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From global targets to local inequalities: subnational projections of reproductive, maternal, newborn and child health coverage and mortality in Mozambique

Qin Li
HEOA Group, West China School of Public Health and West China Fourth Hospital, Sichuan University
Lu Ao
HEOA Group, West China School of Public Health and West China Fourth Hospital, Sichuan University
Kanduma Elsa
Comité para a Saúde de Moçambique (CSM)
Shanquan Chen
School of Public Health, LKS Faculty of Medicine, The University of Hong Kong
Haijun Wang
Department of Maternal and Child Health, School of Public Health, Peking University
Isaías Ramiro
Comité para a Saúde de Moçambique (CSM)
Jay Pan
panjie.jay@scu.edu.cn

HEOA Group, West China School of Public Health and West China Fourth Hospital, Sichuan University

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From global targets to local inequalities: subnational projections of reproductive, maternal, newborn and child health coverage and mortality in Mozambique

Qin Li [1,2,3], *Lu Ao* [1,4], *Elsa Kanduma* [5], *Shanquan Chen* [6,7], *Haijun Wang* [8], *Isaías Ramiro* [5], *and Jay Pan* [1,9*]

[1]HEOA Group, West China School of Public Health and West China Fourth Hospital, Sichuan University, Chengdu, China.

[2]Sichuan Provincial Maternity and Child Health Care Hospital (The Affiliated Women's and Children's Hospital of Chengdu Medical College), Chengdu, China.

[3]School of Information and Software Engineering, University of Electronic Science and Technology of China, Chengdu, China.

[4]Institute for Healthy Cities and West China Research Center for Rural Health Development, Sichuan University, Chengdu, China.

[5]Comité para a Saúde de Moçambique (CSM), Praceta Caetano Viegas, 67 Maputo City, Mozambique

[6]School of Public Health, LKS Faculty of Medicine, The University of Hong Kong, Hong Kong, China.

[7]Department of Health and Rehabilitation Sciences, Stellenbosch University, Francie van Zijl Drive, Tygerberg, Cape Town, South Africa.

[8]Department of Maternal and Child Health, School of Public Health, Peking University, National Health Commission Key Laboratory of Reproductive Health, Beijing, China.

[9]Health Promotion and Food Nutrition & Safety Key Laboratory of Sichuan Province, Chengdu, China.

*Corresponding author: Jay Pan (panjie.jay@scu.edu.cn)

*Correspondence address: HEOA Group, West China School of Public Health and West China Fourth Hospital, Sichuan University, Chengdu, Sichuan, 610044, China.

Abstract

Background

Despite substantial progress towards Sustainable Development Goal 3 (SDG 3), national averages may mask important subnational and socioeconomic inequalities in reproductive, maternal, newborn, and child health (RMNCH). Evidence remains limited on how these inequalities may affect future progress and mortality reduction in high-burden settings. We assessed subnational RMNCH coverage trajectories, inequalities, and potential mortality gains under alternative scale-up scenarios in Mozambique.

Methods

We analysed data from 144,833 households across five Demographic and Health Surveys (DHS) conducted between 1997 and 2018 in Mozambique. Twenty-four RMNCH indicators (20 preventive and four curative) were selected based on WHO recommendations and national priorities. Bayesian hierarchical models were used to project service coverage to 2030 by province, residence, wealth, and education. Socioeconomic inequalities were quantified using the Relative Index of Inequality (RII). Projected coverage trajectories were incorporated into the Lives Saved Tool (LiST) to compare the mortality impact of maintaining current coverage trajectories with that of achieving equitable scale-up to 80% coverage across provinces.

Results

Under current trajectories, Mozambique is unlikely to achieve universal RMNCH coverage by 2030. Only 12 of 24 interventions are projected to reach 80% coverage nationally, with curative services lagging behind preventive services (53.4% versus 67.3%). Coverage above 80% is projected to remain concentrated among the wealthiest populations, while northern provinces—including Niassa, Cabo Delgado, Nampula, and Zambézia—consistently exhibit the lowest coverage levels. Although inequalities narrowed for some interventions between 1997 and 2018, pro-rich disparities persisted in key maternal health services, including antenatal care and institutional delivery. Achieving equitable scale-up to 80% coverage across provinces

could avert 561 maternal deaths, 16,201 neonatal deaths, and 27,701 under-5 deaths by 2030, representing 17,513 additional deaths averted compared with scaling up WHO-recommended essential interventions alone.

Conclusions

Progress towards RMNCH targets in Mozambique masks substantial and persistent geographic and socioeconomic inequalities that constrain potential health gains. Equitable, context-specific scale-up strategies could achieve substantially greater mortality reductions than uniform implementation of standard intervention packages. Integrating subnational evidence into priority setting and resource allocation may help translate global RMNCH targets into more equitable and effective health gains in high-burden settings.

Keywords

Reproductive, maternal, newborn and child health; subnational inequalities; coverage projections; Lives Saved Tool; priority setting; sustainable development goals; Mozambique; Countdown to 2030

Background

Low- and middle-income countries (LMICs) face a persistent challenge of allocating limited health resources among competing priorities amid ongoing demographic and epidemiological transitions[1]. Evidence-based priority setting, guided by frameworks such as Disease Control Priorities (DCP), is critical for maximising health gains[2]. Reproductive, maternal, newborn, and child health (RMNCH) remains central to the Sustainable Development Goals (SDGs) and a key tracer of health system performance[3]. Given its centrality to both national equity and global development, strengthening RMNCH is widely recognized as a cornerstone of global health progress[3]. As emphasized by the Lancet Global Health Commission, reducing preventable maternal and child deaths is indispensable to halving premature mortality by mid-century[4]. However, how global RMNCH targets can be translated into locally actionable and equitable priority-setting strategies remains insufficiently understood.

The pursuit of SDG 3 has coincided with a shift towards decentralised health governance, increasing the role of national governments in health policy design[5]. While this shift allows for context-specific strategies, reliance on national averages often masks profound subnational inequalities[6]. This "data-shielding effect" is particularly detrimental in RMNCH, where subnational disparities in access to and quality of care perpetuate excess preventable mortality in high-burden settings, thereby undermining both health equity and progress towards global targets[7].

Drawing on the DCP focus on health outcome improvement and the WHO Health Systems Framework—which identifies service coverage as a critical pathway—strengthening RMNCH service coverage is essential to improving outcomes (appendix p1-3)[8]. RMNCH services, spanning reproductive health, antenatal, delivery, and postnatal care, as well as child prevention and treatment, form an essential continuum within universal health coverage (UHC)[9]. Strengthening this continuum is vital for mitigating risks across the life course, making expanded RMNCH coverage and quality crucial not only to UHC but also to attaining mortality reduction targets[10].

However, existing approaches typically assess service coverage, inequalities, or health outcomes in isolation, with limited integration into a unified framework that can inform forward-looking policy decisions.

Mozambique, a high-priority country identified by the Countdown to 2030 initiative, exemplifies these challenges[11]. Since the 1992 General Peace Agreement, the country has implemented a series of health sector reforms with a strong emphasis on primary health care and RMNCH. Successive strategic plans—including the *Plano Estratégico do Sector Saúde* (PESS) 2014–2019 and 2020–2024—have prioritised improving service accessibility, quality, and equity, alongside strengthening health system capacity and accountability. Key policy approaches—including decentralisation, community-based service delivery through *Agentes Polivalentes Elementares* (APEs, community health workers), task shifting, and intersectoral action, particularly in education—have sought to expand coverage in underserved populations and improve health outcomes[12-14] (Figure1, appendix p4). Despite these substantial policy commitments, Mozambique continues to bear a severe RMNCH burden, with a maternal mortality ratio of 451 per 100,000 live births, a lifetime risk of maternal death of 1 in 37, and an under-five mortality rate of 79 per 1,000 live births[15]. These national estimates likely conceal profound subnational inequities, underscoring the need to examine how health system strategies translate into equitable and effective health gains at the local level.

To address this gap, we develop an integrated analytical framework that links subnational projections of reproductive, maternal, newborn, and child health (RMNCH) service coverage, equity assessment, and prospective mortality modelling. We quantify inequalities across population subgroups, project the likelihood of achieving universal coverage by 2030, and estimate the mortality reductions achievable under alternative scale-up scenarios. By bridging global targets with local implementation, this framework provides a transferable, policy-relevant tool to inform priority setting and resource allocation in high-burden settings.

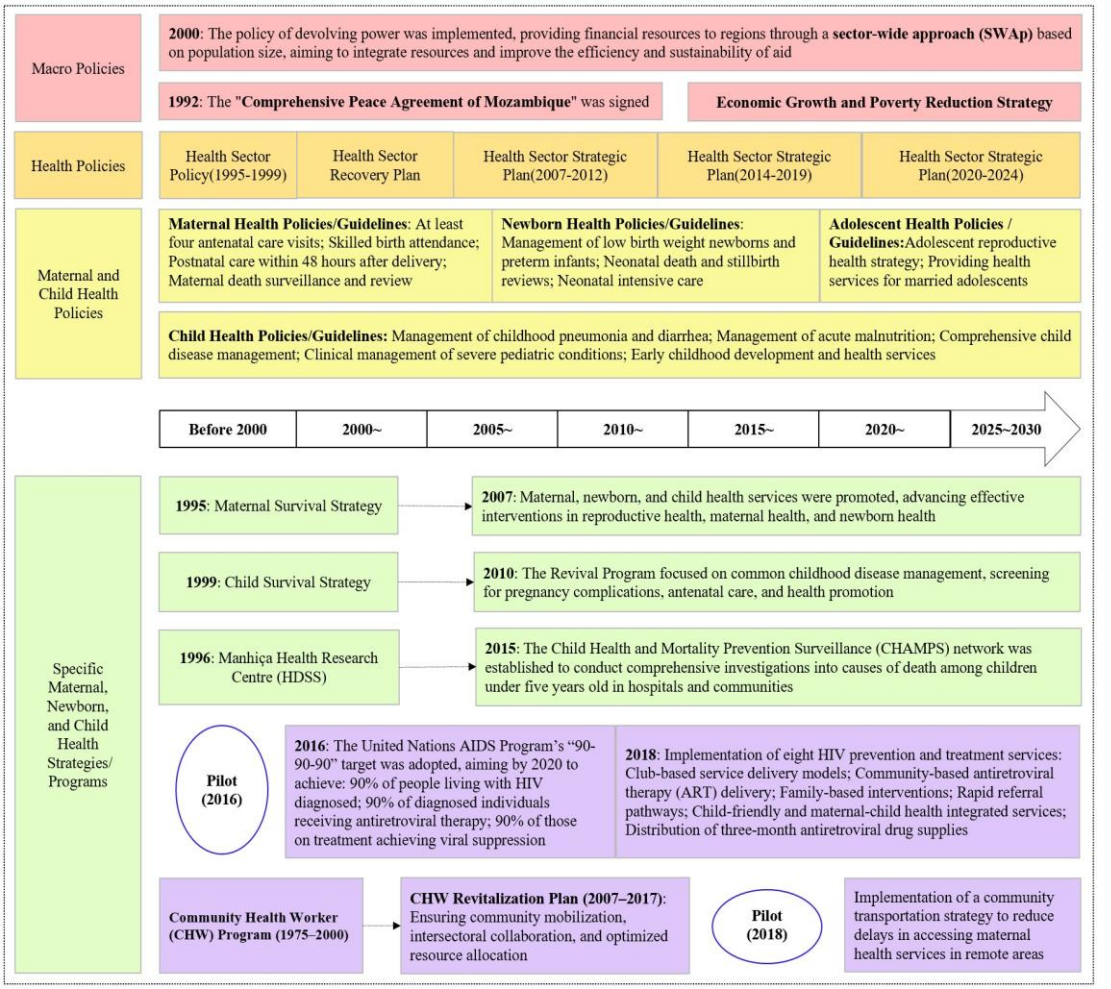


Figure 1 An Overview of Health Policies in Mozambique

Methods

Study design and data sources

We analysed nationally representative, cross-sectional household survey data from Mozambique to estimate trends and projections in RMNCH service coverage. Data were drawn from five Demographic and Health Surveys (DHS; 1997, 2003, 2011, 2015, and 2018), including 144,833 households. Both surveys used a multi-stage cluster sampling design and collected data from women of reproductive age (15-49 years) and children under five years, enabling disaggregation by province, urban–rural residence, and socioeconomic status. Detailed sampling methodologies are available

in DHS reports. As all data are publicly available and de-identified, no additional ethical approval was required (The DHS Program - Using Datasets for Analysis; appendix p2).

Measurement of indicators

RMNCH service indicators

We evaluated RMNCH service coverage at national and subnational levels, stratified by province, residence, maternal education, and wealth quintile. While based on the WHO's eight essential services, our indicator framework was extended into a locally adapted package reflecting Mozambique's specific health priorities, asoutlined in the country's RMNCH profile and Countdown to 2030 national assessments[16]. After excluding indicators with sparse data or inconsistent definitions, 24 interventions were retained—20 preventive and 4 curative—for constructing a local composite coverage index (LCCI). For benchmarking against global standards, we also calculated the WHO composite coverage index (CCI), which integrates eight key interventions across family planning, maternal and newborn care, immunisation, and child illness management, several of which align with SDG monitoring indicators. (e.g., 3.7.1, 3.1.2, 3.b.1) (appendix p3)[17].

Equity in continuous RMNCH service coverage

Socioeconomic inequalities in RMNCH coverage were quantified using the Relative Index of Inequality (RII) via beta regression with a logit link, adjusting for urban–rural residence and maternal education[18]. The regression model was specified as follows:

$$logit\big(E(Y_t)\big) = \beta_0 + \beta_1 rscore_i + \sum_k \beta_k X_{k,i}$$
$$RII = e^{\beta_1} \quad (1)$$

In Equation 1, Y_t is service coverage in year t (0 to 1); $rscore_i$ is socioeconomic rank (0 = poorest, 1 = richest), and $X_{k,i}$ are covariates. An RII of 1 indicates no inequality. If $\beta_1 > 0$ ($RII > 1$) favours wealthier groups; if $\beta_1 < 0$ ($RII < 1$), favours poorer groups.

Temporal changes in the RII, year interaction terms can be added to the model specified in equation 2, with the extended formulation given as:

$$logit\big(E(Y_t)\big) = \beta_0 + \beta_1 rscore_i + \beta_2 year_t + \beta_3 (rscore_i \times year_t) + \sum_k \beta_k X_{k,i} \quad (2)$$

In equation 2, $\beta_3 < 0$ decreasing inequality over time.

Bayesian hierarchical prediction model based on the Beta distribution

We predicted national- and provincial-level RMNCH service coverage using a Bayesian Beta regression model[19], National-level coverage was modelled as:

$$\begin{aligned} CCI_i &\sim Beta(\mu_i\phi, (1-\mu_i)\phi) \\ logit(\mu_i) &= \alpha + \beta X_i + \gamma t_i \\ \alpha &\sim N(0,10), \beta \sim N(0,5) \\ \phi &\sim Gamma(0.1,0.1) \end{aligned} \quad (3)$$

In equation 3, CCI_i is the observed national coverage in year i. X_i denotes covariates for year i (eg, GDP per capita). t_i is the time-trend. ϕ is the Beta precision parameter.

To mitigate overfitting given the limited number of time points, we employed a hierarchical Bayesian framework with partial pooling across provinces and weakly informative priors to regularise parameter estimation. Random intercepts and slopes were included to capture provincial heterogeneity:

$$\begin{aligned} CCI_{ik} &\sim Beta(\mu_{ik}\phi, (1-\mu_{ik})\phi) \\ logit(\mu_{ik}) &= \alpha + \alpha_k + (\beta + \beta_k) X_{ik} \\ \begin{pmatrix} \alpha_k \\ \beta_k \end{pmatrix} &\sim MVNormal(\mathbf{0}, \sum), \sum = \begin{pmatrix} \sigma_\alpha^2 & \rho\sigma_\alpha\sigma_\beta \\ \rho\sigma_\alpha\sigma_\beta & \sigma_\beta^2 \end{pmatrix} \\ \rho &\sim LKJ(2), \ \ \sigma_\alpha, \sigma_\beta \sim Half - Student_3(0,2.5) \end{aligned} \quad (4)$$

In equation4, CCI_{ik} denotes the coverage of RMNCH services in province k and year i. X_{ik} represents time-varying covariates at the provincial level, including GDP per capita. μ_{ik} is the expected coverage for province k in year i, obtained via a logit transformation to ensure values lie within the interval [0,1]. α_k and β_k are the

provincial random intercept and slope, $\sum$ is their covariance matrix, with variance parameters modelled using Half-Student distributions and correlation $\rho \sim \mathrm{LKJ}(2)$.

Posterior distributions were obtained using MCMC (3 chains, 30,000 iterations, 5,000 burn-in). Service coverage was logit-transformed prior to modelling and back-transformed to probabilities for interpretation. Provincial-level projections were used to estimate the probability of achieving ≥80% coverage by 2030[20].

Lives Saved Tool (LiST) analysis

Projected coverage levels from the LCCI were used as inputs for the Lives Saved Tool (LiST) to estimate maternal, neonatal, and under-5 deaths averted under alternative scale-up scenarios[21]. We modelled a baseline scenario following the trajectories projected by the Bayesian models and a scale-up scenario in which coverage was increased linearly to 80% in all provinces by 2030. Simulations were performed for each province and aggregated nationally. A detailed mapping of LCCI components to LiST interventions and coverage indicators is provided (appendix p4-5).The mortality impact of achieving LCCI targets was compared with that of reaching WHO CCI targets to quantify the added value of context-specific priority-setting.

Results

Projection and trend analysis of RMNCH service coverage in Mozambique by 2030

At the national level, coverage of the eight WHO-recommended RMNCH services, including individual interventions and the composite coverage index (CCI), was assessed at five time points (1997, 2003, 2010, 2015, and 2018; Figure 2). In 2018, coverage ranged from 54·3% for oral rehydration therapy to 92·1% for DTP vaccination, with a CCI of 71·8%.

By 2030, Bacillus Calmette-Guérin (BCG), third dose of diphtheria–tetanus–pertussis-containing vaccine (DTP3), and measles vaccine (MSL), as well as care-seeking for pneumonia (CAREP), are projected to reach the 80% coverage target. In

contrast, demand for family planning satisfied by modern methods (DFPSm), antenatal care (ANC) (⩾4 visits), skilled birth attendance (SBA), and oral rehydration solution (ORS) are projected to remain below this threshold. The CCI is projected to reach 78·2%.

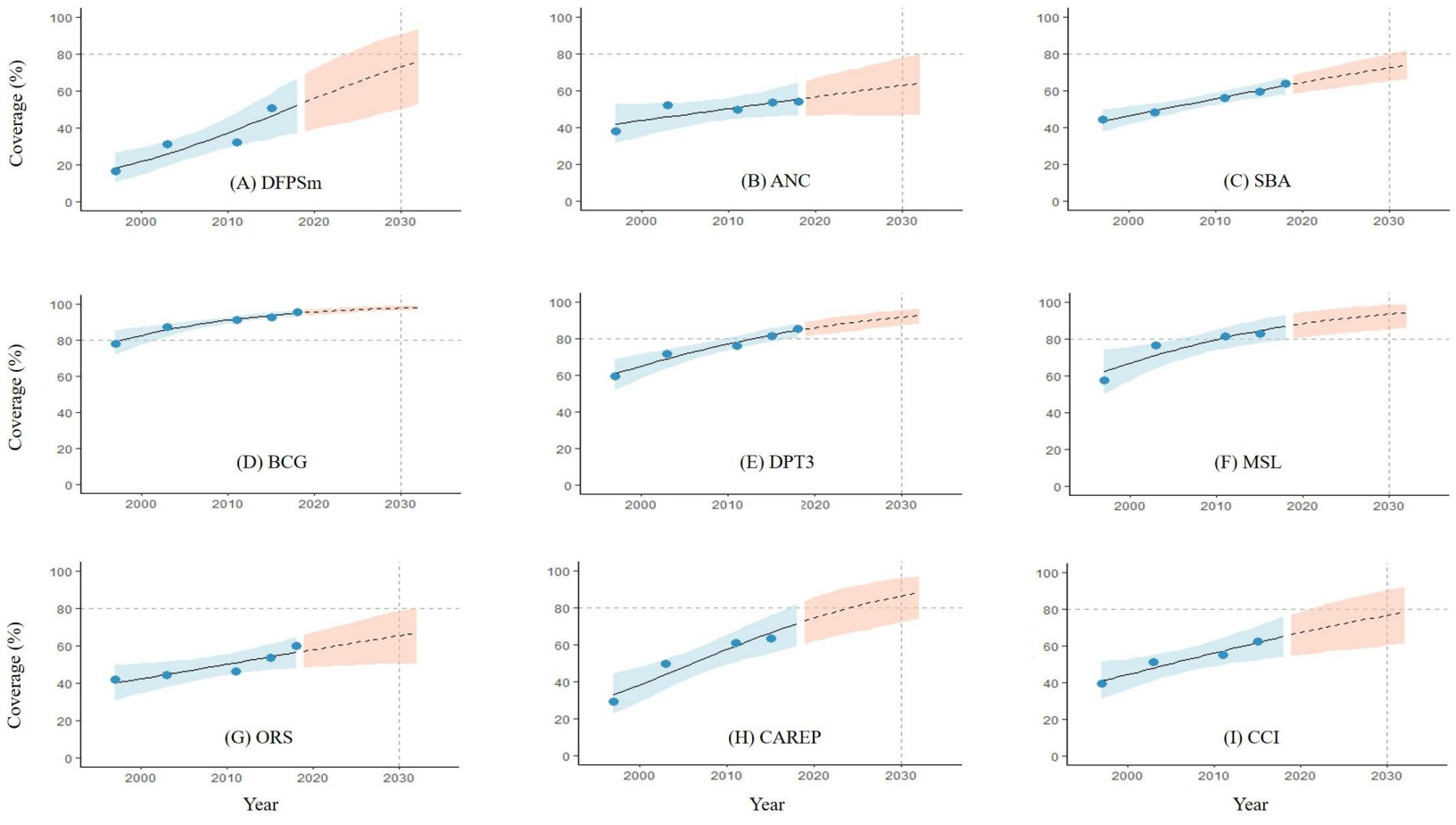


Figure 2 Trends in the coverage of WHO's eight maternal and child health services (specific and composite) in Mozambique, 1997–2030
Solid lines denote observed values from five reference years (1997, 2003, 2010, 2015, and 2018), whereas dashed lines denote projected values, with 2030 representing the final projection point.

Stratified projections indicate persistent disparities (Figure 3). Four provinces—Zambézia, Nampula, Cabo Delgado, and Niassa—are projected to remain below 80% CCI by 2030. Coverage is also projected to remain below this level among rural populations, lower- and middle-wealth groups, and individuals with less than secondary education.

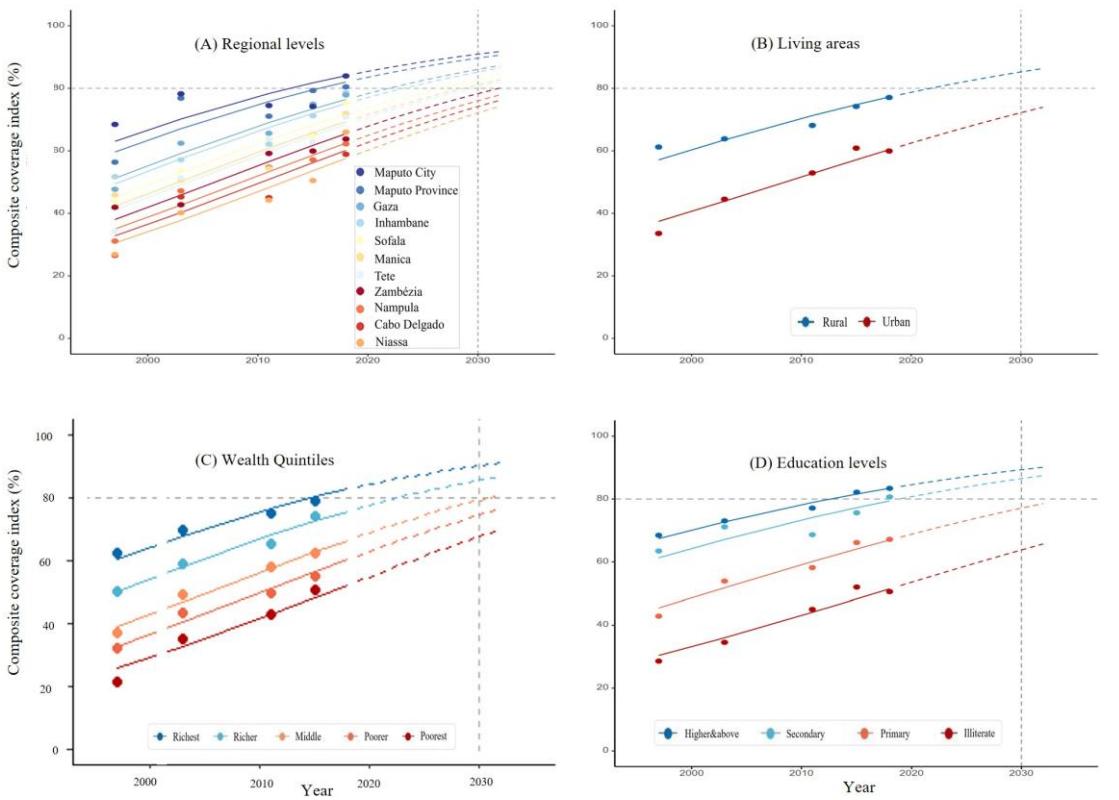


Figure 3 Trends in the composite coverage index (1997–2030) in Mozambique, stratified by province, place of residence, maternal education, and wealth quintile
Solid lines represent observed values from survey data in 1997, 2003, 2010, 2015, and 2018; dashed lines represent projected trends, with 2030 as the final projection point. Owing to data availability constraints, observed data stratified by wealth quintile do not include the year 2018.

Of 20 preventive services, 13 are projected to achieve 80% coverage by 2030, including immunisation, malaria prevention during pregnancy, and early initiation of breastfeeding. Among curative services, institutional delivery and care-seeking for pneumonia are projected to reach the target. In contrast, DFPSm among women aged

15–49 years, ANC (≥4 visits), SBA, and ORS show low probabilities of achieving 80% coverage (Table 1).

Table 1 Trends in the localized composite coverage index (LCCI) for maternal and child health services in Mozambique, 1997–2030

Indicators	Predicted coverage in 2030 (95% credible interval)	Annual % change 1997–2030 (95% credible interval)	Probability of achieving universal coverage of RMNCH services by 2030
Prevention indicators			
Demand for family planning satisfied by modern methods (DFPSm) (15-49 years)	73.12 (50.08, 91.08)	4.12 (2.07, 6.08)	22.91
Demand for family planning satisfied by modern methods (DFPSm) (15-19years)	83.59 (58.22, 98.12)	8.95 (6.09, 11.72)	62.41
Provision of intrauterine device (IUD) insertion services	22.34 (5.84, 43.57)	17.61 (6.73, 28.49)	0.05
Timing of first antenatal care visit (<16 weeks' gestation)	15.50 (5.63, 28.30)	-0.20 (-3.15, 2.73)	0.11
At least four antenatal care visits	62.86 (46.98, 78.35)	1.19 (-0.27, 2.59)	0.90
At least eight antenatal care visits	5.83 (2.52, 10.44)	5.14 (2.11, 8.46)	0.06
Intermittent preventive treatment in pregnancy (IPTp)	98.43 (93.11, 99.99)	13.25 (6.30, 20.49)	99.52
Treatment of pregnant women with HIV	51.33 (5.97, 99.98)	1.67 (-10.49,12.97)	18.11
At least four antenatal counselling sessions	90.88 (74.85,99.98)	12.62 (3.61,23.48)	91.99
Use of insecticide-treated nets (ITNs) during pregnancy for malaria prevention	98.44 (93.1799.97)	13.28 (6.29, 20.33)	99.55
Postnatal care for mothers	95.81	2.16	97.56

within 48 hours of birth	(85.11, 99.86)	(-1.17,7.84)	
Immediate skin-to-skin contact after birth	94.51 (91.25, 97.69)	-0.03 (-0.34, 0.27)	99.76
Neonatal tetanus protection	99.99 (99.24, 100.00)	29.56 (16.75, 40.00)	99.68
BCG immunization	97.98 (96.45, 99.12)	0.63 (0.36, 0.91)	100.00
Polio3 immunisation	85.17 (71.16, 95.52)	1.06 (0.11, 2.02)	80.13
DPT3 immunisation	91.87 (87.24, 95.72)	1.22 (0.73, 1.74)	99.81
Measles immunisation	90.66 (82.64, 96.57)	1.18 (0.43, 1.93)	98.12
Early initiation of breastfeeding	95.12 (88.05, 99.40)	0.09 (-0.77, 0.98)	98.57
Population using basic drinking water services	72.74 (58.84, 85.93)	3.13 (1.71, 4.53)	10.95
Improved sanitation facilities	85.95 (71.53, 95.73)	11.90 (9.64, 14.25)	79.96
Composite prevention index	67.27 (55.96, 77.50)	4.49 (3.40, 7.13)	15.35
Treatment indicators			
Institutional delivery	80.26 (71.48, 87.99)	1.91 (1.10, 2.68)	53.48
Skilled birth attendance	72.40 (65.29, 79.79)	1.52 (0.91, 2.17)	1.80
Oral Rehydration Therapy	64.80 (48.36, 79.48)	0.69 (0.59, 1.91)	1.84
Care seeking for pneumonia	84.96 (75.31, 92.76)	2.77 (1.70, 3.86)	86.29
Composite treatment index	53.38 (43.51, 62.88)	3.20 (2.03, 4.42)	12.79

Note: For 1997, 2003, 2011, 2015, and 2018, values outside parentheses represent observed estimates of maternal and child health service coverage, with 95% confidence intervals (CI) inside parentheses. Results marked with a dagger (†) were estimated using Bayesian linear regression and represent 95% credible intervals (CrI). For 2030, values outside parentheses represent projected

coverage estimates, with 95% CrI inside parentheses. For consistency in the table, all intervals are denoted as 95% CI.

Composite coverage of preventive and curative services increased over time but remained below target levels (Figure 4). By 2030, the localised composite coverage index (LCCI) is projected to reach 67·27% for preventive services and 53·38% for curative services.

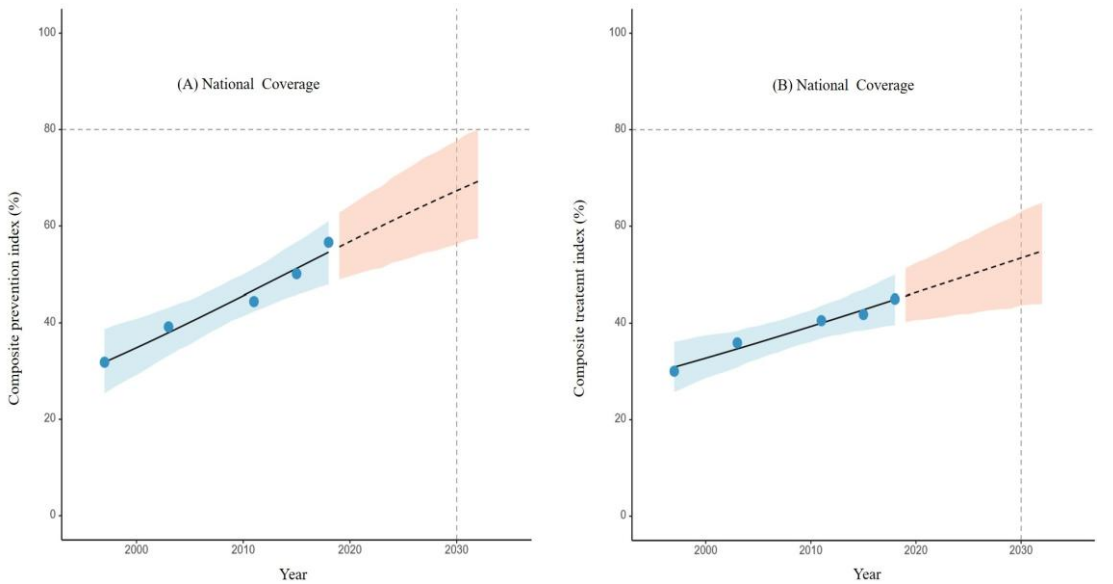


Figure 4 Trends in the localized composite coverage index (LCCI) for preventive and curative maternal and child health services in Mozambique, 1997–2030
Solid lines represent observed values from 1997, 2003, 2010, 2015, and 2018; dashed lines represent projected trends, with 2030 as the final projection point.

Further stratified analyses show that only the wealthiest quintile is projected to achieve preventive service coverage above 80%, whereas all other subgroups remain below this threshold for both preventive and curative services (Figure 5; Appendix 9–24).

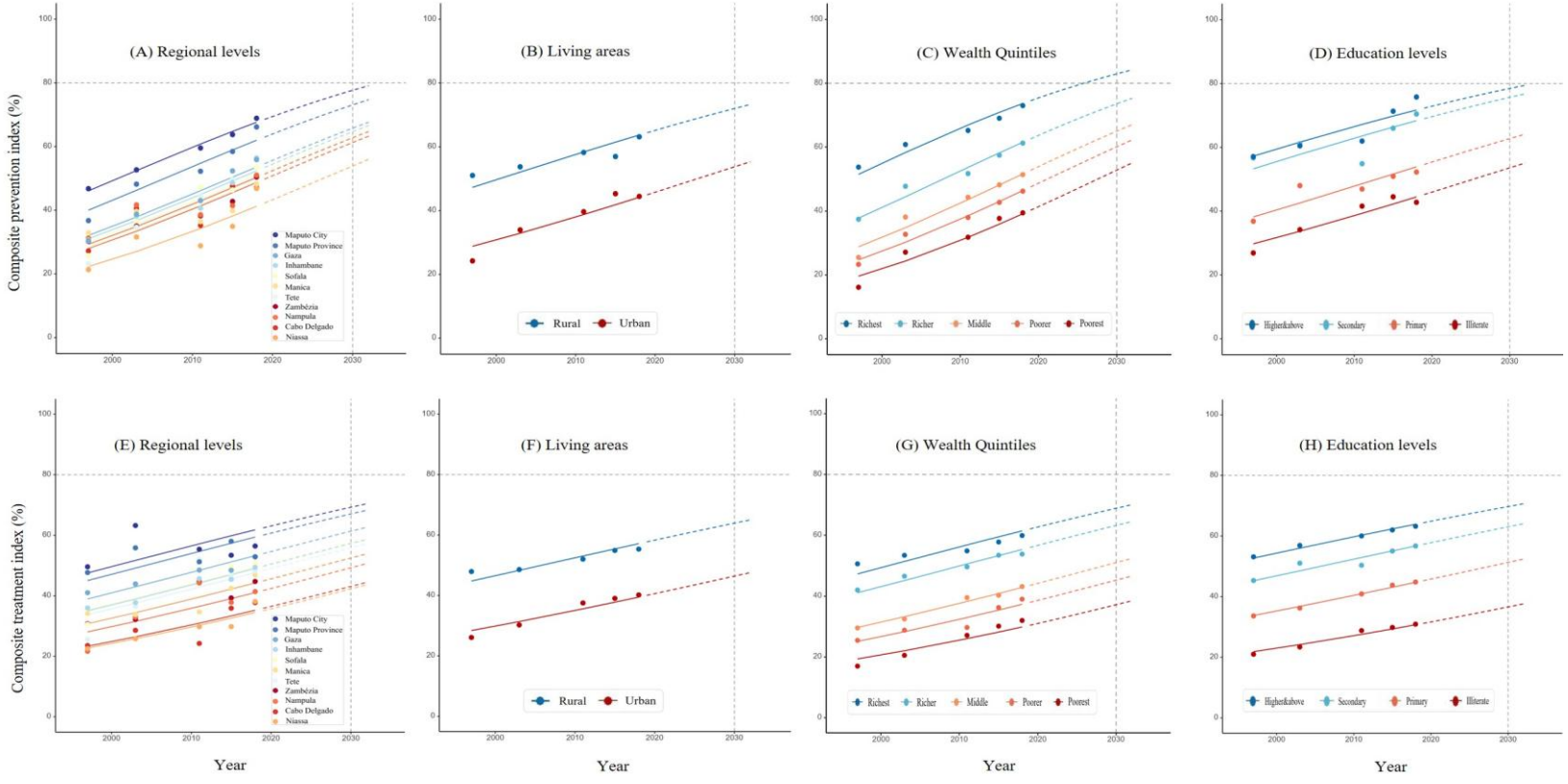


Figure 5 Composite coverage index of preventive and treatment services by province, place of residence, wealth, and education level, 1997–2030

Solid lines indicate observed values, based on data from 1997, 2003, 2010, 2015, and 2018; dashed lines indicate projected values, with 2030 as the final projection point.

Equity in Coverage of Localized RMNCH Coverage in Mozambique, 1997-2018

Socioeconomic inequalities in RMNCH service coverage were evident across most indicators in 1997, with predominantly pro-rich distributions (RII>1), as shown in Table 2. Between 1997 and 2018, relative inequalities declined for several key maternal health services, including demand for family planning satisfied by modern methods (DFPSm; 2.51 to 1.52), institutional delivery (2.81 to 1.21), and skilled birth attendance (2.45 to 1.13), although pro-rich inequalities persisted.

For preventive services, inequalities in early antenatal care and prevention of mother-to-child transmission of HIV also decreased over time. In contrast, some indicators showed a shift towards pro-poor distributions, including intermittent preventive treatment in pregnancy (IPTp; 0.18 to 0.30) consistently showed a pro-poor distribution across all survey years, with RII values remaining below 1.

Child immunisation indicators showed substantial reductions in inequality, with RII estimates approaching unity after 2011 for BCG, polio3, DPT3, and measles vaccination. Neonatal tetanus protection and immediate skin-to-skin contact after birth showed little evidence of inequality across survey years.

For treatment-related services, oral rehydration therapy and care-seeking for pneumonia showed declining or reversed inequalities over time, with RII estimates below 1 in later years.

Overall, although inequalities narrowed over time, disparities persisted across several key RMNCH services.

346 **Table 2 Equity in coverage of localised maternal and child health services in Mozambique, 1997–2018**

Indicators	RII in maternal and child health service coverage				
	1997	2003	2011	2015	2018
Prevention indicators					
Demand for family planning satisfied by modern methods (DFPSm) (15-49 years)	2.51** (1.15, 1.58)	2.37** (1.25, 2.77)	1.79** (1.32, 2.66)	1.68** (1.26, 3.50)	1.52** (1.28, 2.79)
Demand for family planning satisfied by modern methods (DFPSm) (15-19years)	1.25* (1.02, 1.48)	1.02 (0.12, 1.39)	0.49 (0.32, 1.66)	0.43** (0.31, 0.54)	0.41** (0.21, 0.58)
Provision of intrauterine device (IUD) insertion services	1.21* (1.02, 1.27)	1.16 (0.92, 1.34)	1.98* (1.23, 2.03)	1.76** (1.61, 1.92)	1.23** (1.05, 1.60)
Timing of first antenatal care visit (<16 weeks' gestation)	1.29** (1.24, 1.53)	1.07 (0.04, 2.16)	1.14* (1.02, 1.25)	0.74 (0.92, 1.25)	0.72* (0.09, 0.36)
At least four antenatal care visits	1.54** (1.46, 1.71)	1.72** (1.40, 1.94)	1.34** (1.28, 1.40)	1.40** (1.31, 1.47)	1.45** (1.30, 1.59)
At least eight antenatal care visits	1.34 (0.01, 2.08)	1.25 (0.03, 1.38)	1.36 (0.04, 2.09)	1.27** (1.53, 1.41)	1.28** (1.62, 1.82)
Intermittent preventive treatment in	0.18**	0.25**	0.07***	0.19***	0.30**

pregnancy (IPTp)	(0.03, 0.42)	(0.20, 0.39)	(0.01, 0.12)	(0.05, 0.33)	(0.16, 0.44)
Treatment of pregnant women	2.13**	2.07**	1.89**	1.47**	1.41**
with HIV	(1.35, 2.43)	(1.68, 1.45)	(1.52, 2.63)	(1.28, 1.65)	(1.24, 1.63)
At least four antenatal counselling	1.06*	1.10	1.02	0.88	0.64
sessions	(1.03, 1.09)	(0.02, 1.18)	(1.00, 1.20)	(0.05, 0.94)	(0.19, 0.83)
Use of insecticide-treated nets (ITNs) during pregnancy for malaria prevention	2.47** (1.68, 2.89)	1.23 (0.86,1.35)	0.84*** (0.11, 0.96)	0.81*** (0.09, 0.94)	1.21*** (0.89, 1.65)
Postnatal care for mothers within 48	0.86	1.10	1.02	0.76*	0.78**
hours of birth	(0.38, 1.34)	(0.88, 1.32)	(0.93, 1.10)	(0.64, 0.88)	(0.69, 0.86)
Immediate skin-to-skin contact	1.21	1.16	0.98	0.76	0.82
after birth	(0.72, 1.27)	(0.92, 1.34)	(0.23, 1.03)	(0.61, 1.22)	(0.05, 1.19)
Neonatal tetanus protection	1.52 (0.41, 1.64)	1.25** (1.13, 1.36)	1.22 (0.74, 1.29)	1.20 (0.80, 1.27)	0.83 (0.36, 1.34)
BCG immunization	1.57*** (1.36, 1.67)	1.31*** (1.23, 1.39)	1.12 (0.47, 1.18)	1.13 (0.69, 1.17)	1.09 (0.62, 1.11)
Polio3 immunisation	1.73** (1.60, 1.86)	1.54** (1.47, 1.62)	1.22 (0.65, 1.30)	1.33 (0.82, 1.54)	1.26 (0.83, 1.47)
DPT3 immunisation	1.77**	1.54	1.30	1.30	1.28

	(1.06, 1.92)	(0.49, 1.60)	(0.23, 1.36)	(0.22, 1.38)	(0.12, 1.43)
Measles immunisation	1.79***	1.47***	0.86	0.84	0.87
	(1.58, 1.99)	(1.39, 1.54)	(-0.16, 0.97)	(-0.25, 1.42)	(-0.15, 1.29)
Early initiation of breastfeeding	0.27	0.35**	0.26	0.34	0.36**
	(-0.01, 0.36)	(0.07, 0.63)	(-0.10, 0.72)	(-0.14, 1.20)	(0.23, 0.82)
Population using basic drinking	1.81**	2.07	1.02	0.85	0.88
water services	(0.28, 2.34)	(0.75, 2.39)	(0.74, 1.27)	(0.56, 1.14)	(0.68, 1.08)
Improved sanitation facilities	1.16*	2.15**	0.89	1.22	1.18
	(1.02, 1.34)	(1.05, 2.31)	(0.44, 1.35)	(0.48, 1.35)	(0.43, 1.35)
Treatment indicators					
Institutional delivery	2.81**	1.76**	1.16*	1.07*	1.21**
	(1.78, 2.83)	(1.62, 1.94)	(1.01, 1.91)	(1.03, 1.18)	(1.41, 1.77)
Skilled birth attendance	2.45**	1.81	1.74**	1.21**	1.13**
	(1.67, 2.90)	(1.00, 2.60)	(1.58, 1.90)	(1.10, 1.43)	(1.06, 1.44)
Oral Rehydration Therapy	1.55	1.36	1.26**	0.42**	0.45**
	(0.46, 1.64)	(0.18, 1.55)	(1.16, 1.39)	(0.02, 0.83)	(0.12, 0.83)
Care seeking for pneumonia	1.21***	1.08	1.26**	1.13*	0.78**
	(1.01, 1.42)	(-0.03, 1.18)	(1.03, 1.48)	(1.07, 1.34)	(0.45, 0.94)

347 *p<0.05, **p<0.01, ***p<0.001; relative inequality indices are presented in parentheses, with 95% confidence intervals outside parentheses.
348 Relative Index of Inequality (RII)

LiST projections of the impact of RMNCH improvements and SDG attainment in Mozambique by 2030

Scaling up the LCCI to 80% coverage by 2030 was associated with substantial reductions in maternal, neonatal, and under-5 mortality across Mozambique (Table 3). At the national level, this corresponded to 561 maternal deaths, 16,201 neonatal deaths, and 27,701 under-5 deaths averted, compared with the baseline scenario. Detailed provincial estimates for both baseline and scale-up scenarios are provided in the appendix p25.

Compared with a scenario including only the eight WHO-recommended interventions, achieving 80% LCCI coverage resulted in an additional 17,513deaths averted, reflecting the incremental contribution of the expanded intervention package. The composition of the LCCI and its mapping to LiST interventions are described in the appendix p26.

At the national level, the maternal mortality ratio under the scale-up scenario fell below the SDG target of 70 per 100,000 live births by 2030. At the subnational level, projected maternal mortality remained above this threshold in Niassa, Tete, Inhambane, and Gaza.

Under the scale-up scenario, reductions in neonatal and under-5 mortality were observed across all provinces; however, neither national nor provincial estimates met the SDG 3.2 targets for neonatal mortality (<12 per 1,000 live births) or under-5 Mortality (<25 per 1,000 live births) by 2030.

Table 3 Gaps in maternal, neonatal, and under-5 mortality rates relative to SDG targets, by province, Mozambique, 2030

Regions	Additional maternal deaths averted by 2030	Maternal mortality rate in 2030 (per 100,000 live births)	Gap to SDG 3.1	Additional neonatal deaths averted by 2030	Neonatal mortality rate in 2030 (per 1,000 live births)	Gap to SDG 3.2	Additional under-5 deaths averted by 2030	Under-5 mortality rate in 2030 (per 1,000 live births)	Gap to SDG 3.2	Priority
Niassa	54	111.46	✗	834	29.69	✗	1001	48.82	✗	★
Tete	30	71.01	✗	1441	39.91	✗	2921	45.99	✗	★
Inhambane	36	102.96	✗	491	18.8	✗	653	26.59	✗	★
Gaza	29	110.3	✗	667	28.06	✗	902	33.65	✗	★
Cabo Delgado	28	63.13	✓	1426	45.57	✗	2277	61.1	✗	☆
Nampula	76	61.93	✓	1181	26.95	✗	2340	29.73	✗	☆
Zambézia	49	43.37	✓	1453	61.2	✗	3131	67.95	✗	☆
Manica	24	62.87	✓	1696	19.93	✗	2259	49.98	✗	☆
Sofala	61	54.58	✓ 0	674	44.68	✗	2426	34.19	✗	☆
Maputo Province	71	58.63	✓ 0	2751	22.23	✗	4033	23.28	✓	☆
Maputo Cidade	103	35.7	✓ 0	3587	16.48	✗	5758	17.53	✓	☆
National	561	45.51	✓	16201	25.89	✗	27701	42.01	1 ✗ 1	☆

Discussion

This study demonstrates that translating global RMNCH targets into locally prioritised, equity-informed strategies can substantially increase population health gains compared with standardised approaches in low-resource, high-burden settings. By integrating subnational projections, inequality assessment, and prospective mortality modelling, our findings provide a policy-relevant framework to inform priority setting and resource allocation.

Progress towards universal coverage remains uneven. Our findings show that progress towards universal RMNCH service coverage in Mozambique is likely to remain incomplete by 2030 under current trajectories. The LCCI is projected to reach 67·3% for preventive services and 53·4% for curative services, both below the 80% benchmark. Coverage gaps persist across provinces and socioeconomic groups, with disadvantaged populations consistently lagging behind.

These findings reinforce evidence that national averages can mask substantial subnational inequalities, potentially obscuring effective priority-setting [22,23]. Even in higher-performing provinces, projected gains appear insufficient to reach universal targets, pointing to persistent system-level constraints, including workforce shortages, infrastructure limitations, and financial barriers to access[24].

Mozambique's Plano Estratégico do Sector Saúde (PESS) frameworks have prioritised decentralised governance and community-based delivery through Agentes Polivalentes Elementares. However, persistent gaps in northern provinces suggest that these strategies have not adequately reached the most vulnerable populations. This implementation gap likely reflects structural constraints, including uneven APE deployment, limited district-level capacity under fiscal decentralisation, and supply chain disruptions exacerbated by COVID-19 and regional conflict [25]. Achieving the 80% LCCI target in northern provinces will likely depend on targeted efforts to improve service accessibility, strengthen supply systems, and enhance community engagement.

Our analysis further shows that context-specific prioritisation of interventions can yield greater health gains than uniform scale-up of globally standardised packages. Achieving 80% coverage across provinces is projected to avert substantially more maternal and child deaths than scaling up WHO-recommended essential services alone, highlighting the importance of aligning intervention strategies with local epidemiological and health system contexts [26,27] . Notably, projected gains differ across outcomes. While maternal mortality could approach SDG targets under accelerated scale-up, reductions in neonatal and under-5 mortality remain more limited[25]. This pattern suggests persistent gaps in the continuum of care—particularly around childbirth and the immediate postnatal period—where strengthening perinatal services may be critical to maximising overall impact [28].

Persistent inequalities remain a defining constraint. Although disparities have narrowed for some interventions, pro-rich inequalities persist in key services such as antenatal care and institutional delivery, consistent with the inverse equity hypothesis [29]. Importantly, inequalities appear to vary by intervention type. Preventive services delivered through campaigns or single contacts—such as immunisation—show more equitable coverage, whereas services requiring repeated contact or higher indirect costs—such as antenatal care and facility-based delivery—remain less accessible to disadvantaged populations. Notably, IPTp represents an exception within antenatal care services, as it demonstrates both high coverage and pro-poor distribution, likely reflecting its integration into rountine ANC delivery, targeted malaria control strategies, and strong implementation support in high-burden rural areas[30]. These differences highlight how both health system design and demand-side constraints shape equity outcomes.

Implications for health system strengthening. Taken together, these findings suggest that expanding coverage alone may be insufficient without explicit attention to equity. Progress towards RMNCH-related SDGs will likely require a coordinated mix of policy instruments operating across the health system, including supply-side measures

(such as workforce expansion and facility strengthening), demand-side interventions (including financial protection and health education), and broader enabling policies that shape the service environment (such as female education and transport infrastructure)[31].

In resource-constrained settings, prioritising interventions with both high mortality impact and low baseline coverage may offer a more efficient pathway to health gains [32,33]. In Mozambique, this includes services such as skilled birth attendance and oral rehydration therapy, which remain below target levels despite their substantial potential impact.

This study has several limitations. First, projections are based on historical survey data up to 2018 and assume continuity in underlying trends. Although Mozambique has conducted a more recent 2022- 2023 DHS, this dataset was not included because it was not fully harmonised and publicly available at the time of analysis.Nevertheless, we acknowledge that exclusion of the most recent data may limit the timeliness of projections and should be considered when interpreting future estimates. Second, the assumption of linear scale-up towards 80% coverage by 2030 may be optimistic given historical non-linearities in service expansion, health system constraints, and potential external shocks. Therefore, the projected trajectories should be interpreted as aspirational scenarios under sustained investment rather than as forecasts of actual attainment. Third, the Lives Saved Tool(LiST) assumes established causal relationships between intervention coverage and mortality outcomes. However, these estimates do not fully account for unmeasured confounding, variations in implementation quality, or health system performance heterogeneity, which may introduce uncertainty in mortality projections. Fourth, LCCI excludes several indicators due to data constraints , which may lead to conservative estimates of overall coverage. Finally, DHS and MICS data are subject to recall and reporting biases, which may affect baseline estimates.

Despite these limitations, this study provides a policy-relevant and transferable framework for linking global health targets with local implementation. Our findings suggest that reliance on national averages and standardised intervention packages may be insufficient to achieve equitable and efficient health gains. More broadly, this work supports a shift from global target monitoring towards locally informed, equity-oriented decision-making, offering a scalable approach for other low-resource, high-burden settings. The persistent gap between global targets and local implementation realities underscores the importance of adapting intervention packages to local epidemiology and health system capacity[34]. Importantly, while the current LiST framework provides useful static estimates of intervention impact, it does not fully capture dynamic health system constraints and interactions. Emerging modelling approaches increasingly integrate such constraints to improve policy relevance and realism in impact estimation, representing an important direction for future research[35].

Conclusions

In conclusion, the present findings suggest that national progress towards RMNCH-related SDG targets in Mozambique masks substantial and persistent subnational and socioeconomic inequalities. Under current trajectories, many essential RMNCH interventions are unlikely to achieve universal coverage by 2030, particularly in disadvantaged populations and provinces. Equitable, context-specific scale-up strategies could generate substantially greater reductions in maternal, neonatal, and under-5 mortality than uniform implementation of standard intervention packages. Future research should incorporate more recent data and dynamic health system constraints to further refine priority-setting approaches and support equitable progress towards RMNCH-related SDG targets.

Abbreviations

ANC: Antenatal care

BCG: Bacillus Calmette-Guérin

CAREP: Care-seeking for pneumonia

CCI: Composite Coverage Index

DCP: Disease Control Priorities

DFPSm: Demand for family planning satisfied by modern methods

DHS: Demographic and Health Surveys

DTP3: Third dose of diphtheria–tetanus–pertussis-containing vaccine

IPTp: Intermittent preventive treatment in pregnancy

LCCI: Local Composite Coverage Index

LiST: Lives Saved Tool

LMICs: Low- and middle-income countries

MSL: Measles vaccine

ORS: Oral rehydration solution

RII: Relative index of inequality

RMNCH: Reproductive, maternal, newborn, and child health

SBA: Skilled birth attendance

SDGs: Sustainable Development Goals

UHC: Universal Health Coverage

WHO: World Health Organization

Declarations

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Authors' contributions

All authors contributed to the conception and design of the study. QL and JP designed the study. QL and JP had full access to the data and verified the underlying data. QL and LA performed the data analysis and drafted the manuscript, with supervision from JP. EK and IR contributed to data processing and provided critical input. SC and HW revised the manuscript. All authors contributed to data interpretation, critically revised the manuscript for important intellectual content, and approved the

final version for publication. QL and JP had final responsibility for the decision to submit for publication.

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Data availability

The data that support the findings of this study are available from the corresponding author, JP, upon reasonable request.

Declarations

Ethics approval and consent to participate

The study used publicly available, anonymized data from the Demographic and Health Surveys (DHS) Program (https://dhsprogram.com/). Ethical approval for data collection was obtained by the DHS Program and the relevant institutional review boards in Mozambique. Written informed consent was obtained from all survey participants by the DHS Program. Access to the DHS datasets was granted through formal registration and approval by the DHS Program. Because this study involved secondary analysis of de-identified publicly available data, no additional ethical approval or participant consent was required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Supplementary Materials

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Supplementary Files

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