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Prevalence of study-defined cognitive impairment following traumatic brain injury in Africa: A systematic review and meta-analysis

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ABSTRACT

Background: Cognitive impairment is an important sequela of traumatic brain injury (TBI) in African countries, but evidence remains fragmented across small studies using different assessment tools. Because cognitive deficits can compromise quality of life, a cautious synthesis of the available evidence is needed to inform screening, follow-up, and rehabilitation planning.

Objective: To estimate the pooled prevalence of study-defined cognitive impairment following TBI in Africa and to describe the assessment approaches used.

Methods: A systematic review and meta-analysis was conducted including studies from African countries that enrolled adults or mixed-age TBI survivors and reported extractable numerator and denominator data for study-defined cognitive impairment. Study-level proportions were logit-transformed and pooled using a random-effects restricted maximum-likelihood (REML) model with the sampling variance specified as SE^2.

Results: Seven studies from Cameroon, Egypt, Ethiopia, South Africa, and Uganda met inclusion criteria, contributing 800 TBI survivors. The pooled prevalence of study-defined cognitive impairment was 45.77% (95% CI: 24.17%–69.09%). Heterogeneity was very high ($Q = 148.749$, df $= 6$, $p < .001$; $I^2 = 96.0\%$; $\tau^2 = 1.6217$; $\tau = 1.2734$), and study-level prevalence ranged from 12.58% to 85.00%. Leave-one-out analyses produced estimates from 39.11% to 53.19%, demonstrating sensitivity to individual studies.

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Conclusion: Study-defined cognitive impairment was frequent across the included African TBI studies, but the pooled estimate should not be interpreted as a precise continental prevalence because the evidence was heterogeneous in population, injury severity, assessment instrument, threshold, language/education context, and timing of assessment.

1. Introduction

Traumatic brain injury (TBI) is a major cause of mortality, disability, and long-term neurological morbidity worldwide, with a substantial burden in low- and middle-income countries, including sub-Saharan Africa.[1,2] Cognitive impairment is one of the most important sequelae after TBI because it affects memory, attention, executive function, processing speed, independence, return to work, and quality of life.[3–5] In African settings, the burden is compounded by limited trauma systems, scarce neuropsychological services, weak follow-up pathways, and restricted access to structured neurorehabilitation.[6–8] Across Africa, population-level incidence and prevalence estimates vary substantially and are likely underestimated because trauma surveillance and long-term follow-up remain incomplete.[1,2,9] Road traffic injuries and interpersonal violence contribute prominently to the regional burden, leaving many survivors at risk of persistent disability.[4,5,8,9]

Available African studies show that cognitive impairment after TBI is common but inconsistently measured across settings.[10–12] Reported estimates vary because studies differ in TBI severity, age group, timing of assessment, clinical setting, sample size, and cognitive assessment tool.[3,11,13] Some studies use the Montreal Cognitive Assessment or MoCA-Basic (MoCA-B), whereas others use adapted Mini-Mental State Examination (MMSE) tools, Cogstate batteries, clinical follow-up assessments, or locally developed TBI screening instruments.[6,10,12,13] These instruments serve different purposes: MoCA/MoCA-B and adapted MMSE measures provide brief global screening, Cogstate offers domain-specific neuropsychological assessment, and the Groote Schuur Hospital Traumatic Brain Injury Evaluation (GSH-TBIE) and clinical follow-up approaches support pragmatic case identification.[3,6,10–14] No single instrument can be considered uniformly superior for African TBI populations; suitability depends on the cognitive domains of interest, timing after injury, feasibility, language and educational context, cultural adaptation, and the availability of locally validated thresholds.[3,6,11–13,15] These instruments and thresholds are not assumed to be interchangeable; therefore, the present review defines the primary outcome as each study's binary classification of cognitive impairment according to its own prespecified instrument and threshold.

This variation limits direct comparison between studies and makes it difficult to estimate the overall burden of post-TBI cognitive impairment in Africa.[3,11] A focused synthesis is therefore needed to pool available African evidence, quantify between-study heterogeneity, and identify how assessment tools and study characteristics influence reported prevalence. Such evidence is important for planning cognitive screening, follow-up care, rehabilitation services, and future research using locally valid cognitive assessment thresholds. This systematic review and meta-analysis aimed to estimate the pooled prevalence of study-defined cognitive impairment following TBI in Africa. Secondary objectives were to describe the assessment tools and impairment thresholds used across included studies, assess methodological quality, evaluate heterogeneity, and examine the robustness of the pooled estimate through sensitivity and subgroup analyses. The practical purpose of the review is therefore not merely to generate a continental pooled estimate, but to determine whether the available evidence supports structured post-TBI cognitive screening and to identify measurement limitations that must be addressed before prevalence estimates can be used to guide clinical services. By quantifying the burden while mapping the tools and thresholds used, the review provides a basis for strengthening follow-up, neurorehabilitation, and more standardized assessment in African settings.

2. Methods

2.1. Study design and registration

This systematic review and meta-analysis was conducted and reported in accordance with PRISMA 2020 guidelines.[16] The protocol was registered prospectively on PROSPERO (CRD420261405029).

2.2. Information sources and search strategy

PubMed/MEDLINE, Scopus, Web of Science, Lens.org, and African Journals Online (AJOL) were searched up to 1 May 2026. The search combined terms for TBI, cognitive impairment or neuropsychological outcomes, and African settings. No language restriction was applied. Boolean operators (AND, OR) were used to combine search terms appropriately. AJOL was searched through Google Scholar using the site:ajol.info syntax because the native AJOL interface has limited Boolean functionality. The full search strategy is provided in Supplementary File S1.

2.3. Eligibility criteria

Studies were eligible if they enrolled adult or mixed-age participants with confirmed TBI of any severity, were conducted in an African country, reported the prevalence or proportion of participants classified as cognitively impaired using a standardized or clinician-administered cognitive assessment instrument, and provided sufficient data to extract a numerator and denominator. Studies were excluded if they reported only mean cognitive test scores without a binary impairment classification, did not include a primary TBI population, or were case reports, editorials, reviews, or conference abstracts without full-text data. For this review, "study-defined cognitive impairment" referred to the binary classification reported by each study according to its own assessment instrument and prespecified threshold. The pooled estimate therefore represents the cross-study prevalence of study-defined impairment rather than prevalence under a single common diagnostic instrument or threshold.

2.4. Study selection

Records were imported into a reference manager for duplicate removal. Titles and abstracts were screened, and potentially eligible reports were assessed in full text. Two reviewers independently assessed eligibility, and disagreements were resolved by consensus or consultation with a third reviewer.

2.5. Data extraction

Two reviewers independently extracted country, sample size, TBI severity, timing of cognitive assessment, assessment instrument, impairment threshold, and the number of participants classified as cognitively impaired. Discrepancies were resolved by consensus or referral to a third reviewer. Grey literature including full-text theses and dissertations were eligible when they met all other inclusion criteria and their data were sufficiently extractable; conference abstracts without adequate full-text data were excluded. The Mohammedawol[12] thesis was appraised using the same JBI prevalence checklist applied to all included studies.

2.6. Methodological quality assessment

Methodological quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Prevalence Studies.[17] The nine items assessed sample-frame appropriateness, sampling, sample size, participant description, coverage, outcome measurement validity, measurement reliability, statistical analysis, and response-rate management. Each item was scored as yes = 1 or no/unclear = 0. Overall quality was classified as high (7-9), moderate (4-6), or low (0-3).

2.7. Statistical analysis

Each study-level proportion was logit-transformed as logit(p) = ln [p/(1-p)] to stabilize variance. The standard error (SE) was calculated as SE = sqrt[1/x + 1/(n-x)], and the sampling variance supplied to the meta-analysis was vi = SE^2. Pooled estimates and confidence intervals (CI) were back-transformed using the inverse logit transformation.

Primary synthesis used a random-effects REML model implemented through the metafor package in jamovi version 2.6.44, with yi = logit (p_i), vi = SE_i^2, and inverse-variance random-effects weights $1/(vi + \tau^2)$. The model corresponds to metaforrma(yi, vi, method = "REML", test = "z"). Heterogeneity was assessed using Cochran's *Q*, I^2, tau-squared (τ^2), and tau (τ). Small-study effects were explored with Egger's regression, interpreted cautiously because only seven studies were available. Leave-one-out sensitivity analysis and descriptive subgroup analysis by cognitive assessment tool were performed.

3. Results

3.1. Study selection

The searches identified 1875 records before duplicate removal. After removal of 401 duplicates, 1474 records were screened by title and abstract, of which 1432 were excluded. Forty-two reports were sought for retrieval, and three could not be retrieved. Thirty-nine full-text reports were assessed for eligibility. Thirty-two reports were excluded because of wrong population, setting, or non-African study ($n = 12$), no extractable binary cognitive-impairment prevalence data ($n = 14$), or wrong publication type, duplicate report, or insufficient full-text data ($n = 6$). Seven studies met all eligibility criteria and were included in the meta-analysis. The PRISMA flow diagram is presented in Supplementary Fig. S1.

3.2. Study characteristics

The seven included studies were conducted in five African countries: Uganda ($k = 2$), Egypt ($k = 2$), Ethiopia ($k = 1$), Cameroon ($k = 1$), and South Africa ($k = 1$). The combined sample size was 800 TBI survivors, with study sample sizes ranging from 20 to 326. Timing of cognitive assessment ranged from approximately three weeks post-injury to a median of three years post-injury. Study-level prevalence ranged from 12.58% to 85.00% (Table 1).

3.3. Methodological quality of included studies

JBI scores ranged from 5 to 9 out of 9. Four studies were rated high quality, and three were rated moderate quality. No study was rated low quality. The most common methodological concerns were inadequate sample-size justification, non-standard outcome measurement, and unclear response-rate or attrition management. Full item-level ratings are provided in Supplementary Table S1.

3.4. Meta-analysis data

Study-level data used for pooling are presented in Table 2. Event counts, totals, raw prevalence, logit prevalence, standard errors, and sampling variances were recalculated from the extracted data.

3.5. Pooled prevalence of study-defined cognitive impairment

The corrected random-effects meta-analysis yielded a pooled logit prevalence of −0.1694 (SE = 0.4968; 95% CI: −1.1432 to 0.8043; Fig. 1). Back-transformation gave a pooled prevalence of 45.77% (95% CI: 24.17%–69.09%; Table 3). This estimate summarizes study-defined cognitive impairment across the seven heterogeneous studies and should not be interpreted as a precise prevalence for all African TBI populations (see Table 4).

3.6. Heterogeneity

Cochran's Q was 148.749 (df = 6, $p < .001$). The I^2 statistic was 96.0%, the between-study variance tau-squared was 1.6217, and tau was 1.2734 on the logit scale. Study-level prevalence estimates ranged from 12.58% to 85.00%. The very high heterogeneity indicates that the included studies estimates are substantially different from the underlying prevalence values.

Table 1
Characteristics of studies included in the systematic review and meta-analysis of cognitive impairment following traumatic brain injury in Africa.

Study	Country	Sample size (n)	TBI population/severity	Timing	Cognitive assessment	Definition of impairment
Figuim et al.[10]	Cameroon	20	Adults with moderate-to-severe TBI	Acute phase/up to 2 months post-discharge	MoCA	Score < 26
Kintu et al.[11]	Uganda	189	Community-based mixed-severity TBI survivors	Median 3 years post-injury	MoCA/MoCA-B	Score ≤ 25
Mohammedawol[12]	Ethiopia	326	TBI survivors attending surgical referral follow-up	≥3 months post-injury	Adapted MMSE	Score ≤ 23
Ali et al.[13]	Egypt	87	Moderate TBI (GCS 9-12)	Approximately 3 weeks post-trauma/before discharge	Arabic MoCA-B	Score < 26
Bangirana et al.[3]	Uganda	81	Adult TBI survivors	6 months post-discharge	Cogstate neuropsychological battery	≤2 SD below expected mean in ≥ 1 domain
Almamoun et al.[14]	Egypt	50	Elderly patients aged ≥ 65 years with TBI	1 month after discharge	Clinical follow-up assessment	Clinically identified cognitive deficits
Andrew et al.[6]	South Africa	47	TBI survivors; majority severe TBI	≥6 months post-injury in most cases	GSH-TBIE	≥1 positive cognitive screening response or disorientation

Note: n = number; TBI = traumatic brain injury; MoCA = Montreal Cognitive Assessment; MoCA-B = MoCA-Basic; MMSE = Mini-Mental State Examination; GCS = Glasgow Coma Scale; SD = standard deviation; GSH-TBIE = Groote Schuur Hospital Traumatic Brain Injury Evaluation.

Table 2
Study-level prevalence data and logit-transformed estimates used in the meta-analysis.

Study	Events (x)	Total (n)	Prevalence	Logit prevalence	SE	Variance	Assessment tool
Figuim et al.[10]	17	20	0.8500 (85.00%)	1.7346	0.6262	0.3922	MoCA
Kintu et al.[11]	106	189	0.5608 (56.08%)	0.2446	0.1466	0.0215	MoCA/MoCA-B
Mohammedawol[12]	41	326	0.1258 (12.58%)	−1.9389	0.1670	0.0279	Adapted MMSE
Ali et al.[13]	39	87	0.4483 (44.83%)	−0.2076	0.2156	0.0465	Arabic MoCA-B
Bangirana et al.[3]	23	81	0.2840 (28.40%)	−0.9250	0.2464	0.0607	Cogstate neuropsychological battery
Almamoun et al.[14]	12	50	0.2400 (24.00%)	−1.1527	0.3311	0.1096	Clinical follow-up assessment
Andrew et al.[6]	38	47	0.8085 (80.85%)	1.4404	0.3707	0.1374	GSH-TBIE
	276	800	—	−0.1694	0.4968	—	—

Note: Logit prevalence = ln[p/(1-p)]; SE = sqrt[1/x + 1/(n-x)]; sampling variance = SE^2. The random-effects model used vi = SE^2 as the sampling variance input. Pooled logit and SE are from the corrected REML model implemented through metafor in jamovi. x = number of events; n = number; SE = standard error; MoCA = Montreal Cognitive Assessment; MoCA-B = MoCA-Basic; MMSE = Mini-Mental State Examination; GSH-TBIE = Groote Schuur Hospital Traumatic Brain Injury Evaluation.

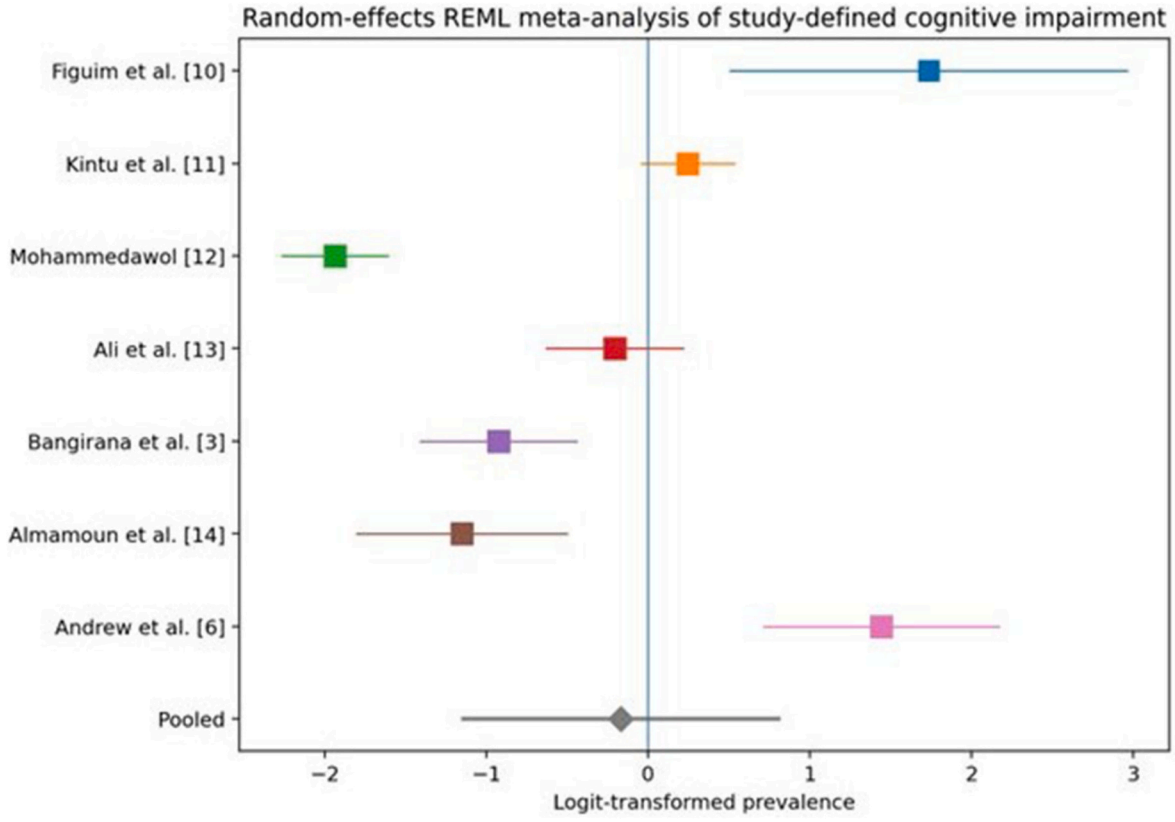


Fig. 1. Forest plot of the random-effects meta-analysis of study-defined cognitive impairment following TBI in Africa. Squares represent study-level logit-transformed prevalence estimates, horizontal lines represent 95% confidence intervals (CI), and the diamond represents the pooled estimate. The pooled prevalence was 45.77% (95% CI: 24.17%–69.09%).

Table 3
Random-effects meta-analysis of study-defined cognitive impairment following traumatic brain injury in Africa.

Model	k	Pooled logit	95% CI (logit)	Back-transformed prevalence	95% CI (prevalence)	Q (df), p	I^2	τ^2 (τ)
Random-effects REML	7	−0.1694	−1.1432 to 0.8043	0.4577 (45.77%)	0.2417 to 0.6909 (24.17%-69.09%)	148.749 (6), $p < .001$	96.0%	1.6217 (1.2734)

Note: REML = restricted maximum-likelihood estimator. The corrected model used yi = logit(p_i) and vi = SE_i^2 in metafor:rma(yi, vi, method = "REML", test = "z"). Back-transformation used p = exp(theta)/[1 + exp(theta)]. $\tau^2 = 1.6217$ and $\tau = 1.2734$. The pooled-effect *Z* test, equivalence test, and their *p*-values are not reported because they do not test a clinically meaningful prevalence hypothesis.

3.7. Sensitivity analysis

Leave-one-out analyses showed pooled prevalence estimates ranging from 39.11% to 53.19% after removal of individual studies. Excluding Figuim et al[10] yielded a prevalence of approximately 39.22%, excluding Kintu et al.[11] yielded 44.21%, excluding Mohammedawol[12] yielded 53.19%, excluding Ali et al.[13] yielded 46.20%, excluding Bangirana et al.[3] yielded 49.18%, excluding Almamoun et al.[14] yielded 49.97%,

Table 4
Leave-one-out and pre-specified sensitivity analyses of the pooled prevalence estimate.

Analysis	Studies included/ excluded	Pooled prevalence (95% CI)	Interpretation
Primary analysis	All seven studies included	45.77% (24.17%-69.09%)	Reference
LOO: exclude Figuim et al.[10]	Six studies	39.22% (20.19%-62.20%)	Decreased
LOO: exclude Kintu et al.[11]	Six studies	44.21% (20.03%-71.48%)	Decreased
LOO: exclude Mohammedawol[12]	Six studies	53.19% (31.41%-73.81%)	Increased
LOO: exclude Ali et al.[13]	Six studies	46.20% (21.14%-73.34%)	Minimal increase
LOO: exclude Bangirana et al.[3]	Six studies	49.18% (23.90%-74.88%)	Increased
LOO: exclude Almamoun et al.[14]	Six studies	49.97% (25.02%-74.93%)	Increased
LOO: exclude Andrew et al.[6]	Six studies	39.11% (19.86%-62.46%)	Decreased
Pre-specified: exclude Figuim et al.[10] + Andrew et al.[6]	Five studies	31.25% (17.46%-49.41%)	Lower estimate

Note: Values are back-transformed pooled prevalence estimates from the corrected REML model; 95% confidence intervals are reported for every leave-one-out scenario. LOO = leave-one-out.

and excluding Andrew et al.[6] yielded 39.11%. The pre-specified simultaneous exclusion of Figuim et al.[10] and Andrew et al.[6] yielded 31.25%. These results indicate that the pooled estimate is not robust to single-study exclusion, which is expected given $k = 7$ and the very high between-study heterogeneity.

3.8. Subgroup analysis by assessment instrument

The descriptive random-effects subgroup estimate was 60.88% (95% CI: 36.85%-80.58%) for the three MoCA/MoCA-B studies and 33.95% (95% CI: 11.14%-67.83%) for the four non-MoCA studies. These differences were not interpreted as an effect of the MoCA instrument itself. The subgroups also differed in age, TBI severity, clinical setting, timing of assessment, language, educational context, and impairment thresholds; with only three and four studies, the analysis cannot disentangle instrument effects from these co-varying study characteristics, respectively (Table 5).

Table 5
Descriptive subgroup analysis of cognitive impairment prevalence by assessment instrument.

Subgroup	Studies included	k	Pooled prevalence	95% CI
MoCA/ MoCA-B	Figuim et al.[10]; Kintu et al.[11]; Ali et al.[13]	3	60.88%	36.85%-80.58%
Non-MoCA	Mohammedawol[12]; Bangirana et al.[3]; Almamoun et al.[14]; Andrew et al.[6]	4	33.95%	11.14%-67.83%
Overall	All studies	7	45.77%	24.17%-69.09%

Note: k = number of studies; CI = confidence interval; MoCA = Montreal Cognitive Assessment; MoCA-B = MoCA-Basic.

3.9. Publication bias and small-study effects

Egger's regression intercept was 3.57 ($p = .516$). Because only seven studies were included, this test has low power and should not be interpreted as evidence for the presence or absence of publication bias. The funnel plot is presented for visual inspection only (Fig. 2).

4. Discussion

Across seven African studies and 800 TBI survivors, the pooled prevalence of study-defined cognitive impairment after TBI was 45.77% (95% CI: 24.17%-69.09%) under a random-effects REML model. Heterogeneity was very high ($I^2 = 96.0\%$; $\tau^2 = 1.6217$; $\tau = 1.2734$), and study-level prevalence ranged from 12.58% to 85.00%. The pooled estimate should therefore be interpreted as a summary of a broad distribution of study-defined prevalence values rather than as a precise single prevalence for African TBI populations.

4.1. Comparison with existing literature

The pooled prevalence was close to the estimate reported by Ganesh et al.[18] for neuropsychiatric sequelae after TBI across Western Asian, South Asian, and African regions of the global south. Phase- and domain-specific evidence from Tsai et al.[19] also demonstrated that cognitive deficits after TBI vary by recovery phase, severity, and cognitive domain. Earlier syntheses have similarly shown persistent deficits in attention, processing speed, memory, and executive function after moderate-to-severe TBI.[20–23] The African estimate may reflect a hospital-enriched case mix, under-representation of mild TBI, high contributions from road traffic injury and interpersonal violence, and limited access to structured rehabilitation.[4,5,8,9] Cross-cultural use of cognitive screening tools may also influence estimates where local education-adjusted norms are unavailable.[15]

4.2. Clinical and methodological interpretation

A pooled prevalence of this magnitude indicates a substantial burden of cognitive impairment among the populations represented in the included studies, but it should not be generalized as a precise continental estimate. The included populations differed materially: Figuim et al.[10] and Ali et al.[13] focused on moderate-to-severe or moderate TBI, Kintu et al.[11] included community-based mixed-severity survivors, Almamoun et al.[14] focused on adults aged ≥65 years, and Andrew et al.[6]

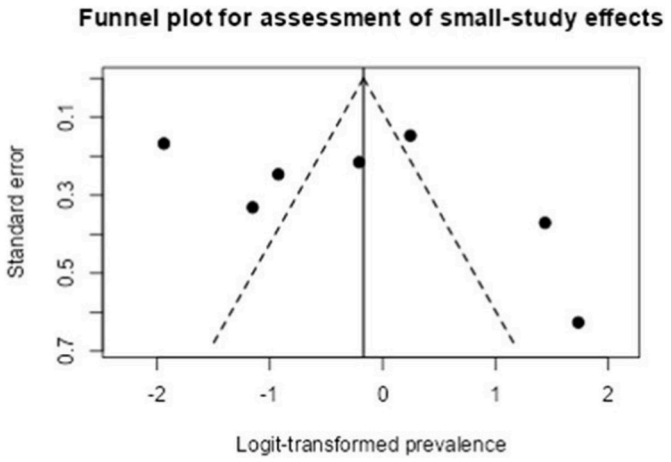


Fig. 2. Funnel plot for assessment of small-study effects across the seven included studies. The horizontal axis shows logit-transformed prevalence estimates, and the vertical axis shows the study-level standard error. The dotted vertical line represents the pooled logit estimate. Pseudo-95% confidence boundaries are shown for visual inspection only.

included a predominantly severe-TBI population. Clinical setting also varied from acute or pre-discharge assessment to community and follow-up services. These differences can alter the case mix and the probability that persistent cognitive impairment is detected.

High heterogeneity was expected because the included studies differed in assessment instruments, impairment thresholds, timing, severity profile, age group, care setting, and likely educational and linguistic context. Cognitive assessment occurred from approximately three weeks after injury to as long as three years after injury. Early assessments may capture acute or subacute effects, whereas later assessments may reflect persistent deficits among survivors who remain engaged with follow-up; therefore, timing can materially influence observed prevalence.[19] The descriptive subgroup analysis showed a higher pooled estimate in MoCA/MoCA-B studies than in non-MoCA studies, but this should not be interpreted as evidence that MoCA itself causes or explains the difference. Instrument choice was confounded by differences in population, setting, timing, language, education, and thresholds.[15]

Leave-one-out and pre-specified sensitivity analyses demonstrated that the pooled estimate was not robust to single-study exclusion. The leave-one-out estimates ranged from 39.11% to 53.19%, while simultaneous exclusion of the two small/high-prevalence studies, Figuim et al.[10] and Andrew et al.,[6] reduced the estimate to 31.25%. This sensitivity is consistent with the small evidence base and very high heterogeneity and indicates that the pooled value should be interpreted as a descriptive synthesis rather than a stable continental benchmark.

Publication-bias assessment was limited by the small number of studies. The Egger regression did not provide strong statistical evidence of asymmetry, but with $k = 7$ the test is underpowered and a non-significant result cannot exclude small-study effects or publication bias. The certainty of evidence should therefore be considered limited by high heterogeneity, small study numbers, and variable measurement methods.

4.3. Strengths and limitations

Strengths include the Africa-focused scope, inclusion of studies with extractable numerator and denominator data, logit transformation of proportions, explicit use of sampling variances (SE^2), pre-specified random-effects REML modelling, sensitivity and subgroup analyses, and inclusion of eligible grey literature. Limitations include the small number of studies, very high heterogeneity, variable cognitive tools and thresholds, limited geographical coverage, incomplete standardization of follow-up timing, and the possibility that educational and linguistic differences affected classification. The absence of West African evidence limits continental generalizability.

4.4. Implications for practice and research

The findings support structured cognitive screening at defined intervals after TBI in African trauma, neurosurgical, and rehabilitation services, while emphasizing that the appropriate instrument and threshold should be locally validated. Future research should use prospective longitudinal cohorts, report outcomes at clearly defined post-injury time points, stratify by injury severity and age, and validate cognitive thresholds across languages and educational levels. Studies should also report numerator and denominator data and clearly distinguish screening classifications from formal neuropsychological diagnoses.

5. Conclusion

Study-defined cognitive impairment was frequent among the African TBI populations represented in this review, with a pooled prevalence of 45.77% among 800 survivors. However, very high heterogeneity ($I^2 = 96.0\%$) and substantial variation in TBI severity, age, setting, assessment instrument, thresholds, educational and linguistic context, and timing of assessment mean that this estimate should not be interpreted as a precise continental prevalence. The sensitivity analysis further showed that the pooled estimate was not robust to exclusion of individual studies. Strengthening cognitive screening, longitudinal follow-up, neurorehabilitation, and locally validated, education- and language-sensitive assessment approaches remains important for African TBI care and research.

CRediT authorship contribution statement

Ehanga Idi Marcel: Writing – original draft, Methodology, Data curation. **Enock Mukiibi:** Writing – review & editing, Writing – original draft, Validation, Methodology, Conceptualization. **Lekuya Monka Herve:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Sura Daniel Elias:** Writing – original draft, Data curation. **Fiston Kinyamaniyi Kamabu:** Writing – original draft, Data curation. **Kalangu Kazadi Kaluile Ntenga:** Supervision, Methodology. **Juliet Sekabunga Nalwanga:** Writing – review & editing, Validation, Methodology. **Catherine R. Lewis:** Writing – review & editing, Validation, Conceptualization. **Niklas Marklund:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Jackson Kakooza:** Writing – original draft, Data curation. **Prosper Akankwasa:** Writing – original draft, Methodology. **John Turyagumanawe:** Writing – original draft, Data curation, Conceptualization. **Amuli Minyeko Ange:** Writing – original draft, Data curation. **Innocent Ayesiga:** Writing – original draft, Data curation. **Franck Katembo Sikakulya:** Writing – review & editing, Validation. **Joel Kabuyaya Lwanzo:** Writing – original draft, Supervision, Data curation, Conceptualization. **Michael Mugenyi:** Writing – review & editing, Validation. **Amos Muhumuza:** Writing – original draft, Methodology. **Evelyn Njawuzi Balondemu:** Writing – original draft, Data curation. **Constant Balu Mabiala:** Writing – original draft, Data curation. **Shafik Kasirye:** Writing – review & editing, Validation, Methodology. **Justine Nyesigamukama:** Validation, Data curation. **Theoneste Hakizimana:** Writing – review & editing, Validation, Methodology. **Bienfait V. Mumbere:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data used in the meta-analysis were extracted from published studies or publicly available theses and are provided in the manuscript and supplementary materials. The thesis was explicitly treated as grey literature and was appraised using the same JBI prevalence checklist applied to the other included studies.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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