

Statistical Methods and Methodological Quality in Health Research in Somalia: A Review of Current Practices, Gaps, and Opportunities

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Abstract

Background

The quality and policy relevance of health research depend fundamentally on the rigor of study designs, sampling frameworks, statistical analyses, and transparent reporting practices. Although Somalia has an expanding body of health literature covering clinical care, maternal and child health, infectious diseases, and health systems, the methodological quality and reporting practices across this evidence base have not been systematically evaluated.

Methods

A methodological review was conducted using an assembled literature set identified through Google Scholar using the search phrase “Health of Somalia” on August 15, 2026. Of the 49 initial records identified, 8 non-Somalia-based studies and 1 duplicate were excluded, leaving 40 articles for synthesis. Data were extracted on study design, sampling procedures, sample size, analytical techniques, statistical reporting, software packages, geographic coverage, and methodological gaps. Findings were synthesized descriptively using frequencies and percentages. Methodological quality was evaluated based on reported practices rather than a single aggregated quality score.

Results

Cross-sectional designs predominated, accounting for 14 of the 40 studies (35.0%), followed by qualitative studies (6, 15.0%), secondary data analyses (4, 10.0%), and retrospective descriptive studies (4, 10.0%). Descriptive statistics were reported in 23 studies (57.5%), logistic regression in 11 (27.5%), and chi-square tests in 9 (22.5%). While 15 studies (37.5%) reported 95% confidence intervals, no study explicitly reported a standardized effect-size measure as a distinct reporting element. Only three studies reported assumption testing, and systematic reporting of sensitivity analyses or comprehensive missing-data handling was absent. SPSS was the most frequently utilized statistical software (15, 37.5%). Geographically, Mogadishu/Banadir represented the most frequently studied setting (18, 45.0%).

Conclusions

While health research in Somalia is active and growing, methodological and reporting practices remain uneven across studies. The credibility, interpretability, and practical utility of future research would be substantially strengthened by the greater adoption of prospective designs, probability sampling, multivariable and multilevel modeling, explicit reporting of effect estimates with measures of precision, routine model diagnostics, and transparent handling of missing data.

1. BACKGROUND

Health research provides an essential foundation for understanding disease burden, evaluating clinical interventions, identifying social and structural determinants of health, and guiding evidence-based policy. However, the validity and generalizability of research findings depend not only on the volume of published evidence, but also on the appropriateness of study designs, sampling frameworks, analytical methods, and reporting fidelity.

Somalia has a rapidly expanding body of health literature addressing maternal and newborn health, child survival, infectious diseases, nutrition, mental health, non-communicable diseases, and health systems governance [1–10]. The literature encompasses facility-based studies, community surveys, assessments within internally displaced person (IDP) settlements, and secondary analyses of national datasets. Qualitative and mixed-methods research has also grown, particularly regarding health system barriers, service utilization, vaccination uptake, and research capacity [3, 6, 10, 14, 15, 17].

Despite this growth, methodological approaches vary widely across published studies, ranging from cross-sectional and retrospective designs to qualitative inquiries, secondary data analyses, prospective cohorts, and cluster-randomized controlled trials [1–40]. While this diversity reflects the varied questions being investigated, it underscores the need for a systematic evaluation of how statistical methods and methodological standards are being applied and reported.

Statistical methods dictate how quantitative data are summarized, how associations are estimated, and how uncertainty is quantified and communicated. Published studies in Somalia have employed a wide spectrum of techniques, including basic descriptive statistics, chi-square tests, multivariable logistic regression, multilevel modeling, analysis of variance (ANOVA), spatial statistics, and thematic analysis [5, 7, 22, 25, 29, 32, 37]. Selected studies demonstrate advanced methods tailored to complex data structures; for instance, a cluster-randomized trial utilized mixed-effects regression, survival analysis, difference-in-difference estimates, intention-to-treat protocols, and multiplicity corrections [7]. Similarly, spatial studies have incorporated Moran's I, Getis-Ord G_i^* , and kriging techniques [32].

However, broader literature trends indicate significant variability in reporting rigor. Basic descriptive statistics remain far more common than advanced analytical modeling. While p-values and confidence intervals are reported in several studies, explicit reporting of standardized effect sizes, sensitivity analyses, model diagnostics, and missing-data procedures remains sparse. Reliance on p-values alone fails to convey the magnitude or practical importance of observed associations, whereas unverified model assumptions and unreported missing-data procedures can compromise internal validity.

Sampling frameworks and geographic representation also condition the interpretation of health research. Published studies range from probability-based national survey analyses to convenience, purposive, and facility-based sampling schemes. Furthermore, research activity is geographically concentrated in Mogadishu/Banadir (18 of 40 studies, 45.0%), leaving rural, nomadic, and remote populations relatively underrepresented.

While individual papers often note specific study limitations, a cross-study methodological assessment provides a system-wide view of recurring strengths and systemic reporting gaps. Therefore, this review aimed to systematically evaluate statistical methods and methodological quality in health research conducted in Somalia, identifying current practices, recurrent methodological gaps, and practical opportunities to strengthen future health research.

2. METHODS

2.1 Review Design

This study employed a methodological review design to examine statistical and reporting practices in published health research conducted in Somalia. The unit of analysis was the published article rather than individual human participants or raw primary data. Methodological characteristics were systematically extracted across key domains, including study design, sampling strategy, sample size, analytical techniques, statistical reporting, software packages, geographic focus, and acknowledged study limitations.

2.2 Information Source and Search Strategy

The study set was identified through Google Scholar on August 15, 2026, using the search term “Health of Somalia”. The search yielded an initial set of 49 published records.

2.3 Eligibility Criteria and Selection

From the 49 records, 8 were excluded because they were not based on Somalia or Somali populations, and 1 duplicate record was removed, leaving 40 articles for full methodological evaluation. This process represents a documented literature selection process rather than a full PRISMA 2020 systematic review, as a multi-database search history and comprehensive screening log were not compiled.

Articles were retained if they presented empirical health research or structural analyses focused on Somalia or Somali populations. The final sample included primary quantitative studies, qualitative inquiries, mixed-methods designs, secondary data analyses, a study protocol, systematic and narrative reviews, commentaries, and policy-oriented preprints. This inclusive approach was adopted to capture the broader methodological landscape of Somali health literature.

2.4 Data Extraction

Data were extracted into a standardized matrix capturing: publication year, primary study design, sampling methodology, sample size, statistical tests, reporting of uncertainty (confidence intervals, p-values), software packages, geographic setting, health domain, main conclusions, and reported methodological limitations.

2.5 Data Synthesis

Findings were synthesized descriptively using frequencies and percentages, using 40 as the general denominator unless otherwise indicated. Statistical methods and software tools were analyzed as non-mutually exclusive counts, as individual articles frequently employed multiple analytical techniques. Similarly, geographic categories were treated as overlapping where studies covered urban, regional, and IDP populations concurrently.

2.6 Methodological Assessment Framework

Methodological quality was evaluated through comparative assessment of reported practices rather than an aggregated numerical quality score. Evaluation criteria included study design appropriateness, sampling adequacy, analytical rigor, quantification of uncertainty, model diagnostics, missing-data handling, sensitivity analysis, and geographic representativeness.

2.7 Operational Definitions

- Effect-Size Reporting: Explicit quantification of the magnitude of an effect (e.g., Cohen's d , standardized regression coefficients) as a distinct reporting element, beyond binary significance testing.
- Confidence Interval Reporting: Explicit presentation of interval estimates, predominantly 95% CIs.
- Assumption Testing: Documented verification of statistical model assumptions (e.g., normality, homoscedasticity, absence of multicollinearity, proportional hazards).
- Missing-Data Handling: Explicit description and statistical treatment of incomplete records (e.g., multiple imputation, sensitivity testing, complete-case analysis specification).
- Sensitivity Analysis: Secondary analyses evaluating the robustness of findings to alternative definitions, analytical models, or sample inclusions.

3. RESULTS

3.1 Overall Methodological Profile

The synthesized dataset comprised 40 health research articles spanning clinical medicine, public health, maternal and child health, infectious diseases, nutrition, mental health, and health system governance.

Observational cross-sectional studies constituted the single largest design category, descriptive statistics predominated analytical approaches, and Mogadishu/Banadir represented the primary geographic focus. The distribution of study designs across the included articles is presented in Table 1.

Table 1
Distribution of study designs among the included
articles (N = 40)

Study Design	n	%
Cross-sectional	14	35.0
Qualitative	6	15.0
Secondary data analysis	4	10.0
Retrospective descriptive	4	10.0
Mixed-methods	3	7.5
Narrative review	2	5.0
Case-control	1	2.5
Cluster-randomized controlled trial	1	2.5
Prospective cohort	1	2.5
Systematic review	1	2.5
Study protocol	1	2.5
Short report / Policy analysis	1	2.5
Editorial / Commentary	1	2.5
Commentary / Perspective	1	2.5
Total	40	100.0

Table 1. Cross-sectional studies accounted for 14 of the 40 articles (35.0%). Qualitative studies comprised 6 articles (15.0%), while secondary data analyses and retrospective descriptive studies each accounted for 4 (10.0%). Only one prospective cohort study and one cluster-randomized trial were identified.

3.2 Sampling Strategies

Purposive sampling was the single most frequently reported approach (8/40, 20.0%), followed by multistage stratified cluster probability sampling (6/40, 15.0%), convenience sampling (5/40, 12.5%), and facility-based consecutive sampling (4/40, 10.0%). Among the 38 studies where sampling was applicable, non-probability sampling was used in 18 studies (47.4%), particularly within facility-based and qualitative research. National health survey analyses provided the primary examples of probability sampling frameworks.

3.3 Statistical Methods Used

Descriptive statistics were presented in 23 studies (57.5%). Among inferential methods, multivariable logistic regression was utilized in 11 studies (27.5%), chi-square tests in 9 (22.5%), and multilevel modeling in 3 (7.5%). Qualitative thematic analysis was performed in 12 studies (30.0%). Statistical and methodological reporting practices across the included studies are summarized in Table 2.

Table 2
Statistical and methodological reporting practices
across included studies (N = 40)

Reporting or Analytical Element	n	%
Descriptive statistics	23	57.5
Qualitative thematic analysis	12	30.0
Logistic regression	11	27.5
Chi-square test	9	22.5
Mean $\pm$ Standard Deviation (SD)	8	20.0
Cronbach's alpha	5	12.5
ANOVA	5	12.5
Mann-Whitney U test	4	10.0
Multilevel modeling	3	7.5
Multiple linear regression	3	7.5
Pearson correlation	2	5.0
Spatial analysis	1	2.5
95% Confidence Intervals (CIs)	15	37.5
p-values	17	42.5
Adjusted Odds Ratios (aORs)	10	25.0
Explicit standardized effect sizes	0	0.0
Model assumption testing	3	7.5
Systematic sensitivity analysis	0	0.0
Comprehensive missing-data handling	0	0.0

Table 2. Advanced analytical approaches were present in specialized studies. The cluster-randomized trial incorporated mixed-effects regression, survival analysis, difference-in-difference modeling, intention-to-treat protocols, and multiplicity adjustments [7]. Spatial studies employed multilevel mixed-effects logistic regression alongside spatial autocorrelation metrics [32].

3.4 Statistical Reporting Practices

Reporting focused heavily on basic point estimates rather than measures of uncertainty or model robustness. Frequencies and percentages were reported in 23 studies (57.5%), p-values in 17 (42.5%), and 95% confidence intervals in 15 (37.5%). Adjusted odds ratios were presented in 10 studies (25.0%), and unadjusted odds ratios in 5 (12.5%).

No study explicitly presented standardized effect-size measures as a distinct reporting element. Model assumption testing was reported in only 3 studies (7.5%). Systematic sensitivity analyses and structured missing-data procedures were entirely absent from the reported methodologies.

3.5 Software Packages

SPSS was the predominant software package, used in 15 studies (37.5%), followed by STATA (7, 17.5%) and NVivo (6, 15.0%). Seven studies (17.5%) did not specify the analytical software used.

3.6 Geographic Focus

Mogadishu/Banadir represented the largest single geographic concentration (18, 45.0%), followed by multi-regional or national studies (6, 15.0%) and Somaliland (5, 12.5%). IDP settings were evaluated in 3 studies (7.5%), and Puntland/Bosaso in 2 (5.0%). Overall, 18 studies focused on urban settings, 6 on rural communities, and 4 included nomadic populations.

3.7 Major Methodological Gaps

The primary methodological gaps identified across the literature set included the heavy reliance on cross-sectional designs, geographic imbalance favoring urban centers, underutilization of inferential diagnostics, and incomplete reporting of uncertainty and missing data. These gaps are summarized in Table 3.

Table 3
Major methodological and reporting gaps identified across the literature (N = 40)

Methodological Gap	Frequency	%
Over-reliance on cross-sectional / limited prospective designs	31/40	77.5
Geographic coverage imbalance (urban bias)	29/40	72.5
Limited or basic statistical modeling	27/40	67.5
Absence of explicit standardized effect-size reporting	40/40	100.0
Absence of systematic sensitivity analysis	40/40	100.0
Absence of comprehensive missing-data procedures	40/40	100.0
Incomplete or absent model diagnostics/assumption testing	37/40	92.5
Limited inferential reporting	25/40	62.5
Use of non-probability sampling (where applicable)	18/38	47.4
Unaddressed recall or reporting bias	25/40	62.5

Table 3. These findings reflect reporting omissions within published manuscripts and should not be interpreted as absolute proof that underlying analytical steps were completely omitted during trial execution.

4. DISCUSSION

This review demonstrates that while health research in Somalia encompasses a wide range of topics and analytical approaches, published literature remains methodologically uneven. Cross-sectional designs predominate, representing 35.0% of all published studies. While cross-sectional frameworks are efficient for establishing baseline disease prevalence and resource allocation priorities, their observational nature precludes causal inference. The presence of longitudinal designs—such as the prospective cohort study by Barut and Mohamud [26] and the cluster-randomized trial by Grijalva-Eternod et al. [7]—demonstrates the feasibility of conducting robust, temporally ordered health research in Somalia.

Sampling rigor represents another key area for enhancement. Nearly half of the studies where sampling was applicable relied on non-probability convenience or purposive methods. While appropriate for exploratory qualitative research or specialized clinical cases, non-probability sampling limits external validity and introduces selection bias. Conversely, studies leveraging national survey datasets demonstrate how probability-based cluster sampling can support representative population inferences when appropriate sampling weights and design effects are accounted for [28, 29, 32].

Statistical analysis quality depends on model specification and diagnostic validation, not merely software execution. Multivariable regression models were used in over a quarter of the studies, yet explicit verification of underlying statistical assumptions (e.g., linearity, multicollinearity, residual normality) was reported in only 7.5% of papers. Unverified model assumptions leave published estimates vulnerable to residual confounding or misspecification bias.

Reporting practices regarding statistical uncertainty also require standardized improvement. While p-values were reported in 42.5% of studies and confidence intervals in 37.5%, explicit standardized effect sizes were absent as distinct reporting features. Relying solely on p-values conflates sample size with effect magnitude, whereas presenting effect estimates alongside interval precision allows readers to assess clinical and policy significance. Furthermore, the total absence of reported missing-data procedures and sensitivity analyses across the reviewed sample reduces transparency regarding estimate stability.

Geographically, research activity remains heavily concentrated in Mogadishu/Banadir (45.0%), driven by the density of academic institutions, referral hospitals, and international agencies in the capital. However, health profiles, environmental exposures, and service access vary markedly across rural, pastoralist, and nomadic populations. Expanding research coverage to underrepresented rural and nomadic settings is critical for building an inclusive national evidence base.

5. RECOMMENDATIONS FOR STRENGTHENING RESEARCH

- 1. Expand Prospective and Longitudinal Frameworks:** Increase the adoption of prospective cohort and longitudinal designs to investigate temporal relationships, disease incidence, and long-term health outcomes.
- 2. Enhance Sampling Rigor and Geographic Scope:** Utilize probability sampling frameworks whenever population-level inferences are intended, incorporating explicit stratification for rural, nomadic, and displaced communities.
- 3. Adopt Appropriate Multivariable and Multilevel Modeling:** Apply analytical techniques that match data structures, such as hierarchical multilevel modeling for nested survey data or mixed-effects models for longitudinal clusters.
- 4. Standardize Inferential Reporting:** Report point estimates alongside 95% confidence intervals and effect magnitudes, avoiding total reliance on binary p-value thresholds.
- 5. Implement Model Diagnostics and Sensitivity Analyses:** Routinely report diagnostic checks (e.g., multicollinearity, residual diagnostics, goodness-of-fit) and perform sensitivity analyses to test parameter robustness.
- 6. Transparently Document Missing Data:** Explicitly state missing data proportions and describe statistical handling methods (e.g., multiple imputation or complete-case specifications).

7. Build Institutional Analytical Capacity: Strengthen institutional training in study design, biostatistics, reproducible programming (e.g., R, STATA), and adherence to international reporting guidelines (e.g., STROBE, CONSORT).

6. LIMITATIONS

This review has several limitations. First, the study set was assembled using Google Scholar rather than a full multi-database systematic search log, and thus represents a documented methodological review rather than a formal PRISMA systematic review. Second, the included studies varied widely in design and objectives, meaning that certain statistical reporting indicators were not applicable to all papers. Third, evaluation was limited to reported practices within published texts; unreported analytical steps could not be evaluated. Finally, geographic and analytical categories were non-mutually exclusive, requiring cautious interpretation of aggregated frequencies.

7. CONCLUSIONS

This methodological review indicates that health research in Somalia is vibrant and growing, yet methodologically heterogeneous. Observational cross-sectional studies, facility-based convenience sampling, and descriptive statistics dominate the current literature. Nevertheless, high-quality prospective studies, cluster-randomized trials, and spatial multilevel analyses demonstrate that advanced research methodology is fully feasible in this setting. Future health research in Somalia will benefit from broader adoption of longitudinal designs, representative probability sampling, rigorous model diagnostics, transparent reporting of uncertainty, and geographic diversification beyond major urban centers.

Declarations

Ethics Approval and Consent to Participate

Not applicable. Ethical approval was not required for this methodological review as it involved secondary analysis of previously published literature and did not involve primary human subject data.

Consent for Publication

Not applicable.

Availability of Data and Materials

The extraction dataset supporting the conclusions of this article is included within the supplementary information files.

Competing Interests

The authors declare that they have no competing interests.

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Clinical Trial Number

Not applicable.

Authors' Contributions

All authors contributed to study conceptualization, methodology design, data extraction, statistical synthesis, manuscript drafting, and critical revision. All authors read and approved the final manuscript.

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Figures

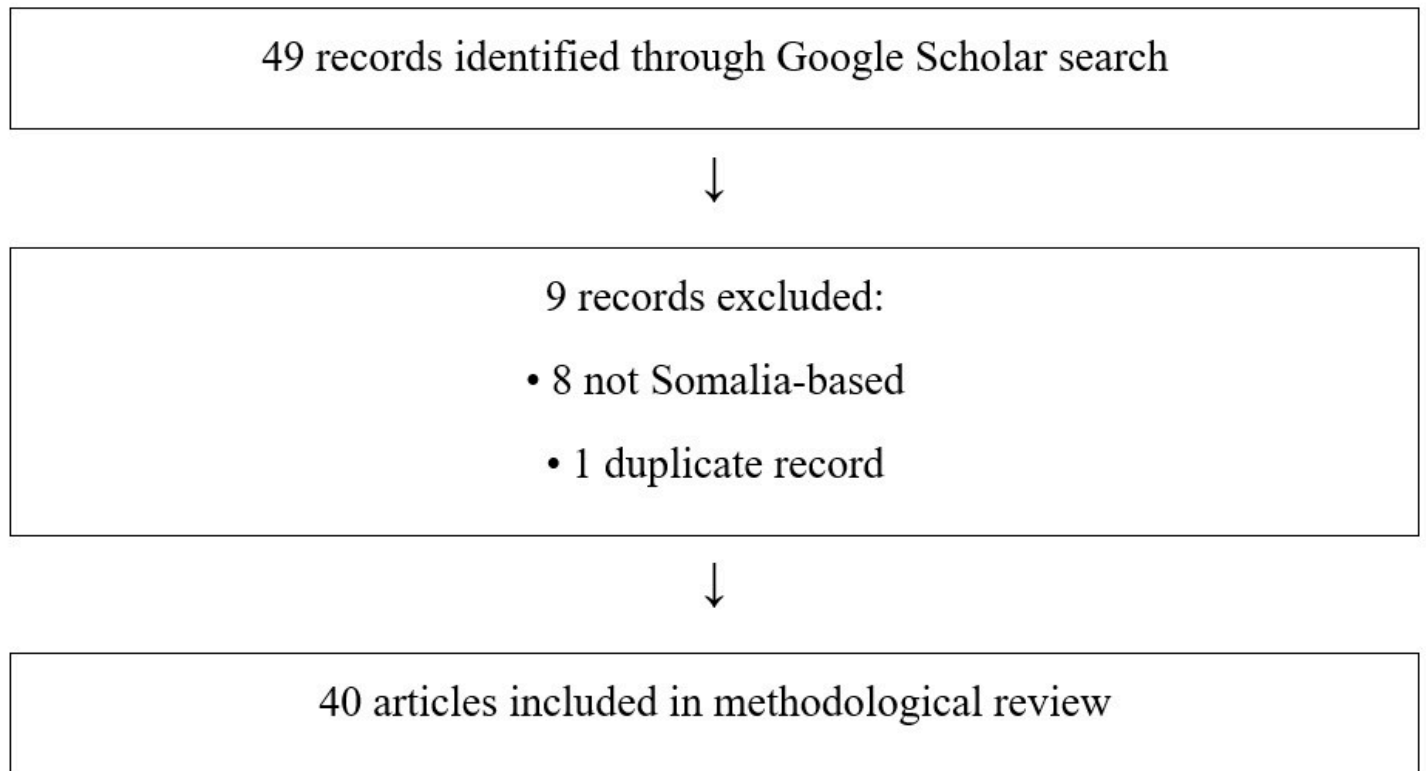


Figure 1

Documented selection flow of articles included in the methodological review