


Prevalence, assessment and correlates of mental health problems in neglected tropical diseases: a systematic review

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Neglected tropical diseases (NTDs) are a group of disease conditions that affect the world's poorest people in low- and middle-income countries. NTDs are associated with negative behavioural experiences, including discrimination, rejection and stigmatization, that predisposes those affected to mental health problems. Consequently, researchers have shown profound interest in elucidating the mental health burden associated with NTDs. To address pertinent issues in the burgeoning literature relating to the prevalence, assessment and correlates of mental health problems in NTDs, a systematic review methodology was used. Underpinned by the PRISMA guidelines, a search was conducted of electronic databases, individual journals and bibliographies for articles that were screened and subjected to predetermined inclusion and exclusion criteria. Sixteen articles from African, Asian and South American countries were included in the review. Depression was the most widely investigated mental health issue, followed by stress and anxiety, with prevalence estimates of 7–54%, 8–43% and 19–53%, respectively. The PHQ-9 and GAD-7 and Self-Reporting Questionnaire were the most widely administered mental health screening tools. The major correlates of mental health problems are lower education and economic status and female gender. We recommend multisectoral and multilayered mental health and related interventions to address the increasing burden of mental health in NTDs.

Les maladies tropicales négligées (MTN) sont un groupe de maladies qui affectent les populations les plus pauvres du monde dans les pays à revenus faibles ou intermédiaires. Les MTN sont associées à des expériences sociales négatives, notamment la discrimination, le rejet et la stigmatisation, qui prédisposent les personnes touchées à des problèmes de santé mentale. C'est pourquoi les chercheurs ont manifesté un intérêt conséquent pour l'étude des problématiques de santé mentale pour les patients atteints de MTN. Pour répondre aux questions pertinentes soulevées par la littérature concernant la prévalence de ces 'doubles pathologies', l'évaluation et les corrélats des problèmes de santé mentale chez ces patients, une méthodologie d'examen systématique a été utilisée. Une recherche a été effectuée à partir de bases de données électroniques, sur la base des directives PRISMA, et de publications et bibliographies pour les articles qui ont été sélectionnés et soumis à des critères d'inclusion et d'exclusion prédéterminés. Seize (16) articles provenant de pays d'Afrique, d'Asie et d'Amérique du Sud ont été inclus dans l'étude. La dépression est le problème de santé mentale le plus étudié, suivie par le stress et de l'anxiété, avec des estimations de prévalence allant de 7% à 54%, 8% à 43% et 19% à 53%, respectivement. Le PHQ-9, le GAD-7 et le questionnaire d'auto-évaluation sont les outils de dépistage de pathologies mentales les plus utilisés. Les principaux corrélats pouvant expliquer les problèmes de santé mentale chez les personnes atteintes de MTN sont : un niveau d'éducation et un statut économique inférieurs, ainsi que le genre. Nous recommandons des interventions multisectorielles en matière de santé mentale et des interventions connexes pour faire face au fardeau croissant de la santé mentale dans les MTN, dans le contexte de leur lien avec des pathologies mentales diverses.

Las enfermedades tropicales desatendidas (ETD), son un grupo de enfermedades que afectan a las personas más pobres del mundo en países de renta baja y media. Las ETD se asocian a experiencias negativas de comportamiento, como la discriminación, el rechazo y la estigmatización que predisponen a las personas afectadas a sufrir problemas de salud mental. En consecuencia, los investigadores han demostrado un profundo interés en dilucidar la carga de salud mental asociada a las ETD.

Para abordar las cuestiones pertinentes en la creciente literatura relativa a la prevalencia, evaluación y correlatos de los problemas de salud mental en las ETD, se utilizó una metodología de revisión sistemática. Siguiendo las directrices PRISMA se realizó una búsqueda en bases de datos electrónicas, revistas individuales y bibliografías de artículos que se examinaron y sometieron a criterios de inclusión y exclusión predeterminados.

En la revisión se incluyeron dieciséis (16) artículos de países africanos, asiáticos y sudamericanos. Se pudo evidenciar que la depresión fue el problema de salud mental más investigado, seguido del estrés y la ansiedad, con estimaciones de prevalencia que oscilaban entre el 7% al 54%, del 8% al 43% y del 19% al 53%, respectivamente. El PHQ-9 y el GAD-7 y el Cuestionario de Autoinforme fueron los instrumentos de cribado de salud mental más utilizados.

Los principales correlatos de los problemas de salud mental fueron un nivel educativo y económico más bajo y el sexo femenino. Se recomiendan intervenciones multisectoriales y a varios niveles en materia de salud mental y otras afines para hacer frente a la creciente carga de salud mental en las ETD.

Keywords: anxiety, depression, mental health, neglected tropical diseases, prevalence.

Introduction

Neglected tropical diseases (NTDs) are heterogeneous disease conditions that disproportionately affect disadvantaged and poor people in low- and middle-income countries (LMICs). NTDs such as leprosy and cutaneous leishmaniasis are commonly termed skin NTDs, not only because they are visible on the skin, but also because they disfigure different exposed parts of the body, culminating in troublesome and unsightly changes¹ that in some instances last even after treatment.² While persons with skin NTDs look distinctively different from other community members, their plights are further worsened by the misconceptions and beliefs about the causes of these diseases, which are often situated within a demonology framework that encompasses witchcraft, ancestral curse and/or punishment from God.³ The rejection, discrimination and stigmatization experiences can cause persons with NTDs to suffer from mental health problems. The presence of mental health problems further exacerbates negative experiences such as stigmatization, leading to a vicious cycle. Despite the plethora of risk factors, the overall burden of mental health problems in NTDs has not been granted the requisite attention, due partly to the late recognition of the interrelationship between these conditions.^{4,5} In fact, until recently there was near neglect of mental health issues associated with NTDs compared with efforts devoted to the control, prevention and elimination of NTDs.⁵

Supported by the growing literature, several reviews have been undertaken on NTDs, addressing a myriad of issues including mental health, stigma and quality of life (QoL).⁶⁻¹² These studies have offered some useful insights regarding the psychosocial burden associated with NTDs. However, the literature appears to lack a clear-cut discussion of the mental health burden of NTDs. For example, in terms of assessment, previous reviews have included measures that were not designed specifically to assess mental health issues. In their review of mental health and stigma in NTDs, Koschorke et al.¹⁰ included studies that used components

of QoL to index mental well-being. From a clinical and epidemiological research perspective, QoL measures cannot be substituted for measures of mental health and psychological well-being, as they are not designed to be sensitive to mental health symptoms, compared with mental health-specific measures such as the Patient Health Questionnaire.¹³

The increasing recognition of mental health problems associated with NTDs calls for reviews to take stock of the literature to understand the characteristics of existing studies focusing specifically on mental health problems. This systematic narrative review is filling this significant void in the literature by addressing some salient and critical issues. The first relates to the predominant mental health issues investigated in NTDs. Mental health problems are heterogeneous and diverse, yet it is not clear which ones have dominated the NTD literature in recent years. Although previous reviews have provided initial evidence on the prevalence of mental health burden in NTDs, the focus was restricted mostly to leprosy, podoconiosis and lymphatic filariasis.^{11,12} Recent additions to the list of NTDs, such as scabies and snakebites, have not been granted sufficient attention in recent reviews. Thus it is unclear how mental health problems are distributed across other NTD categories. Health professionals with this knowledge would be more empowered to dedicate limited resources to profiling, screening and addressing the most pressing mental health issues in NTDs. One of the comprehensive reviews undertaken by Koschorke et al.¹⁰ on mental health and NTDs was limited to studies conducted in 2018 or earlier. The omission of recent studies in the review may limit discussions relating to the distribution and prevalence of mental health issues.

Our review is intended to update the literature to address this significant gap. Similarly, there is no integrated information relating to the strategy and measures used to identify mental health problems in NTDs. That is, there are limited data on whether self-reports, professional-assisted assessments or both are used, the tools used to determine mental health problems, the extent of use and how they are used. This insight is necessary to guide

future research and practice in terms of the choice of assessment tools for mental health problems.

Lastly, the integration of data on the factors influencing the burden of mental health problems in NTDs is limited, with initial work dedicated to individuals affected by leprosy and their family members¹² or restricted to studies conducted in 2018 or earlier and does not include recent additions to the NTDs list.¹⁰ Within the population of persons with NTDs, there could be possible differences in vulnerability to mental health problems, based on several factors including demographic characteristics, necessary to streamline research and practice decision making and interventions. This review was undertaken to address the above topical issues to obtain the needed evidence to guide future efforts to delineate the scope and extent of mental health research among NTD populations as the field continues to evolve.

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines underpinned the study.¹⁴ Articles were obtained by conducting a search in electronic databases such as PubMed, Scopus and research registers, including the Cochrane Register and specific journals (PLoS One), using database-specific search terms and strategies. For PubMed, the search terms were 'Mental Health'[Mesh] OR 'Mental health'[tw] OR 'Mental wellbeing'[tw] OR 'Psychological wellbeing'[tw] OR 'Depress*[tw] OR Anxiety[tw] OR 'Mental disorder*[tw] OR 'Psychological disorder*[tw] OR 'Mental illness*[tw] OR 'Psychological distress'[tw] OR 'Mental distress'[tw] OR 'Emotional distress'[tw] AND 'Neglected Diseases'[Mesh] OR 'Neglected tropical disease*[tw]'. The above search strategy was modified for other databases. The search was conducted from 2003 to March 2023 to obtain an understanding of current developments in the literature. We also scanned the reference lists of retrieved documents for additional articles. To be included in the review, articles must be published in English, focused on one or more gaps identified in the literature (e.g. prevalence and/or correlates of mental health problems) using data from persons with NTDs, regardless of geographical location and must be available online. We excluded reviews, opinion/discussion papers and papers that adopted qualitative methodology.

Results

A summary of the search and screening processes is illustrated in Figure 1. A total of 16 articles were included in the review. The study characteristics are summarized in Table 1. As can be seen, all the studies originated from LMICs, addressing mental health issues in a range of NTDs. Half of the studies originated from African countries,^{15–22} followed by Asia (n=5),^{23–27} South America (n=2) and the Middle East (n=1).^{28–30} The next sections were organized along the above research gap.

Commonly investigated mental health problems in NTDs

About 81% (n=13) investigated one or more mental health issues in NTDs. Specifically, four studies (30.77%) investigated one

mental health issue, while the remaining focused on two or more mental health issues. Across the studies, depressive symptoms, anxiety and stress, comprising post-traumatic stress disorder (PTSD), were the most widely investigated (n=19). Depression ranked highest in terms of the number of times it was investigated, representing 52.63% (n=10), followed by stress (n=5 [26.32%]) and anxiety (n=4 [21.05%]).

Prevalence of mental health problems in NTDs

A total of 13 studies (81.2%) provided data on the prevalence of mental health problems in NTDs. For depression, the prevalence estimates ranged from 7% among persons with past infection of Buruli ulcer¹⁶ to 54% in patients with snakebite envenoming.²⁴ In terms of severity, Obindo et al.²¹ found that 41%, 31.6% and 26.3% of persons with lymphatic filariasis in Nigeria had mild, moderate and severe depressive symptoms, respectively. Relatedly, Bow-Bertrand et al.²⁷ reported that 44% and 53% of persons with leprosy in Bangladesh endorsed mild and moderate–severe depression, respectively.

The prevalence of anxiety symptoms was reported to range from 19% in persons with leprosy in India²⁶ to 52.9% in persons with snakebite in Bangladesh.²⁵ In terms of stress, the prevalence of PTSD reportedly ranged from 8% among snakebite patients in Iran²⁸ to 43% in Nigeria.¹⁸ On the other hand, acute stress symptoms were endorsed by 36% of patients who suffered from snakebite in Iran.²⁸ The prevalence of non-specific mental health problems ranged from 26% in persons with cutaneous leishmaniasis in Colombia³⁰ to 80% in snakebite patients in Nigeria.¹⁸

Commonly used mental health assessment measures

Different measures were used to screen for or diagnose specific and/or general mental health problems in the study participants. For depression, the 9-item Patient Health Questionnaire (PHQ-9) was the commonly used assessment measure (n=6). The Beck Depression Inventory (BDI; n=1) and the depression subscales of the Hospital Anxiety and Depression Scale (HADS; n=1) and Composite International Diagnostic Interview (CIDI; n=1) were rarely used. For the PHQ-9, the cut-off for depression prevalence was a score ≥ 5 ,^{15,17,20,22,27} or ≥ 10 ,²⁶ whereas for the BDI, a score ≥ 14 ²⁴ was used.

Anxiety symptoms were measured using the 7-item Generalized Anxiety Disorder scale (GAD-7)²⁷ and the anxiety subscale of the HADS.¹⁶ Stress, namely acute stress disorder (ASD) and PTSD, was assessed using the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)²⁸ and self-report measures. The self-report measures were the Posttraumatic Checklist, with a cut-off of ≥ 35 ,¹⁸ and the PTSD self-report, with a cut-off of ≥ 20 .²⁴ ASD and PTSD were both evaluated using the DSM-IV-TR diagnostic criteria.²⁸ General mental health issues were assessed using the 12-item General Health Questionnaire (GHQ-12), Self-Reporting Questionnaire (SRQ) and 10-item Kessler scale.

Correlates of mental health problems

Twelve studies (75%) investigated the correlates of mental health problems in different types of NTDs. A critical examination

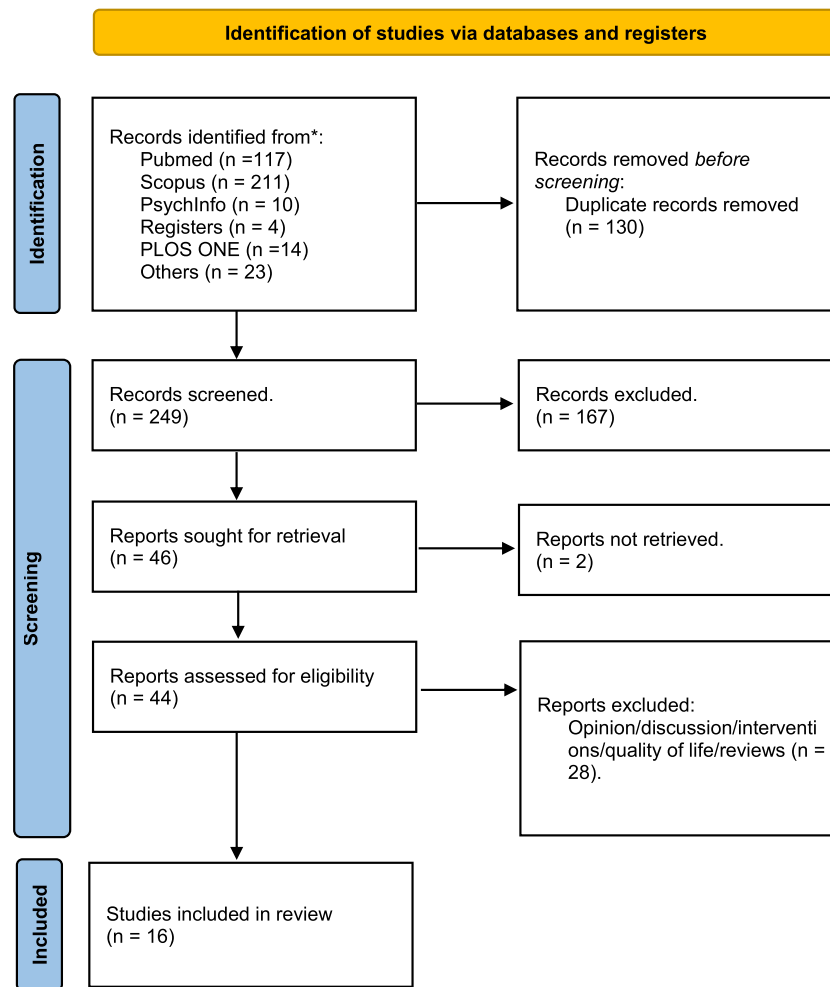


Figure 1. Schematic representation of the systematic review of research on NTDs and mental health.

revealed that the correlates appear similar, regardless of the type of NTD. These include lower education, poverty/low economic status, female gender and varying levels of disability and functional impairment.

Discussion

This article synthesized the literature on mental health issues in NTDs. Consistent with expectations and previous studies,^{10–12} the review found evidence for mental health issues among persons living with NTDs. The studies included in this review focused primarily on three common mental health issues, namely depression, anxiety and stress, comprising acute stress and PTSD. Together, these represent the most common mental health issues reported globally among persons with physical disease conditions.^{10–12,31} In keeping with previous reviews focusing on individuals with NTDs,^{10,11} depressive symptoms emerged as the most investigated mental health issue, followed by anxiety and stress. The data on prevalence revealed quite an alarming mental health burden in NTDs. For instance, depression was estimated to

be as high as 54%, while anxiety and stress have been found to affect 52% and 43% of persons with NTDs, respectively.

Although discussions regarding the seemingly high mental health burden are beyond the scope of this review, it is important to reiterate that, like other disease conditions, NTDs are characterized by stressful experiences, including those relating to the processes of seeking treatment and dealing with the negative attitudes and perceptions of community members towards NTDs. As noted previously, these include the that persons with NTDs are being punished for committing heinous sins or immoral activities or are possessed by evil spirits/demons.³ These stressors, coupled with uncertainties relating to, for instance, the availability and outcome of treatment, could provide fertile ground for the manifestation of depressive tendencies and other mental health issues. Other notable mental health-inducing factors are physical and bodily changes associated with skin NTDs, discrimination and stigmatization.^{3,32} In addition to the above risk factors, the review found that the vulnerability of persons with NTDs to mental health issues is heightened by certain demographic factors. For example, female gender, poverty and low education emerged as significant risk factors for mental health issues. This

Table 1. Summary of Characteristics of studies that investigated mental health issues in NTD

Author, year	Country	Disease condition (sample size)	Design	Recruitment place	Mental health problem and assessment	Prevalence	Correlates of mental health problem	Main findings/recommendations
Tsutsumi et al., 2007 ²³	Bangladesh	Leprosy (189)	Cross-sectional	Healthcare setting	Mental health problems: SRQ	-	Not investigated	Provide mental health interventions to leprosy patients
Williams et al., 2011 ²⁴	Sri Lanka	Snakebite (88)	Cross-sectional	Research database	Depression: modified BDI; PTSD: PTSD scale	Depression: 54%; PTSD: 21.6%	PTSD predicts depression	Mental health burden persists several years after snakebite
Khosrojerdi and Amini, 2013 ²⁸	Iran	Snakebite (53)	Longitudinal	Healthcare setting	Acute stress disorder and PTSD: SCI questionnaire	Acute stress: 36%; PTSD: 8%	Female gender, younger age	Snakebite is traumatic and causes stress; snakebite victims need mental health support
Mousley et al., 2015 ¹⁹	Ethiopia	Podoconiosis (346)	Cross-sectional	Community	Mental distress: Kessler-10 scale	-	Income, gender, alcohol use, age, place of residence, family history of mental illness	Integrate psychosocial care into management of podoconiosis
Bartlett et al., 2016 ¹⁷	Ethiopia	Podoconiosis (271)	Cross-sectional	Community	Depression: PHQ-9	Depression: 12.6%	Older age	Integrate evidence-based treatments into podoconiosis interventions
Obindo et al., 2017 ²¹	Nigeria	Lymphatic filariasis (98)	Cross-sectional	Healthcare setting	Depression: PHQ-9 and depression module of CIDI	Depression: overall 20%, mild 4.1%, moderate 31.6%, severe 26.3%	History of mental illness, longer illness duration, unemployment, low self-esteem	Interventions to address emotional or mental health burden of lymphatic filariasis
Muhammed et al., 2017 ²⁰	Nigeria	Snakebite (187)	Cross-sectional	Healthcare setting	Depression: PHQ-9	25%	Worry about family welfare, financial loss, history of snakebites, lower income	Train health professionals to recognize mental health problems

Table 1. Continued

Author, year	Country	Disease condition (sample size)	Design	Recruitment place	Mental health problem and assessment	Prevalence	Correlates of mental health problem	Main findings/recommendations
Islam et al., 2018 ²⁵	Bangladesh	Snakebite (121)	Cross-sectional	Healthcare setting	Mental health disorders	Anxiety:52.9%; depression:33.9%; PTSD: 27.3%	Not investigated	Integrate mental health care into management of snakebite patients
Fischer et al., 2019 ²⁹	Colombia	Leprosy and leishmaniasis (55)	Cross-sectional	Patient register	Mental health problems: SRQ	-	Not investigated	SRQ is a valid tool for routine screening
Gómez et al., 2019 ³⁰	Colombia	Leprosy (106), cutaneous leishmaniasis (98), Chagas disease (100)	Cross-sectional	Patient register	Mental health problems: SRQ	Leprosy: 49%; Chagas: 50%; cutaneous leishmaniasis: 26%	Lower education, residence in rural areas	Rural residence and low education impact mental health problems
Semrau et al., 2019 ²²	Cameroon	Podoconiosis (52)	Cross-sectional	Community	Depression: PHQ-9	Podoconiosis: 38.6% register ≥mild depressive symptoms	Unemployment	Unemployed people more depressed; PHQ-9 not validated in study setting
Ali et al., 2020 ¹⁵	Ethiopia	Lymphoedema due to podoconiosis and lymphatic filariasis and leprosy (251)	Cross-sectional	Healthcare and community	Depression: PHQ-9	Moderate to severe 47.4%	Disability, age, sex, education status, employment status, marital status, social support, income	Depression is associated with lymphoedema due to NTDs

Table 1. Continued

Author, year	Country	Disease condition (sample size)	Design	Recruitment place	Mental health problem and assessment	Prevalence	Correlates of mental health problem	Main findings/recommendations
Amodoko et al., 2021 ¹⁶	Ghana	Buruli ulcer (active infection, 26; past infection, 29)	Case-control	Clinics and communities	Mental distress: SRQ; anxiety & depression: HADS	Mental distress: active cases 26%, past infection 29%; depression: \geq mild symptoms 27% of active infections and 7% of past infections; anxiety: 42% of active infections and 20% of past infections	Limitations in clothing and personal care, limitations in movement	Integrate psychosocial interventions into Buruli ulcer management programs
Govindasamy et al., 2021 ²⁶	India	Leprosy (220)	Cross-sectional	Patient and community register	Depression: PHQ-9; anxiety: GAD-7	Depression: 33%; anxiety: 19%	Female gender, presence of disability, low income, lower education	Low education and income increase the risk for depression and anxiety; include mental health support into care systems
Habib et al., 2021 ¹⁸	Nigeria	Snakebite (140)	Retrospective cohort	Healthcare setting	Mental health problem: GHQ-12; PTSD: Posttraumatic checklist	GHQ-12: 80%; PTSD: 43%	Not investigated	Mental health burden constitutes a chronic burden
Bow-Bertrand et al., 2019 ²⁷	Bangladesh	Leprosy	Cross-sectional	Community	Depression: PHQ-9; anxiety: GAD-7	Depression: mild 44%, moderate-severe 53%; anxiety: moderate 37%, severe 37%	High levels of disability, gender (being a woman), low education, economic dependence	Integrate mental healthcare into leprosy management

observation is largely consistent with extant literature on the risk and protective factors of poor mental health, underpinned by the Social Determinants of Mental Health framework.³³

Similar mental health issues have been reported across different types of NTDs, although PTSD is associated more with snake envenoming partly because snake attacks can create episodic memories that can be re-experienced.^{24,25,28} More importantly, the different phases of NTDs, such as active infection and healed phases, are associated with mental health issues. That is, mental health problems are not limited to the active phase of an NTD, but also can be experienced several years after the infection,²⁴ although at a decreasing rate.¹⁶

Of importance is how mental health problems have been recognized in the NTD population. As noted previously, about 90% of the studies included in the review used mental health screening measures such as the PHQ-9 and GAD-7. These measures are widely used in the mental health literature, with robust and sound psychometric properties in different populations. The main caveat, however, relates to the observation that they have not been validated in the NTD population. The insight that population characteristics can affect responses to study measures has motivated validation studies of screening measures in different populations.^{34,35} Thus, while the relatively high prevalence of depressive symptoms, anxiety and stress in persons with NTDs could reflect the mental health burden in this population, it could also be due to the artifact of the screening tools. The SRQ, developed by the World Health Organization (WHO), screens for the presence of mental disorders in patients contacting primary health-care providers.³⁶ Although the 20-item SRQ is reportedly sensitive to cultural and language differences,¹⁶ it has not been validated for use in persons with skin NTDs. Each of the SRQ items is scored dichotomously: 0 (symptom absent) and 1 (symptom present), with higher scores, i.e. >8, indicating greater mental distress.³⁷ However, a cut-off score of 5 was used among the NTD population,¹⁶ while others did not specify the cut-off point used to determine general mental health problems.^{23,30}

Clinical implications of the review

The review points to the need to provide mental health and psychosocial services to improve the mental well-being of persons suffering from NTDs. Integrating mental healthcare into primary and community care of persons with NTDs is critical to providing and achieving holistic care. The challenge, however, relates to the few professionals and resources for mental health services in settings primarily affected by NTDs. In recognition of this profound gap, the task-sharing/-shifting model proposed by the WHO, is recommended to empower health professionals with no/limited background in mental health to deliver basic mental health and psychosocial support to health service users. This is anchored in several core international agreements and frameworks, such as the WHO Roadmap on Neglected Tropical Diseases 2021–2030, WHO Mental Health Action Plan 2013–2030, WHO Mental Health Gap Action Programme and WHO QualityRights initiative.³⁸ Healthcare system strengthening for integrated care requires training and capacity-building programs for health professionals in core areas such as screening and provision of basic and culturally sensitive psychosocial/mental health interventions and referrals. Guidelines containing and providing instructions on using

mental health resources and tools (e.g. screening tools) would strategically support and streamline efforts to provide integrated care at the primary and community levels to persons with NTDs.

Recommendations for future research

Establishing psychometric equivalence for mental health screening measures in NTDs is highly recommended. Individuals with NTDs have comparatively poor backgrounds that may not only exacerbate their mental health challenges, but could exert some influence on the screening and identification of mental health problems. It is highly recommended that validation studies be conducted to determine the psychometric appropriateness of the commonly administered mental health assessment tools. These tools are important in the call to health professionals to integrate mental healthcare into primary and community care of persons with NTDs under the task-shifting framework.³⁹ A simple screening tool that is easy to administer and score would lessen the burden of integrated care by reducing the time spent administering mental health measures. The low education background of persons with NTDs makes interviewer-administered assessment of mental health problems necessary, as opposed to self-reports. This observation provides impetus for calls to develop/adapt and validate screening measures with few items, similar to the UK's National Institute for Health and Care Excellence recommendation to improve perinatal mental health.⁴⁰

Focussing on depression, anxiety and stress would largely streamline and direct clinical care and investigations into mental health issues. For instance, guided by the above findings, clinicians could integrate depression, anxiety and stress screening tools into their assessment measures, allowing for a more focused profiling to inform dedicated mental health service delivery. This can be important in low-resource settings or instances where health professionals have limited time to address mental health issues in the NTD population. However, the current literature is skewed, depriving the research community and practitioners of knowledge of mental health issues associated with NTDs beyond depression, anxiety and stress. There is an urgent need to expand the scope of the mental health literature by incorporating a wide range of assessment tools to detect subtypes of mental health issues in the NTD population.

An overwhelming number of studies have adopted a cross-sectional survey design, providing snapshot data on the mental health situation in NTDs. This has partly affected our understanding regarding the characteristics and evolution of mental health issues in NTDs, including the factors influencing changes in mental health status across time. Understanding the risks and protective factors at different points in the NTD trajectory is critical to designing intervention programming to address the mental health burden at different time points, while offering enormous opportunity for research to interrogate the nature and dynamics of the risks and protective factors. Methodological designs, including a longitudinal design, that enable researchers to investigate the temporality of behaviours are highly recommended.

Lastly, the existing research has focused on skin NTDs to the apparent neglect of non-skin NTDs. Although non-skin NTDs are not accompanied by observable physical deformities or changes, they have the tendency to induce mental health issues. The severe joint and muscle pain associated with dengue fever, the

abdominal discomfort that characterizes hookworm infestation and schistosomiasis-induced blood in the urine could predispose infected persons to mental health issues. Future research should focus on people with non-skin NTDs so that they do not suffer double agony by being excluded from mental health intervention programming, in addition to their near neglect in the global health agenda.

Conclusions

The review found evidence of significant mental health challenges associated with NTDs. Depression, stress and anxiety were widely reported among people suffering from NTDs. The risk is reportedly high among those with lower educational and income status and female gender. Thus the review calls for dedicated and concerted effort to increase our understanding of critical areas relating to NTDs and mental health, and more importantly, to institute interventions aimed at delivering mental health services as part of the suite of healthcare services available to people with NTDs. These collective efforts would contribute to the global effort to manage the burden associated with NTDs.

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