E6).

If the coverage targets were reached, Jamaica could achieve SDG target 3.7 on universal access to sexual and reproductive health services, and SDG target 3.1 on reducing maternal deaths to less than 70 per 100,000 live births (Figure E5 and Figure **E6**). A small population size and a low number of births per year means the maternal mortality ratio should be interpreted with caution.
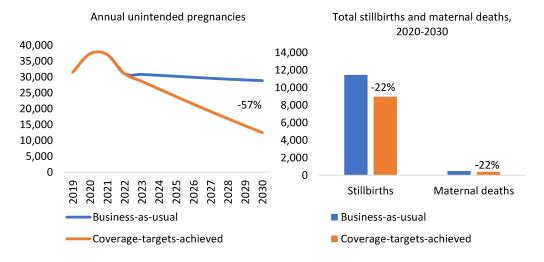

Figure E5. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right)
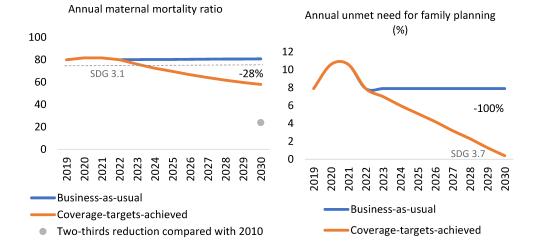
Figure E6. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to a small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.

E.4.   *Saint Lucia*

In 2019, Saint Lucia had a population of 186,000, including 52,000 women of reproductive age, and an estimated 2,400 births, all of which occurred in health facilities. In the 2012 Multiple Indicator Cluster Survey it was reported that there was an estimated 55% contraceptive prevalence rate (modern and traditional methods), 17% unmet need for family planning and a fertility rate of 1.4. The Maternal Mortality Estimation Inter-Agency Group (1) estimated the maternal mortality ratio at 117 deaths per 100,00 live births in 2019.

The business-as-usual coverage scenario with estimated 2019 coverage levels maintained until 2030, incorporating any reductions in 2020 and 2021 due to COVID-19 disruptions, predicted 18,056 unintended pregnancies, 294 stillbirths, and 30 maternal deaths between 2020 and 2030, with the 2030 maternal mortality ratio projected to be 119 deaths per 100,000 live births.

Achieving 95% coverage of maternal health interventions and zero unmet need for family planning by 2030 in Saint Lucia could prevent an additional 3,613 unintended pregnancies (20% more averted, 9% of all pregnancies), 69 stillbirths (23% more), and 9 maternal deaths (30% more) between 2020 and 2030 (Figure E7), with the projected 2030 maternal mortality ratio falling to 77 deaths per 100,000 live births (Figure E8).

If the coverage targets were reached, Saint Lucia could achieve SDG target 3.7 on universal access to sexual and reproductive health services. While Saint Lucia is not projected to reach SDG target 3.1 even if the coverage targets are achieved, given a high estimated maternal mortality ratio in 2019, a 36% reduction in the projected 2030 maternal mortality ratio could be achieved (Figure E7 and Figure **E8**). A small population size and a low number of births per year means the maternal mortality ratio should be interpreted with caution.

Annual unintended pregnancies

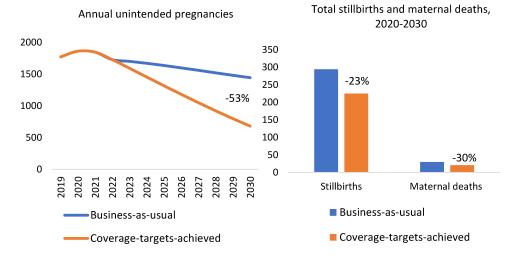### Total stillbirths and maternal deaths, 2020-2030

Figure E7. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on unintended pregnancies (left), and stillbirths and maternal deaths (right)

Annual maternal mortality ratio

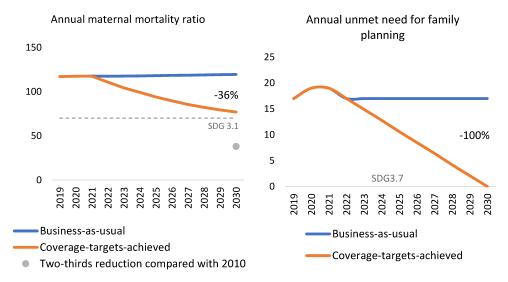### Annual unmet need for family planning

Figure E8. Impact of achieving coverage targets (95% coverage of maternal health interventions and zero unmet need for family planning) on the maternal mortality ratio (left) and unmet need for family planning (right). Due to a small population size and a low number of births per year, the maternal mortality ratio should be interpreted with caution.
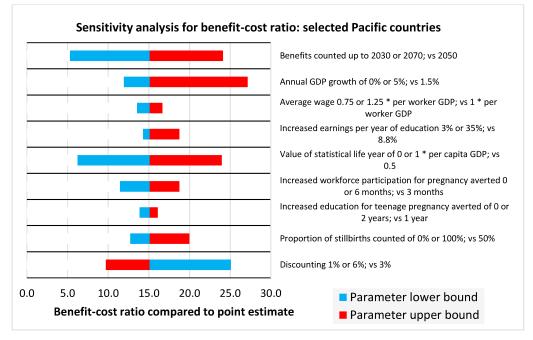
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F. Sensitivity analysis

Figure F1: Sensitivity analysis of benefit cost ratios parameters for select countries in the Pacific
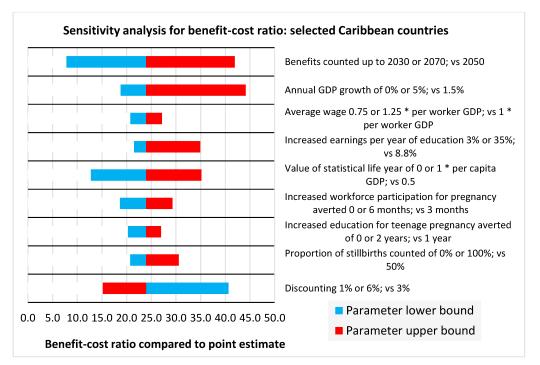Values are aggregated for Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu.

Figure F2. Sensitivity analysis of parameters for benefit cost ratios for select countries in the Caribbean
Values are aggregated for Barbados, Guyana, Jamaica, and Saint Lucia.

Supplemental material

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