

BMJ Open Studies on cognitive performance among older people living with HIV in eastern Europe and central Asia: a scoping review

Esma Imerlishvili ^{1,2}, Deborah R Gustafson ³, Mariam Pashalishvili,^{1,2} Danielle C Ompad,⁴ Mamuka Djibuti ²

To cite: Imerlishvili E, Gustafson DR, Pashalishvili M, *et al.* Studies on cognitive performance among older people living with HIV in eastern Europe and central Asia: a scoping review. *BMJ Open* 2025;**15**:e094427. doi:10.1136/bmjopen-2024-094427

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2024-094427>).

DCO and MD contributed equally.

Received 30 September 2024
Accepted 21 May 2025



© Author(s) (or their employer(s)) 2025. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ Group.

¹Ivane Javakhishvili Tbilisi State University Faculty of Medicine, Tbilisi, Georgia

²Partnership for Research and Action for Health, Tbilisi, Georgia

³Department of Neurology, SUNY Downstate Health Sciences University, New York City, Brooklyn, USA

⁴Department of Epidemiology, New York University School of Global Public Health, New York, New York, USA

Correspondence to

Esma Imerlishvili;
esma.imeri@gmail.com

ABSTRACT

Background Despite the growth of the population of older people living with HIV (PLWH), data on cognitive disorders among older PLWH, particularly in low- and middle-income countries, are scarce. These data are especially underrepresented in the literature from eastern Europe and central Asia (EECA).

Objectives This scoping review aimed to describe the peer-reviewed literature on cognitive health among PLWH in the EECA region.

Eligibility criteria We selected articles from peer-reviewed journals that reported on cognitive assessments or the prevalence and characteristics of cognitive disorders among adult (≥18 years) PLWH in EECA countries (Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan). Studies assessing cognition among PLWH related to traumatic brain injury, brain tumours, COVID-19, meningitis, neurosyphilis and/or other central nervous system infections were excluded.

Source of evidence We searched for relevant data published up to March 2025 using four online databases (PubMed, CINAHL, Web of Science and PsycINFO).

Charting methods Covidence, a web-based collaborative software platform, was used for data screening and extraction. Two independent reviewers screened abstracts and full texts, resolving disagreements through consensus. The data were extracted based on the predefined data extraction criteria.

Results A total of 1388 peer-reviewed articles were identified; 295 articles were removed due to duplication; and 1053 and 25 articles were excluded based on the abstract/title and full-text screenings, respectively. Finally, 15 articles met the inclusion criteria. All 15 studies used different neuropsychological assessments to measure cognitive performance by domain and/or cognitive disorders among various subgroups of PLWH. One cross-sectional study focused on older populations (≥40 years old), using standardised cognitive performance assessment tests. However, it neither provided information about the prevalence estimate of cognitive disorders nor identified risk factors.

Conclusion Existing literature on cognitive disorders among older PLWH in the EECA region is limited and insufficient to estimate prevalence, or identify risk factors, and ultimately develop appropriate policy addressing the

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ We applied a systematic approach to review the existing literature on cognitive performance and/or disorders among people living with HIV in the eastern Europe and central Asia (EECA) region.
- ⇒ Following the reporting criteria of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews, our scoping review highlighted gaps where future research should be applied.
- ⇒ Due to searching peer-reviewed literature, we may have missed studies from the EECA region.

needs of older PLWH in this region. This scoping review underscores the urgent need for large-scale, longitudinal studies employing standardised, culturally adapted neuropsychological batteries and adherence to rigorous reporting standards.

INTRODUCTION

Effective antiretroviral therapy (ART) has significantly increased life expectancy for people living with HIV (PLWH), leading to a projected 73% of PLWH being over 50 years old by 2030.¹ This growing population of older PLWH is more susceptible to ageing-related conditions, including cognitive disorders, presenting a critical global public health challenge.^{2,3} Impaired cognitive performance negatively impacts people's health outcomes and overall well-being. Specifically, cognitive impairment can adversely affect treatment adherence,^{4,5} health behaviours, working capacity, everyday function and overall quality of life.⁶⁻⁹

The literature on cognitive performance among older PLWH is growing globally; however, the data remain insufficient as ~70% of countries have not contributed to this body of literature,¹⁰ and the existing evidence primarily originates from high-income countries.¹¹ The current estimated prevalence

of cognitive disorders among older PLWH varies from 22% to 70%, depending on geography, patient characteristics and diagnostic or screening methods used.⁶ PLWH are disproportionally affected by comorbid cognitive disorders in low- and middle-income countries (LMICs).^{10–11} The heterogeneous nature of the ageing process for PLWH may explain the unequal geographical distribution of these conditions. Cognitive disorders are not only associated with HIV itself (eg, neurotoxicity, immunosuppression, chronic inflammation and coinfections) but also with lifestyle factors (eg, substance use disorders and smoking) and other health-related factors (eg, cardiovascular risk factors) among PLWH, which often differ from people without HIV and vary across countries.^{4 12–17} An additional reason for the variability in the prevalence of cognitive disorders globally stems from the use of different diagnostic and screening techniques with various sensitivities and specificities, for example, brain imaging, and access to neurologists, psychiatrists or neuropsychologists who can make consistent and accurate diagnoses.^{18 19}

The eastern Europe and central Asia (EECA) region is disproportionately affected by the HIV epidemic. Contrary to global trends, HIV incidence and mortality rates have increased by 49% and 46%, respectively, since 2019.²⁰ Moreover, the region experienced the largest increase in the age-standardised incidence of HIV, along with a rise in disability-adjusted life years among older adults (aged 60–89 years) from 1990 to 2019.²¹ The epidemic is driven by factors such as injection drug use, stigmatisation of vulnerable groups and limited access to prevention and treatment programmes.²² Insufficient access to prevention and treatment services as well as stigma further exacerbates the challenges in the EECA region. In 2022, only 48% of PLWH were virally suppressed in the EECA region.²⁰ Given the high prevalence, late diagnosis, concentration among vulnerable populations and limited availability of ART among PLWH in the EECA region, the burden of HIV is likely to increase and be accompanied by a higher prevalence of age-associated comorbid diseases, frailty and reduced quality of life among older PLWH. Despite the burden of HIV, there is limited knowledge about cognitive performance among PLWH in the EECA region.^{11 16} This knowledge gap may hinder the HIV treatment response due to the factors mentioned above, for instance, cognitive disorders impeding treatment adherence and reducing the overall quality of life for PLWH.

Given this context, we conducted a scoping review to systematically map the existing research and identify knowledge gaps on cognitive health among PLWH in the EECA region. Specifically, we aimed to understand how cognitive performance is assessed among PLWH, whether the literature focuses on age-related cognitive damage among PLWH and to identify gaps in knowledge regarding the assessment, prevalence and risk factors for cognitive impairment among PLWH in the EECA region.

METHODS

Following the steps of the Joanna Briggs Institute (JBI) manual for evidence synthesis for conducting a scoping review,²³ the study team developed a protocol (online supplemental file 1) that included search terms, eligibility criteria for studies, data management and an analysis plan. We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-S) checklists to guide the reporting process.^{24 25} The following databases were searched individually: CINAHL (via EBSCO), PsycINFO (via OVID), PubMed (via the U.S. National Center for Biotechnology Information) and Web of Science (via Clarivate). We identified one additional relevant article that met our inclusion criteria. Although this article was published after our initial search and, thus, not captured in the original results, we included it due to its clear relevance to the review. No additional search methods were used; this includes study registries, online resources, manual browsing, citation searches or author contact.

We developed a comprehensive search strategy to identify studies assessing cognitive functioning among PLWH. The search was guided by geography and three core conceptual domains: (1) HIV or PLWH populations, (2) cognitive function or related domains (eg, neurocognition, memory and executive function) and (3) measurement or assessment tools. These concepts were operationalised using both controlled vocabulary (eg, Medical Subject Headings (MeSH) terms in PubMed) and keyword searches tailored to each database's syntax. The geographic search terms were developed iteratively by the research team in consultation with a medical librarian, incorporating the names of EECA countries, major cities and regions, as well as transliterations. Strategies, such as the inclusion of regional eponyms, author affiliations and language proxies, were used to maximise retrieval sensitivity. Full search strings, as executed, are reported in online supplemental file 2 for each database. The search terms were adapted to the syntax for each database.

Study team members developed an initial search strategy and an experienced medical librarian was consulted to optimise the search strategy. No formal peer review of the search strategy has been conducted. The strategy was initially developed for PubMed and then translated for other databases, including CINAHL, PsycINFO and Web of Science. Boolean operators were used to combine search terms across the three conceptual domains. No language or date restrictions were applied to the initial search. The final search was executed on 11 March 2025.

The inclusion criteria were as follows: (1) the population must have consisted of PLWH; (2) the data on cognition must have been reported; (3) studies must have been published in peer-reviewed journals and (4) studies must have reported relevant data only from EECA countries (ie, Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine and/or Uzbekistan). Studies on the paediatric population (<18 years old) and

those assessing cognition among PLWH related to traumatic brain injury, brain tumours, COVID-19, meningitis, neurosyphilis and/or other central nervous system infections were excluded. Although the protocol specified inclusion of studies in English, Russian or Georgian, we did not exclude any studies based on language during screening.

To facilitate the screening and data extraction processes, we used a web-based collaborative software platform, Covidence, which streamlines systematic and other types of literature reviews.²⁶ The first round of screening was conducted based on the title and abstract, which was followed by a second round of full-text screening. Both rounds of screening were independently conducted by two reviewers. Conflicts were resolved by at least two different reviewers. Notably, 11 out of 112 abstract/title screening conflicts were initially resolved by the entire team. The remaining 101 conflicts from the abstract/title and 13 from full-text screening were resolved by two reviewers. The first author (EI) extracted the data from all eligible articles that remained after two rounds of screening. Data extraction was conducted using a template developed based on the consensus of all authors. The extracted data were reviewed by two authors (MD and DRG) and double checked whenever concerns arose or clarification was needed. Information extracted from articles included (1) study characteristics, such as the lead author, title, year of publication, country, aim, study design, data collection period, recruitment method, study setting, population size and eligibility criteria; (2) population characteristics, such as sex at birth, gender, age and education; (3) specific diagnostic/screening methods; (4) specific cognitive disorders or performance reported and (5) prevalence and mean scores of cognitive disorders and/or cognitive performance. The extracted data also included information on funding and conflicts of interest. In addition to the articles identified through our systematic search, we applied the same data extraction procedures to one additional article that was manually included. Descriptive analysis was conducted to explore the range of cognitive measurements, disorders and reporting scales. The results section is supported by tables providing a summary of each article. Patients and the public were not included in the development of the study design.

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of our research.

RESULTS

Literature search

A search of the databases identified 1387 articles, 14 of which were eligible for data extraction and analysis (figure 1). A total of 295 articles were removed due to duplication; 1053 and 25 articles were excluded based on the abstract/title (the first round) and full-text screening

(the second round) rounds, respectively. Of the 25 articles excluded from the second round, two were excluded because we could not locate full texts via the Internet or an interlibrary loan request, (Articles from the following journals could not be located: *Klinicheskaja Meditsina* (n=1) and *Terapevticheskii Arkhiv* (n=1)). 16 were excluded because of outcomes or other measurements unrelated to cognition, 3 because they met our exclusion criteria based on population (PLWH with cerebral toxoplasmosis), 3 excluded articles were conference abstracts and 1 of an inappropriate study design (review article).

In addition to the 14 articles identified through the systematic search, we manually identified and included 1 additional relevant article that met our eligibility criteria but was published after our search was conducted. This resulted in a final total of 15 articles included for data extraction and analysis.

Study characteristics

Table 1 (see the online supplementary file 3) provides a comprehensive summary of the characteristics of the included studies. Among the 15 articles, 9 were from Russia,^{27–34} 2 from Belarus,^{35 36} 1 from Kazakhstan,³⁷ 1 from Azerbaijan³⁸ and 2 from Georgia.^{39 40} The two articles from Belarus were based on one multicountry study (Belarus, UK, Denmark and Italy);^{35 36} one study from Russia was also multicountry (Russia and USA).³⁰ Except for six publications in the Russian language,^{27 29 31 33 34 41} all were published in English.^{28 30 32 35–40} Publication years ranged from 1992 to 2025. Most studies were cross sectional (n=12).^{28 29 31 33–41} There was also a secondary data analysis based on a randomised controlled trial,³⁵ a case series (n=1)²⁷ and a longitudinal observation study (n=1).³² Study sample sizes ranged from n=7 (case series) to n=400 (an overall sample from the multicountry study). Not all publications precisely reported study settings or sampling methods. However, those that did report included diverse groups of PLWH, including older (defined as ≥40 years old) PLWH (n=1), those with alcohol use disorders (n=1), those with drug use disorders (n=2), HIV outpatient clinic patients (n=4), inpatients of psychiatric/neurology clinics (n=3), inpatients of an AIDS Centre (n=1), incarcerated PLWH (n=1) and heterosexual men with HIV stage III (n=2). All were conducted among adults, with a reported minimum mean age of 29.4±0.9 and maximum median age of 49 (IQR 44–54) years. Two publications did not report sample age.^{31 39} Only one of these publications mentioned specifically being focused on older PLWH.⁴⁰

Reported measurements and outcomes in the reviewed literature

All 15 studies used different instruments to assess cognitive performance by domain, global cognitive performance and/or cognitive disorders among diverse subgroups of PLWH. Specifically, in addition to global cognition in six studies,^{27 37–41} executive function was reported in four studies,^{29 32 35 40} verbal memory in five studies^{31 32 35 36 40} and visual-constructive motor functions,^{28 32} verbal fluency,^{35 40}

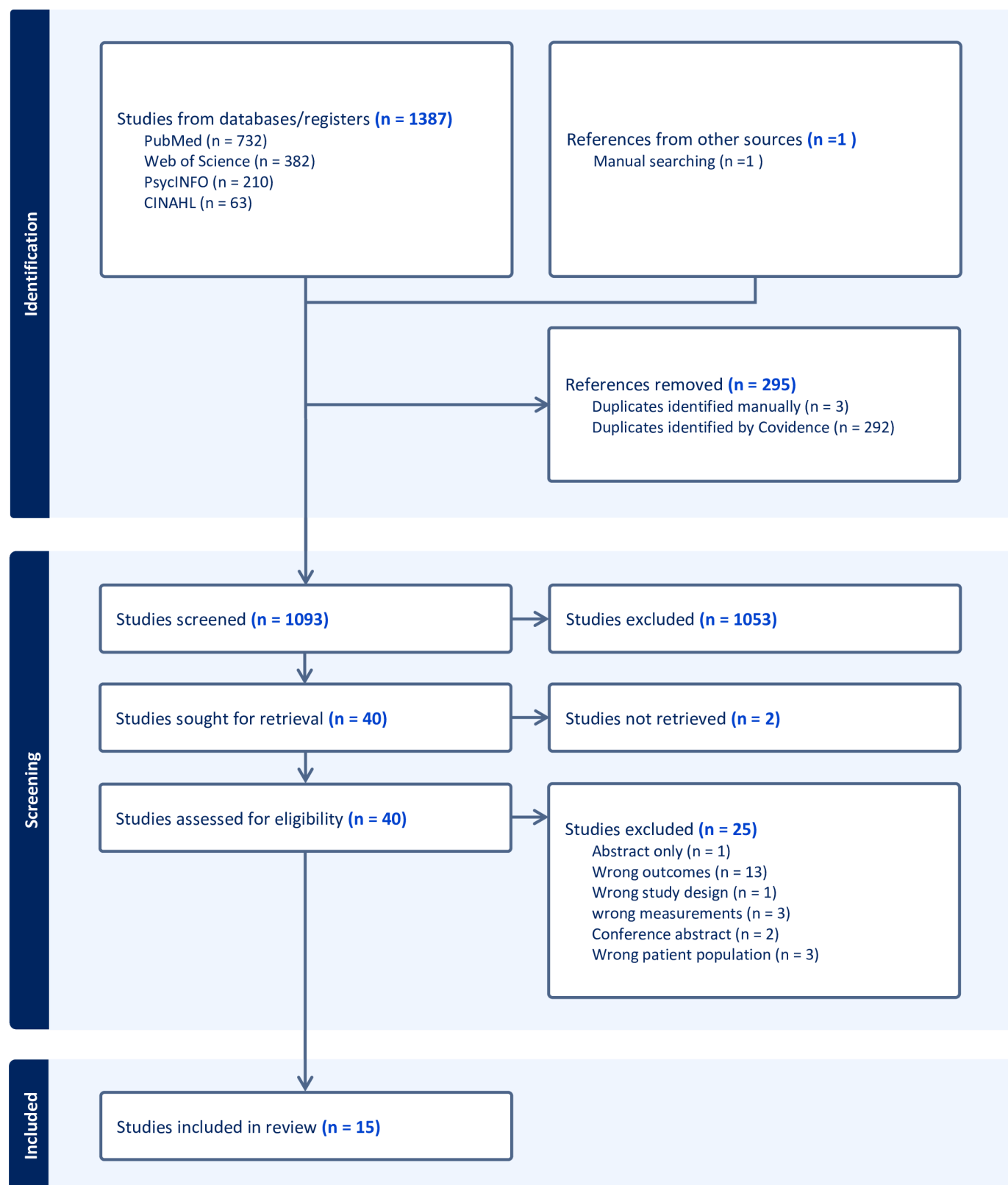


Figure 1 Studies on cognitive performance among older PLWH in EECA: a scoping review. PRISMA flow diagram. EECA, eastern Europe and central Asia; PLWH, people living with HIV; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

working memory^{35 37} and psychomotor speed^{35 40} were reported in two studies; abstract reasoning⁴² and speed of information processing³² were each reported in one

study. Three studies used brain MRI to detect cerebral atrophy³⁹ to study the structural characteristics of cognitive and psychological changes³³ and cerebellar

degeneration.²⁷ One study assessed the quality of life.³⁰ Among 12 publications reporting country-specific data, up to 15 neurocognitive assessments were conducted, all within observational studies. The following assessments were commonly used screening tools among older PLWH in other literature: Clock Drawing Test⁴¹; Cogstate Cognigram^{35 36}; Controlled Oral Word Association Test (COWAT)^{35 36}; Frontal Assessment Battery (FAB)⁴¹; HIV Dementia Scale³⁹; Mini-Mental State Examination (MMSE)^{38 41}; Montreal Cognitive Assessment (MoCA)^{27 40}; Trail Making Tests, and Stroop Colour and Word Tests⁴⁰; Verbal Fluency Test and Grooved Pegboard Test^{32 33 40}; Brief Visuospatial Memory Test, Hopkins Verbal Learning Test, Paced Auditory Serial Addition, Colour Trail Tests 1 and 2 and Adult Intelligence Scale III³²; Wechsler Test^{32 33}; Schulte tables³³; PROMIS V.2.0 Adult Cognitive Function 8a short form (8-item) and the 16-item Forgetfulness Assessment Inventory.³⁷

Two studies using neurocognitive performance batteries did not report country-specific data.^{35 36} Six studies reported the percentage of PLWH with neurocognitive disorders.^{28 30 34 38 39 41} However, the cut-off scores for cognitive performance and/or diagnostic criteria for reported cognitive disorders or impairment were not clearly reported in any of these studies. None of those studies included a representative sample to generalise study findings and estimate prevalence. Six studies reported mean or median scores and SD or IQR for some neurocognitive assessment results.^{27 29–31 33 37} Two publications based on one multicountry study did not report country-specific data.^{35 36} Detailed information about the measurements, neurocognitive performance results, the percentage of cognitive disorders and mean scores reported in the studies are shown in Table 2 (see the online supplementary file 4).

DISCUSSION

To our knowledge, this is the first scoping review on cognitive disorders among PLWH in the EECA region. The results of this review highlight a significant gap in the peer-reviewed literature regarding age-associated cognitive performance among PLWH in this region. Specifically, only one of the reviewed studies focused on older populations, which should be a primary consideration for assessing cognitive disorders among PLWH. Moreover, with the exception of the study conducted in Kazakhstan, which included randomly selected patients with HIV from one AIDS care clinic in a city,³⁷ the other studies either focused on different subgroups of PLWH, used non-randomly selected samples, or had sample sizes too small to generalise findings. As a result, there are insufficient published data to estimate the prevalence of cognitive disorders among PLWH in this region. Given the disproportionate burden of HIV in the EECA region, where HIV incidence and mortality rates have risen significantly since 2019, the need for research on age-associated cognitive disorders among older PLWH

is even more critical.^{20 21} Understanding the prevalence of different clinical presentations, associated risk factors and priority subpopulations for cognitive disorders among older PLWH is crucial for developing policies and appropriate healthcare services. This knowledge can contribute to reduce the burden of cognitive impairment and improving the overall health and quality of life among older PLWH.⁴³

In most studies that reported country-specific data, neither clear cut-offs nor diagnostic criteria for cognitive performance and disorders have been reported. Additionally, none of these studies mentioned score adjustments (eg, T-scores) or the validity of assessment tools within the local context. The lack of reporting on diagnostic criteria, cut-off scores and score adjustments (eg, for educational attainment) can challenge the applicability and interpretability of the data in both local and global contexts. It is noteworthy that many of the reviewed studies used common standardised screening tools, including the MMSE, MoCA, FAB, HIV Dementia Scale, COWAT, CogState's Cognigram and the Clock Drawing Test.^{18 19} This offers promise for future studies in the EECA region, as these tools can be easily administered, provided that they are validated for the local context, which is essential for the proper interpretation of cognitive function.⁶ Moreover, using similar assessments across studies will enable comparisons across populations. Ultimately, this approach will help define policy priorities and guide the development of targeted healthcare interventions.

Since most cognitive assessments are developed and validated in high-income countries, adaptation and validation studies in low-resource settings are essential to ensure their accuracy and applicability. Similar to our review, other literature on cognitive performance among PLWH in low-resource settings is often criticised for factors such as a lack of data on the validity and reliability of screening and diagnostic tools,⁴⁴ small sample sizes, the absence of comparison groups⁴⁵ and failure to incorporate psychosocial and behavioural variables.⁴⁶ Research in the EECA region should address these gaps by developing sound study designs (eg, representative sample, a variety of variables and having comparison groups) and focusing on defining appropriate cut-off scores, adjustments and diagnostic criteria tailored to the local context. This will not only improve the reliability of cognitive assessments but also ensure that they are relevant to the unique challenges faced by PLWH in this region.

Research in the EECA countries, including studies that use screening tools and other diagnostic methods, can help address the challenges of implementing effective and practical cognitive screening strategies in clinical practice. Studies have demonstrated the feasibility of cognitive screening in other low-resource settings. These tests are relatively easy to administer and interpret when performed by trained research staff and non-specialised healthcare personnel.⁴⁷ Notably, routinely administering a comprehensive neuropsychological battery in clinical practice in low-resource settings often leads to

delayed service delivery and additional challenges for patients navigating the healthcare system.⁴⁸ Moreover, comprehensive cognitive screening for PLWH may not be cost-effective if performed routinely. Hence, identifying factors that inform clinical practice, such as which screening/diagnostic tools should be used, for whom and when, will guide the development of efficient, cost-effective strategies for the EECA region.

In our scoping review, we exclusively searched peer-reviewed journals indexed in four major databases, which may have led to the exclusion of relevant research from the EECA region, where most countries are LMICs, and where publications in such peer-reviewed journals are less prevalent.⁴⁹ While our initial inclusion criteria specified English, Russian and Georgian languages, in practice, no studies were excluded based on language. This suggests that relevant articles were accessible within those languages, and potential language bias was minimised. Furthermore, the research team did not impose a restriction on the publication date, which could have allowed for a more nuanced analysis of studies published before and after the initiation of ART. Given that ART became available at varying times across countries in the EECA region, we did not predefine a specific year for the inclusion of studies from the post-ART era based solely on publication date. Had a larger volume of literature been identified, we would have considered conducting separate analyses depending on the ART era. Despite these limitations, the findings of our scoping review highlighted the research gap and the need for further research to address these gaps in cognitive disorders among PLWH in the EECA region.

CONCLUSION

Our scoping review provides valuable evidence for the scientific community and for policymakers to prioritise research on older PLWH in the EECA region. This finding confirms a critical gap in scientific knowledge on cognition and cognitive disorders among older PLWH in the EECA region. This underscores the urgent need for well-designed, long-term studies, particularly those focused on ageing PLWH. Such research should prioritise culturally and linguistically appropriate assessments and rigorous reporting of findings to ensure the applicability and relevance of the data for both local and global contexts.

Acknowledgements The authors would like to express their gratitude to the MACS/WIHS Combined Cohort Study, Brooklyn Clinical Research Site, for their support made by the National Institutes of Health U01-HL146202. The authors also thank Hope Lappen, Life Sciences Librarian at New York University's Bobst Library, for her expert guidance in developing the search strategy for this review.

Contributors EI, DRG, DCO and MD designed the review and developed eligibility criteria. EI, DRG, MP and MD identified relevant studies. EI extracted the data. EI and DRG analysed and interpreted data. All other authors contributed to data interpretation. EI wrote the first draft of the article. All authors (EI, DRG, MP, DCO and MD) critically revised the article and approved the final version. EI is responsible for the overall content as a guarantor.

Funding The Fogarty International Center and the National Institute on Drug Abuse and Alcoholism under Award Number D43 TW011532 supported research reported

in this publication. DCO was funded, in part, by the Center for Drug Use and HIV Research (CDUHR); funded by the National Institute on Drug Abuse under award number P30DA011041.

Disclaimer The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. The data that support the findings of this scoping review are available from the corresponding author on reasonable request (esma.imeri@gmail.com).

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Esma Imerishvili <http://orcid.org/0000-0002-8512-0575>
Deborah R Gustafson <http://orcid.org/0000-0001-9556-8560>
Mamuka Djibuti <http://orcid.org/0000-0002-1614-854X>

REFERENCES

- 1 Smit M, Brinkman K, Geerlings S, *et al.* Future challenges for clinical care of an ageing population infected with HIV: a modelling study. *Lancet Infect Dis* 2015;15:810–8.
- 2 Negredo E, Back D, Blanco J-R, *et al.* Aging in HIV-Infected Subjects: A New Scenario and a New View. *Biomed Res Int* 2017;2017:5897298.
- 3 Alford K, Vera JH. Cognitive Impairment in people living with HIV in the ART era: A Review. *Br Med Bull* 2018;127:55–68.
- 4 Onen NF, Overton ET, Seyfried W, *et al.* Aging and HIV infection: a comparison between older HIV-infected persons and the general population. *HIV Clin Trials* 2010;11:100–9.
- 5 Nachega JB, Hsu AJ, Uthman OA, *et al.* Antiretroviral therapy adherence and drug–drug interactions in the aging HIV population. *AIDS* 2012;26:S39–53.
- 6 Cysique LA, Rourke SB. *Neurocognitive complications of HIV-infection: neuropathogenesis to implications for clinical practice*. Cham: Springer International Publishing, 20 May 2021. Available: <https://link.springer.com/10.1007/978-3-030-80759-7>
- 7 Mayston R, Kinyanda E, Chishinga N, *et al.* Mental disorder and the outcome of HIV/AIDS in low-income and middle-income countries: a systematic review. *AIDS* 2012;26:S117–35.
- 8 Brandt R. The mental health of people living with HIV/AIDS in Africa: a systematic review. *Afr J AIDS Res* 2009;8:123–33.
- 9 Nweke M, Mshunqane N, Govender N, *et al.* Impact of HIV-associated cognitive impairment on functional independence, frailty and quality of life in the modern era: a meta-analysis. *Sci Rep* 2022;12:6470.
- 10 Keng LD, Winston A, Sabin CA. The global burden of cognitive impairment in people with HIV. *AIDS* 2023;37:61–70.
- 11 Autenrieth CS, Beck EJ, Stelzle D, *et al.* Global and regional trends of people living with HIV aged 50 and over: Estimates and projections for 2000–2020. *PLoS One* 2018;13:e0207005.

- 12 McIntosh EC, Tureson K, Rotblatt LJ, *et al.* HIV, Vascular Risk Factors, and Cognition in the Combination Antiretroviral Therapy Era: A Systematic Review and Meta-Analysis. *J Int Neuropsychol Soc* 2021;27:365–81.
- 13 Nou E, Lo J, Grinspoon SK. Inflammation, immune activation, and cardiovascular disease in HIV. *AIDS* 2016;30:1495–509.
- 14 Lorkiewicz SA, Ventura AS, Heeren TC, *et al.* Lifetime marijuana and alcohol use, and cognitive dysfunction in people with human immunodeficiency virus infection. *Subst Abuse* 2018;39:116–23.
- 15 Triant VA. Cardiovascular disease and HIV infection. *Curr HIV/AIDS Rep* 2013;10:199–206.
- 16 Soliman EZ, Sharma S, Arastéh K, *et al.* Baseline cardiovascular risk in the INSIGHT Strategic Timing of AntiRetroviral Treatment (START) trial. *HIV Med* 2015;16:46–54.
- 17 Global prevalence and burden of HIV-associated neurocognitive disorder. *Neurology (Ecricon)* 2013. Available: <https://n.neurology.org/content/95/19/e2610.long>
- 18 Zipursky AR, Gogolishvili D, Rueda S, *et al.* Evaluation of brief screening tools for neurocognitive impairment in HIV/AIDS: a systematic review of the literature. *AIDS* 2013;27:2385–401.
- 19 Kamminga J, Cysique LA, Lu G, *et al.* Validity of cognitive screens for HIV-associated neurocognitive disorder: a systematic review and an informed screen selection guide. *Curr HIV/AIDS Rep* 2013;10:342–55.
- 20 UNAIDS. UNAIDS data 2023. Geneva Joint United Nations Programme on HIV/AIDS; 2023.
- 21 Fu L, Tian T, Wang B, *et al.* Global, regional, and national burden of HIV and other sexually transmitted infections in older adults aged 60–89 years from 1990 to 2019: results from the Global Burden of Disease Study 2019. *Lancet Healthy Longev* 2024;5:e17–30.
- 22 Pape U. HIV/aids politics and policy in Eastern Europe and Central Asia. In: *Oxford research encyclopedia of politics*. Oxford University Press, 2019. Available: <https://oxfordre.com/politics/view/10.1093/acrefore/9780190228637.001.0001/acrefore-9780190228637-e-1314>
- 23 Peters MD, Godfrey C, McInerney P, *et al.* Scoping reviews. In: Aromataris E, Lockwood C, Porritt K, *et al.*, eds. *JBI manual for evidence synthesis*. JBI, 2024. Available: <https://jbi-global-wiki.refined.site/space/MANUAL/355862497/10.+Scoping+reviews>
- 24 Tricco AC, Lillie E, Zarin W, *et al.* PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med* 2018;169:467–73.
- 25 Rethlefsen ML, Kirtley S, Waffenschmidt S, *et al.* PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews. *Syst Rev* 2021;10:39.
- 26 Goulas G. How can i cite covidence? 2022. Available: <https://covidence-knowledge-base.groovehq.com/help/how-can-i-cite-covidence>
- 27 Nuzhnyi EP, Brsikyan LA, FedotovaEy, *et al.* Cerebellar degeneration associated with HIV infection. *Z nevrologii i psikiatrii im SS Korsakova*. *Z Nevrol Psikhiatr Im SS Korsakova* 2023. Available: <http://www.mediasphera.ru/issues/zhurnal-nevrologii-i-psikhiatrii-im-s-s-korsakova/2023/5/1199772982023051123>
- 28 Belyaeva VV, Rutchkina YV, Pokrovsky VV. Phenomenology of Neuropsychological Deficiency in a Selected Population of HIV-Infected Individuals in Russia. *AIDS Patient Care* 1994;8:79–80.
- 29 Polyanskiy DA, Kalinin VV. Characteristics of psychopathological symptomatology in HIV-infection schizophrenic patients. *Z Nevrol Psikhiatr Im SS Korsakova* 2017;117:11.
- 30 Kim TW, Heeren TC, Samet JH, *et al.* Alcohol and falls among people with HIV infection: A view from Russia and the United States. *Alcohol Clin Exp Res* 2022;46:1742–52.
- 31 Belyaeva VV, Semenovich AV, Ruchkina EV, *et al.* Study of memory functions in males with AIDS. *Psikhologicheskii Zhurnal* 1994;128–30.
- 32 Grant I, Krupitsky E, Vetrova M, *et al.* Effects of Opioid Withdrawal on Psychobiology in People Living with HIV. *Viruses* 2024;16:92.
- 33 Gromova EA, Kataeva GV, Khomenko IG, *et al.* Psychic State and Cognitive Function in HIV-infected Patients and Functional State of the Brain Structures (According to Positron Emission Tomography and Magnetic Resonance Spectroscopy). *Clin Psychol (New York)* 2020;9:78–103.
- 34 BelyaevaVV, Semenovich AV, Rutchkina EV, *et al.* Clinico-experimental study of mental processes in men with HIV infection. *Vestn Ross Akad Med Nauk* 1992;31–2.
- 35 Laverick R, Haddow L, Daskalopoulou M, *et al.* Self-Reported Decline in Everyday Function, Cognitive Symptoms, and Cognitive Function in People With HIV. *J Acquir Immune Defic Syndr* 2017;76:e74–83.
- 36 Haddow LJ, Laverick R, Daskalopoulou M, *et al.* Multicenter European Prevalence Study of Neurocognitive Impairment and Associated Factors in HIV Positive Patients. *AIDS Behav* 2018;22:1573–83.
- 37 Mergenova G, Davis A, Gilbert L, *et al.* Mental health and cognition in relation to adherence to antiretroviral therapy among people living with HIV in Kazakhstan: a cross-sectional study. *J Int AIDS Soc* 2024;27.
- 38 Abdullayeva N, Mammadbayli A, Taghiyeva M. Anxiety, depression and neurocognitive disorder among HIV-infected people in penitentiary institutions of Azerbaijan. *Int J Prison Health* (2024) 2025;21:187–96.
- 39 Bolokadze N, Gabunia P, Ezugbaia M, *et al.* Neurological complications in patients with HIV/AIDS. *Georgian Med News* 2008;34–8.
- 40 Baliazhvili D, Imerlishvili E, Karaulashvili A, *et al.* Cardiovascular risk factors and cognitive performance among people living with HIV: cross-sectional study in the country of Georgia. *BMJ Open* 2025;15:e090918.
- 41 Chritinin DF, Novikov VV. Clinical features of exogenous organic mental disorders in patients with HIV infection. *Z Nevrol Psikhiatr Im SS Korsakova* 2016;116:17.
- 42 Dobrova-Krol NA, Ijzendoorn MH, Bakermans-Kranenburg MJ, *et al.* Effects of Perinatal HIV Infection and Early Institutional Rearing on Physical and Cognitive Development of Children in Ukraine. *Child Dev* 2020. Available: <https://srcd.onlinelibrary.wiley.com/doi/10.1111/j.1467-8624.2009.01392.x>
- 43 Deng L, Zhang X, Gao Y, *et al.* Association of HIV infection and cognitive impairment in older adults: A meta-analysis. *Ageing Res Rev* 2021;68:101310.
- 44 Mwangala PN, Newton CR, Abas M, *et al.* Screening tools for HIV-associated neurocognitive disorders among adults living with HIV in sub-Saharan Africa: A scoping review. *AAS Open Res* 2018;1:28.
- 45 Nyamayaro P, Chibanda D, Robbins RN, *et al.* Assessment of neurocognitive deficits in people living with HIV in Sub Saharan Africa: A systematic review. *Clin Neuropsychol* 2019;33:1–26.
- 46 Dreyer AJ, Nightingale S, Roux CL, *et al.* The relationship between psychosocial factors and cognitive test performance in a South African cohort. *Alzheimer's & Dementia* 2024;20.
- 47 Yechoor N, Towe SL, Robertson KR, *et al.* Utility of a brief computerized battery to assess HIV-associated neurocognitive impairment in a resource-limited setting. *J Neurovirol* 2016;22:808–15.
- 48 Robbins RN, Gouse H, Brown HG, *et al.* A Mobile App to Screen for Neurocognitive Impairment: Preliminary Validation of NeuroScreen Among HIV-Infected South African Adults. *JMIR Mhealth Uhealth* 2018;6:e5.
- 49 Käser M, Maure C, Halpaap BMM, *et al.* Research Capacity Strengthening in Low and Middle Income Countries - An Evaluation of the WHO/TDR Career Development Fellowship Programme. *PLoS Negl Trop Dis* 2016;10:e0004631.