

Review Article

Infant and Child Mortality and Its Risk Factors in Sub-Saharan Africa: The Contribution of Healthcare Delivery

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Abstract

Background. Infant and child mortality remains a key indicator of population health in sub-Saharan Africa (SSA), where the risk of death before age five is more than six times higher than in Europe. Biological, maternal, socio-economic and environmental factors interact with the organisation of healthcare delivery, whose impact on under-five mortality has not yet been comprehensively synthesised. This scoping review aimed to map the risk factors for under-five mortality documented in SSA between 2003 and 2023, with particular attention to components of healthcare delivery. **Methods.** A scoping review was conducted following the Arksey & O'Malley framework as updated by Levac et al., and aligned with the PRISMA-ScR guidelines and the JBI manual. The research question followed the PCC format, targeting infants (0 -11 months) and children under five. Four sources were searched (PubMed/MEDLINE, Web of Science, African Index Medicus, Google Scholar), complemented by grey literature. Double-blind screening (Rayyan) and standardised extraction were conducted by two independent reviewers. A structured narrative synthesis was performed. **Results.** Twenty-nine documents were retained (19 original studies and 10 contextual documents) covering Western, Eastern, Southern and Central Africa. Four groups of determinants emerged: (i) biological and perinatal factors (malaria, acute respiratory infections, diarrhoea, prematurity, perinatal asphyxia, sickle-cell disease, breastfeeding); (ii) maternal and obstetric factors (maternal education, parity, antenatal care, three-delays model); (iii) socio-economic and environmental determinants (poverty, rural residence, WASH); (iv) healthcare delivery (geographical and financial access, quality of care, continuum of care). User-fee exemption policies and Universal Health Coverage have increased service use but may widen pro-rich inequalities in the absence of targeted measures and parallel quality improvements. **Conclusion.** Infant and child mortality in SSA is multifactorial and socially structured. In Senegal, the effectiveness of free-care policies depends on improving quality of care, addressing socio-environmental determinants, and pursuing an explicit territorial and social equity strategy. Rigorous impact evaluations are needed to inform future reforms.

Keywords

Infant and Child Mortality, Risk Factors, Health Services Delivery, Universal Health Coverage, Sub-Saharan Africa, Senegal, Scoping Review

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1. Introduction

Infant and child mortality remains, in Senegal as in the rest of Sub-Saharan Africa, a key indicator for monitoring population health [1]. Each year, approximately 4.9 million children worldwide die before their first birthday, over 47% of whom die during the neonatal period [2]. Although under-five mortality decreased by more than half between 1990 and 2015 as part of the Millennium Development Goals [3], deep regional disparities persist. The risk of death before age one in the WHO African Region is more than six times higher than in the European Region [4]. In Sub-Saharan Africa (SSA), the infant and child mortality rate is estimated at 51 per 1,000 live births, with particularly marked excess mortality in West Africa (73 per 1,000 live births) [5, 6]. These levels remain far from the Sustainable Development Goal 3.2 targets set for 2030: 12‰ for neonatal mortality and 25‰ for under-five mortality [7].

The causes of this mortality are multidimensional. Direct factors such as malaria, respiratory infections, diarrhea, neonatal sepsis, prematurity, and malnutrition [8] are exacerbated by social determinants including low maternal education, household poverty, rural residence, and inadequate sanitation [9, 10]. Beyond these individual factors, the organization of healthcare delivery itself constitutes a structural determinant of infant mortality. Longitudinal analyses of over 250,000 children in seven SSA countries showed that fees for vaccination (OR = 1.20) and delivery (OR = 1.11) were associated with significant excess infant and child mortality [11]. In several West African countries, fewer than 50% of women give birth in the presence of skilled attendants [12], even though assisted deliveries substantially reduce the risk of neonatal death [12].

To address these challenges, several SSA countries have undertaken structural reforms of their health systems: free obstetric care policies, community-based health insurance, and strengthening of primary healthcare [13, 14]. These mechanisms aim to remove financial and geographical barriers to healthcare access. However, their actual impact on infant and child mortality has not yet been systematically synthesized at the SSA level. Scoping reviews make it possible to map the extent and diversity of evidence in a heterogeneous field [15, 16]; this design therefore appears best suited to this objective. This scoping review aims to analyze the infant and child mortality risk factors documented in SSA between 2003 and 2023, with particular attention to the healthcare delivery components associated with variations in this mortality.

2. Methodology

2.1. Methodological Framework

This is a scoping review conducted according to the five-step methodological framework and aligned with PRISMA-ScR guidelines [15-17]. This design was chosen to map a heterogeneous field where primary studies, evidence syntheses, and programmatic documents coexist [18].

2.2. Research Question

The research question was formulated according to the PCC (Population, Concept, Context) format recommended by the Joanna Briggs Institute (JBI) [18]:

- 1) Population: Infants (0–11 months) and children under five years of age;
- 2) Concept: Infant mortality, risk factors, and components of healthcare delivery;
- 3) Context: Sub-Saharan African countries, period 2003–2023.

The guiding question is: “What are the documented risk factors for infant and child mortality in Sub-Saharan Africa, and to what extent do healthcare delivery components contribute to them?”

2.3. Literature Search Strategy

Three databases and one search engine were queried: PubMed/MEDLINE, Web of Science, African Index Medicus, and Google Scholar. The search strategy was constructed using controlled MeSH terms and free-text words, combined according to Boolean operators AND/OR. The main terms used were: ("Infant Mortality" [MeSH] OR "Child Mortality" [MeSH] OR "Perinatal Mortality" [MeSH]) AND ("Risk Factors" [MeSH] OR "Cause of Death" [MeSH]) AND ("Health Services Accessibility" [MeSH] OR "Delivery of Health Care" [MeSH] OR "Primary Health Care" [MeSH]) AND ("Africa South of the Sahara" [MeSH] OR "Africa, Western" [MeSH]). The search was limited to publications from January 2003 to December 2023. A supplementary search of gray literature (WHO, UNICEF, World Bank, USAID reports) was conducted via Google Scholar and institutional websites. The references of included articles were also manually reviewed.

2.4. Eligibility Criteria

Studies were selected according to the following inclusion and exclusion criteria:

Table 1. Selection criteria.

Criteria	Inclusion	Exclusion
Study type	Primary studies (cross-sectional, cohort, case-control, trials), systematic reviews, meta-analyses, institutional reports	Editorials, letters, opinions, isolated case studies
Population	Infants (0–11 months) and children <5 years in Sub-Saharan Africa	Populations outside SSA or irrelevant age groups
Language	French, English	Any other language
Period	January 2003 – December 2023	Publications prior to 2003
Research theme	Infant/neonatal mortality, at least one risk factor and one healthcare delivery component	Studies exclusively on maternal mortality without data on infant mortality

Study Selection

The literature search results were imported into Rayyan software for duplicate management and study selection. The selection was conducted in two independent and blinded phases: (i) title and abstract screening by two reviewers, followed by (ii) full-text reading of preselected articles. Disagreements were resolved by consensus or, if persistent, by arbitration with a third reviewer. The selection process is described according to the PRISMA-ScR flow diagram.

2.5. Data Extraction and Management

Data were extracted using a standardized form developed a priori and tested on five pilot articles. For each included study, the following information was collected: author(s), year and

country of publication, study design, sample size, target population, risk factors explored, healthcare delivery components studied, main results, and reported mortality indicators. Two reviewers performed the extraction independently; disagreements were resolved through discussion.

2.6. Data Synthesis and Analysis

In accordance with JBI recommendations for scoping reviews [18], no formal methodological quality assessment of the studies was performed. The data underwent a structured narrative synthesis organized around major categories of risk factors. A descriptive summary table was produced to map the geographic distribution of studies, the designs used, and the most frequently documented healthcare delivery dimensions.

3. Results

3.1. Presentation of Study Selection

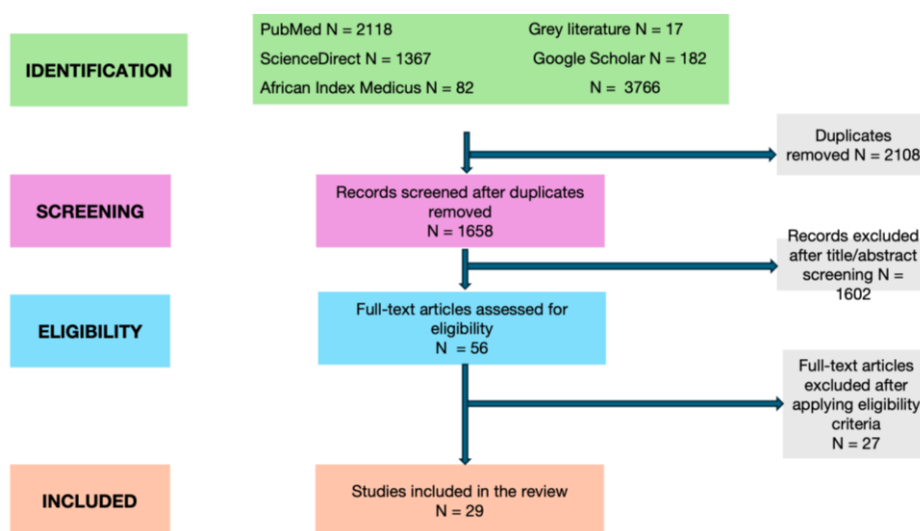


Figure 1. Flow diagram of study selection.

At the end of the PRISMA-ScR selection process, 29 documents were retained for the final synthesis. The selection includes 19 original scientific studies published in peer-reviewed journals and 10 contextual documents (institutional reports, communications, strategic and normative documents) covering more specifically the Senegalese and West African context. All of these documents cover the period 2003-2023 and provide an integrated mapping of infant and child mortality risk factors and healthcare delivery components in SSA.

3.2. Study Characteristics

The included studies show great methodological diversity. Observational designs dominate: cross-sectional studies from Demographic and Health Surveys (DHS) [19-21], prospective hospital cohorts [22, 23], case-control studies with social autopsy [24], perinatal audits using the three-delays model [25], verbal and social autopsies applied at community or national level [26-28], multi-country ecological studies [29, 30], and a hospital-community linked longitudinal study [31]. Evidence syntheses complete this set: one systematic review [32], one scoping review [12], and one exploratory review [33]. Quasi-experimental intervention evaluations [34-36] and econometric time-series analyses [37] shed light on the impact of public policies. Finally, institutional and strategic documents (government reports, WHO, UNICEF, AFD, UN) structure the normative and programmatic framework [21, 38-43].

The geographic coverage is broad: West Africa (Senegal, Mali, Burkina Faso, Nigeria, Niger, Ghana, Guinea-Bissau, Sierra Leone), East Africa (Kenya, Tanzania, Rwanda, Uganda), Southern Africa (Mozambique, Zimbabwe), and Central Africa (DRC). Reported mortality indicators include neonatal (0-28 days), post-neonatal, infant (<1 year), and under-five (<5 years) mortality, as well as, in some studies, perinatal mortality and maternal mortality as an indirect determinant of newborn survival [24, 25, 29]. Target populations include newborns, premature infants [23], children under five, and pregnant women in studies focusing on obstetric care [35] (Table 2).

3.3. Biological and Perinatal Factors

Direct causes of infant and child mortality remain dominated by infectious diseases and perinatal complications. Verbal and social autopsies conducted in Malawi [26] and Niger [28] identify malaria, acute respiratory infections, and diarrheal diseases as the main biological causes, along with neonatal sepsis and malnutrition. The hospital-community linked study from Bissau [31] confirms the predominance of malaria, ARI, and malnutrition among causes of in-hospital and community child mortality. In Inhambane (Mozambique), Källander et al. report a high proportion of deaths attributable to treatable causes (malaria, pneumonia, and diarrhea), the majority of which could have been prevented by early management [27].

Perinatal factors constitute the second major group of biological determinants. The ten-year retrospective study at Cape Coast Teaching Hospital (Ghana) shows that preterm infant survival is conditioned by gestational age, birth weight, and the occurrence of complications, with a clear gradient: the lower the gestational age, the higher the mortality [23]. The perinatal audit from Kigali (Rwanda) identifies perinatal asphyxia, prematurity, and low birth weight as major causes of perinatal death, a significant proportion of which were avoidable [25]. The CHAMPS study in Sierra Leone reports that obstetric complications and prematurity are central to the genesis of neonatal mortality [24]. Two specific determinants deserve emphasis: sickle cell disease, for which neonatal screening and early management significantly reduce mortality (demonstrated by the DRC pilot project [44]), and exclusive breastfeeding, for which the ecological analysis with multi-country meta-regression (2000-2018) shows that it is associated with a substantial reduction in under-five mortality and considerable economic gains [30].

3.4. Maternal and Obstetric Factors

Maternal and obstetric determinants occupy a central place. Maternal education level, age at childbearing, and parity are consistently associated with child survival in multi-country DHS analyses [19, 20] and in social autopsies [26, 28]. The use of antenatal care (ANC) and the quality of its content appear as protective factors: the Kigali audit highlights that inadequate ANC is associated with excess perinatal deaths [25], and the Kenya-Tanzania DHS analysis shows a socioeconomic gradient in the use of obstetric care and cesarean section, with underuse among the poorest and overuse among the richest [19].

The "three delays" model (decision, transport, care provision) helps to understand how maternal characteristics interact with healthcare delivery. The CHAMPS study shows that maternal delays contribute significantly to neonatal mortality [24]. The Rwandan audit shows that Type 1 delays (decision to seek care) and Type 3 delays (quality of care at the facility) dominate among preventable perinatal deaths [25]. In rural areas, the decision to seek care depends largely on social capital and community perceptions [27], and delayed care-seeking remains a major factor in excess mortality [27]. The ecological analysis by Alvarez et al. on maternal mortality in SSA [29] (an indirect but powerful determinant of newborn survival), confirms that the density of skilled human resources and coverage of maternal indicators (ANC, assisted delivery) are negatively associated with maternal mortality. Finally, Pretorius et al. emphasize the protective role of early-initiated exclusive breastfeeding [30].

3.5. Socioeconomic and Environmental Factors

Socioeconomic determinants are cross-cutting and powerful. Poverty, low maternal education, and rural residence are

systematically associated with increased mortality in DHS analyses [19, 20], social autopsies [26, 28], the systematic review by Rutherford et al. [32], and Senegalese contextual studies [45]. The UN CESC report documents a major inequality in Senegal: infant and child mortality stands at 63% in rural areas versus 43% in urban areas [42]. The equity analysis by Fall in Senegal shows that the free care policy increased overall healthcare utilization but paradoxically widened pro-rich inequalities in ANC and consultations [45]. The scoping review by Dadjo et al. on West Africa confirms that although health insurance improves access to maternal and child health services, coverage remains very low and unevenly distributed [12].

Environmental factors, although less systematically reported, play a confirmed role. Access to safe water, sanitation, and housing quality (WASH) are identified as determinants in the Malawi social autopsy [26] and the Rutherford systematic review [32]. Ndiaye shows that in Senegal, improved access to safe water, coupled with the availability of antimalarials, explains a substantial part of the decline in under-five mortality between 1980 and 2015, whereas free care alone proved insufficient to transform this indicator in the short term [37]. Social capital and community support networks also appear as modulating factors in the care-seeking pathway [27].

3.6. Contribution of Healthcare Delivery

3.6.1. Geographic and Organizational Accessibility, and Continuity of Care

Geographic and organizational accessibility of healthcare delivery is a primary structural determinant. Multivariate DHS analyses show that distance to facilities, transport availability, and shortage of qualified personnel are associated with excess under-five mortality [20]. The systematic review by Rutherford et al. concludes there is a robust and recurrent association between access barriers (geographic and financial) and under-five mortality in SSA [32]. Social autopsies confirm this relationship in Niger [28] and Malawi [26].

The continuum of care around hospitalization appears fragile. In Bissau, despite hospitalizations, community mortality remains high: many children die at home without reaching the hospital, and those who are discharged have excess post-hospitalization mortality [31]. In Harare, Mujuru et al. report that the majority of in-hospital deaths occur within 24 hours of admission, with very significant pre-admission delays [22]. The mobilization of community health workers (CHWs) in Mozambique improves care-seeking, but their coverage remains partial and financial barriers persist [27]. The three-delays model, applied in Rwanda [25] and Sierra Leone [24], demonstrates that the quality of facility-based care (3rd delay) is as critical as the decision or transport delay.

3.6.2. Healthcare Financing and Free Care/Exemption Policies

Financial barriers constitute a major and recurring obstacle

to access to pediatric care. DHS analyses [19, 20], social autopsies [26, 28], the systematic review [32], and the Bissau community study [31] all converge in identifying the cost of care (direct fees, informal payments, indirect costs) as a factor in excess mortality.

Free care and exemption policies aimed at removing these barriers have been extensively evaluated in SSA. The exploratory review by Ridde and Morestin, on fee abolition in Africa, reports a substantial increase in healthcare utilization and a documented reduction in child morbidity and mortality, particularly in Sahelian countries [33]. The quasi-experimental evaluation by Ridde, Haddad, and Heinmüller in Burkina Faso demonstrates that removing user fees for children improves equity in access to care [36]. Druetz's thesis on Burkina Faso estimates that free care combined with quality improvement could have saved between 14,000 and 19,000 child lives, although morbidity did not improve significantly [34]. In Mali and Senegal, exemption from cesarean section fees is associated with increased use of obstetric procedures, with expected benefits for neonatal survival [35].

In Senegal, the policy arsenal combines free care for children aged 0-5 years launched in October 2013 [38], the national neonatal mortality reduction plan [40], the strengthening of Universal Health Coverage (UHC) [41], and financial support from donors [43]. Available evaluations paint a mixed picture. BEPP documents increased healthcare utilization following the implementation of free care policies, while identifying residual non-financial barriers [39]. DHS-Continuing 2017-2018 confirms a downward trend in infant and child mortality indicators post-2013 [21]. Ndiaye's econometric analysis over the period 1980-2015 concludes that high-impact interventions – distribution of antimalarials and improved access to safe water – are the main factors associated with the decline in under-five mortality, with free care alone proving insufficient [37]. Pouye reports mixed effects of free care on child malnutrition [46], while Fall highlights that the policy, although globally positive for utilization, has increased pro-rich inequalities in ANC and consultations [45]. The UN CESC emphasizes that the effectiveness of free care must be strengthened, particularly in rural areas where infant and child mortality inequalities persist [42]. Finally, the scoping review by Dadjo et al. on West Africa shows that health insurance and exemptions increase access to maternal and child health services, but that coverage remains very low at the regional level [12], a finding confirmed by the WHO-Senegal UHC strategic framework 2024-2028 [41].

In summary, the available evidence converges on a triple observation:

- (i) Financial barriers remain a robust determinant of infant and child mortality in SSA;
- (ii) Free care and exemption policies improve healthcare utilization and save lives when supported by parallel quality improvement;
- (iii) Their impact on mortality is modulated by the persistence of non-financial barriers (distance, quality, socioeco-

conomic and environmental inequalities) and by the risk of paradoxically increasing pro-rich inequalities in the absence of targeted measures.

Table 2. Characteristics of included studies.

N°	First author	Year	Ref	Study design	N	Target age group
1	Ridde V, Haddad S, Heinmüller R	2013	[36]	Scientific article (quasi-experimental)	Burkina Faso	<5 years
2	Pouye R	2023	[46]	Conference communication (quantitative analysis)	Senegalese data	<5 years
3	Ndiaye M	2023	[37]	Econometric analysis (time series 1980-2015)	Aggregated Senegal data	0-5 years
4	Fall M	2023	[45]	Quantitative analysis (inequality decomposition)	Household surveys (Senegal)	<5 years
5	Republic of Senegal/WHO	2018	[40]	National action plan	National coverage	Neonatal
6	UNICEF Senegal	2013	[38]	Institutional report	≈2.5 million children <5 years (target population)	0-5 years
7	Druetz T	2015	[34]	PhD thesis (intervention pre-post)	Burkina Faso population	<5 years
8	BEPP	2011	[39]	Government evaluation report	Prior national coverage	0-5 years + pregnant women
9	UN CESC	2019	[42]	UN report (concluding observations)	National (Senegal)	<5 years
10	Johri M	2014	[35]	Scientific article (quasi-experimental)	Mali & Senegal populations	Pregnant women + newborns
11	ANSD	2018	[21]	National survey (DHS-Continuing 2017-2018)	National sample 2017-18	<5 years
12	Alvarez JL	2009	[29]	Ecological study (SSA countries)	SSA countries (aggregated analysis)	Women of childbearing age (maternal mortality)
13	Källander K	2019	[27]	Mixed study (caregiver interviews, autopsy)	Caregivers of deceased children <5 in 2015 (Inhambane)	<5 years
14	Agbeno EK	2021	[23]	Retrospective hospital study (10 years)	Preterm infants in SCBU (Cape Coast)	Preterm infants
15	Mujuru HA	2012	[22]	Prospective hospital cohort	Admitted patients (pediatric unit, Harare)	Children (not strictly specified in abstract)
16	Tshilolo L	2008	[44]	Narrative/systematic review (pilot programs)	Pilot screening programs (DRC + SSA)	Neonatal
17	Pretorius CE	2021	[30]	Ecological analysis + meta-regression (2000-2018)	SSA countries (World Bank)	<5 years
18	Adedini SA	2014	[20]	Multivariate DHS analysis 2008 Nigeria	NAHS 2008 – children <5 years	<5 years

N°	First author	Year	Ref	Study design	N	Target age group
19	Koffi AK	2017	[26]	Verbal and social autopsy (retrospective)	Deaths <5 years (3 districts, 2007–2010)	<5 years
20	Koffi AK	2016	[28]	Verbal and social autopsy (national)	Deaths <5 years (Niger national sample 2012)	<5 years
21	Veirum JE	2007	[31]	Longitudinal hospital-community linked study (DSS linkage)	6 years of hospital data + community cohort	<5 years
22	Rutherford ME	2010	[32]	Systematic review	Studies included in SSA (not specified in abstract)	<5 years
23	WHO	2024	[41]	Strategic document (CCS WHO-Senegal)	National	NA
24	Preslar JP	2021	[24]	Case-control (social autopsy – CHAMPS)	Cases (neonatal deaths) + controls (survivors), CHAMPS site	Newborns (0–28 d)
25	Musafili A	2017	[25]	Hospital perinatal audit (3-delays model)	Perinatal deaths (2 Kigali hospitals, Jul 2012–May 2013)	Perinatal (22 weeks–7 d)
26	Dadjo J	2023	[12]	Scoping review (PRISMA-ScR)	Included studies in West Africa	Mother-child
27	Ochieng Arunda M	2020	[19]	Cross-sectional DHS analysis (logistic regression)	DHS Kenya & Tanzania (live births)	Newborns
28	Ridde V, Morestin F	2011	[33]	Exploratory literature review	African studies on fee abolition	General population (focus mother-child)
29	AFD	2013	[43]	Program document (donor)	4 Sahelian countries (including Senegal)	<5 years

N°	Biological & perinatal factors	Maternal factors	Socioeconomic factors	Environmental factors	Healthcare delivery: Accessibility	Healthcare delivery: Financing & costs	Mortality Indicator
1	NA	NA	Equity	NA	Healthcare utilization	User fee removal for children	Equity of access (mortality proxy)
2	Malnutrition	NA	Inequalities	NA	Healthcare utilization	Free care policies	Malnutrition/morbidity (intermediate outcome)
3	NA	NA	NA	Safe water (exposure)	NA	Free care policy	Under-5 mortality
4	NA	NA	Social inequalities in healthcare utilization	NA	Healthcare utilization (ANC, consultations)	Exemption/free care policy	Healthcare utilization (mortality proxy)
5	NA	NA	NA	NA	Neonatal mortality reduction strategies	Includes free care	Neonatal mortality (programmatic target)

Nº	Biological & perinatal factors	Maternal factors	Socioeconomic factors	Environmental factors	Healthcare delivery: Accessibility	Healthcare delivery: Financing & costs	Mortality Indicator
6	NA	NA	National coverage	NA	Free care package: consultation, vaccination, hospitalization	Free care – launch Oct. 2013	Objective: reduce under-5 mortality (programmatic target)
7	Child morbidity, stunting	NA	NA	NA	Healthcare utilization	Free care + quality improvement	Infant and child mortality (estimated lives saved)
8	NA	Pregnant women	Poverty	NA	Documented increased utilization	Free care – impact evaluation	MDGs, poverty, utilization
9	NA	NA	Urban-rural inequalities	NA	Effectiveness of free care; inequalities	Free care	Rural IM 63% vs urban IM 43%
10	NA	Delivery (cesarean)	NA	NA	Obstetric service utilization	Cesarean section fee exemption	Cesarean utilization (neonatal survival proxy)
11	NA	NA	NA	NA	NA	Post-2013 free care data	Infant and child mortality (intermediate values)
12	NA	Maternal indicators (ANC, assisted delivery)	GDP, health spending	NA	Human resources, facility density	Health spending (% of GDP)	Maternal mortality (outcome)
13	Treatable causes (malaria, pneumonia, diarrhea)	Delayed care-seeking, social capital	Social capital, poverty	NA	CHWs – coverage and use	Costs related to care; financial barriers	Under-5 mortality
14	Gestational age, birth weight, complications	ANC, complications	NA	NA	SCBU (Cape Coast Teaching Hospital)	Costs of neonatal care (implicit)	Preterm survival / neonatal mortality
15	Illness duration, severity at admission	Care-seeking behavior	NA	NA	Delay in care-seeking and care provision	Cost mentioned as barrier to early care-seeking	In-hospital mortality <24h
16	Sickle cell disease (exposure)	NA	Poverty	NA	Neonatal screening and clinical follow-up	Cost and resources for screening	Sickle cell mortality/morbidity
17	Exclusive breastfeeding (EBF)	Breastfeeding, nutrition	Poverty, GDP	NA	NA	Economic cost (secondary outcome)	Under-5 mortality + economic cost
18	NA	Education, maternal age	Income, residence	NA	Distance, transport, staff shortage	Cost of care, prohibitive fees	Under-5 mortality
19	Pneumonia, diarrhea, malaria (biological causes)	Education, care-seeking behavior	Poverty, residence	WASH, housing	Distance, transport	Cost of care, household financing	Under-5 mortality
20	Malaria, pneumonia, diarrhea	Care-seeking, education	Poverty, residence	NA	Distance, availability	Cost of care, financing	Under-5 mortality

N°	Biological & perinatal factors	Maternal factors	Socioeconomic factors	Environmental factors	Healthcare delivery: Accessibility	Healthcare delivery: Financing & costs	Mortality Indicator
21	Hospital causes (malaria, ARI, malnutrition)	NA	Urban residence (Bissau)	NA	Pediatric hospitalization rate; hospital coverage	Cost of care mentioned as barrier	Community mortality + in-hospital under-5 mortality
22	Various (synthesis)	Various	Poverty, education	WASH, housing	Distance, availability, quality	Cost of care (re-current barrier)	Under-5 mortality
23	NA	NA	NA	NA	UHC (strengthening)	UHC	NA
24	Obstetric complications, prematurity	Maternal delays (decision/transport/care – 3 delays)	Low maternal education, poverty (barrier)	NA	Delays in access to maternal care (3 delays)	Financial barriers to care access	Neonatal mortality
25	Perinatal asphyxia, prematurity, low birth weight	Inadequate ANC, obstetric complications, parity	Poverty, maternal education	NA	Delays 1/2/3 (care-seeking, transport, care); quality of care	Financial barriers (OOP) cited in all 3 delays	Perinatal mortality
26	NA	Maternal service utilization	Insurance status, poverty	NA	Mother-child service coverage	Health insurance/UHC, fee exemption	Access to mother-child care (intermediate outcome)
27	Delivery mode (cesarean)	Maternal age, parity, ANC	Wealth index, education, residence	NA	Obstetric care utilization; access to cesarean	Health insurance/UHC; OOP	Neonatal mortality
28	NA	NA	Poverty	NA	Healthcare utilization	User fee abolition	Utilization + infant morbidity/mortality
29	NA	NA	NA	NA	Financial access to care	EUR 8M (I3S); CFAF 1.8B Senegal 2013	Access to care for <5 years (target)

NA: NON AVAILABLE

4. Discussion

Based on 29 documents published between 2003 and 2023, this scoping review mapped the risk factors for infant and child mortality and the components of healthcare delivery in Sub-Saharan Africa, with a particular focus on Senegal. Four major groups of determinants emerge: biological and perinatal factors, maternal and obstetric factors, socioeconomic and environmental determinants, and healthcare delivery, considered in its dual dimensions of organizational accessibility and financing. Comparison with the existing literature.

Our results are broadly consistent with the international body of literature on the social determinants of child health. The convergence between social autopsies [26-28], hospital audits [22, 25], DHS analyses [19, 20], and evidence synthe-

ses [12, 32, 33] reinforces the robustness of the reported associations. Three points nevertheless deserve particular attention.

First, the financial dimension of healthcare access is systematically documented, both in community studies [26-28, 31] and in population-based analyses [12, 19, 20] and reviews [32, 33]. This convergence justifies the priority given to financial protection through free care policies, exemptions, and universal health coverage [36, 38, 41]. However, intervention evaluations conducted in Burkina Faso [34-36] and the Senegalese econometric analysis [37] show that free care alone is a necessary but insufficient lever: its effect on mortality depends on a concurrent improvement in care quality and the removal of non-financial barriers.

Second, the issue of equity appears central. Inequality analyses in Senegal [45] and UN CESCRO observations [42] show that universal free care policies can paradoxically widen pro-rich inequalities in healthcare utilization when non-financial

barriers (distance, perceived quality, social capital) persist. This phenomenon, also found by Ochieng Arunda et al. in Kenya and Tanzania for cesarean sections [19] and by Dadjo et al. at the West African level [12], argues for policies that actively target disadvantaged households and territories, rather than uniform free care. This approach aligns with the broader literature on progressive universal health coverage.

Third, the role of non-medical structural factors in reducing infant and child mortality deserves emphasis. Ndiaye's Senegalese time series analysis [37] identifies access to safe water and the availability of antimalarials as the main drivers of the decline observed between 1980 and 2015. This finding supports multisectoral approaches linking health, water, sanitation and hygiene, nutrition [30], and social protection [43].

4.1. Implications for Senegal and Francophone West Africa

From a programmatic perspective, the assessment of the free care policy launched in 2013 [38] and the National Neonatal Mortality Reduction Plan [40] call for strengthening the quality and equity components, beyond the financial dimension alone. The findings from BEPP [39], ANSD [21], and the UN CESC report [42] converge in highlighting the persistence of an urban-rural gradient (63% vs 43%), which calls for differentiated territorial coverage strategies.

From a strategic standpoint, the implementation of the WHO-Senegal Cooperation Strategy 2024-2028 [41] and the support from donors such as AFD [43] offer a window of opportunity to reorient investment toward high-impact interventions for mortality reduction: quality emergency obstetric and neonatal care, neonatal screening for sickle cell disease [44], promotion of exclusive breastfeeding [30], strengthening of community health workers and task shifting for integrated management of childhood illnesses, and consolidation of UHC financing within a progressive and equitable framework [12, 41, 45].

On the research front, several gaps remain to be filled: impact evaluations of free care that go beyond healthcare utilization, i.e., focusing on mortality and morbidity, using robust quasi-experimental designs [34, 37]; qualitative studies on care-seeking pathways in rural Senegal, following the three-delays framework [24, 25]; action research on the equity of UHC coverage and its articulation with mandatory health insurance [12, 45]; and production of local data on causes of neonatal death using CHAMPS-type social autopsies [24, 27, 28].

4.2. Strengths and Limitations

This study has several strengths. The rigorous application of the PRISMA-ScR methodology, followed by the structured retention of 29 documents, ensures both scientific and programmatic coverage of the field. The diversity of included

study designs facilitates triangulation of results. The systematic integration of Senegalese contextual documents anchors the discussion in the national reality.

Several limitations must nevertheless be acknowledged. First, a scoping review neither aims to formally assess the methodological quality of included studies nor to produce pooled effect estimates; the comparison of association magnitudes therefore remains descriptive. Second, the heterogeneity of study designs, populations, and mortality indicators limits quantitative synthesis. The inclusion of programmatic and institutional documents [38-43], while relevant to the context, adds additional heterogeneity that must be considered in interpretation. Finally, the restriction to publications in French and English indexed in the searched databases may have excluded relevant work published in other languages; a selection bias cannot therefore be completely ruled out.

5. Conclusion

This scoping review confirms the multifactorial and socially structured nature of infant and child mortality in Sub-Saharan Africa. Four groups of determinants interact: biological and perinatal factors, maternal and obstetric factors, socioeconomic and environmental determinants, and components of healthcare delivery. In Senegal, the free care policies and universal health coverage implemented since 2013 have led to a documented increase in healthcare utilization. However, their effect on infant and child mortality remains limited as long as they are not accompanied by improvements in care quality, action on socio-environmental determinants, and an explicit strategy for territorial and social equity. Rigorous impact evaluations are needed to guide future reforms.

Abbreviations

SSA	Sub-Saharan Africa
WHO	World Health Organization
PCC	Population, Concept, Context (Methodological Framework)
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (Guidelines for Scoping Reviews)
JBI	Joanna Briggs Institute (Evidence-based Healthcare Research Institute)
CI	Confidence Interval
MeSH	Medical Subject Headings (Controlled Vocabulary for Indexing Biomedical Articles)
AND/OR	Boolean Operators for Database Searches

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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