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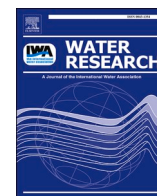
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Making Waves

Making waves: Mental health impacts of inadequate drinking water services — From sidenote to research focus

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ABSTRACT

The paramount significance of the harmful impacts of poor drinking water services on physical health have been recognized for decades. Besides, over the past twenty years, an additional body of literature on their negative mental health impacts has emerged. With this brief review, we summarise the findings of the scholarship to advance addressing overall health (physical, mental, and social) in the water sector. We furthermore review the key policy documents of this field with a focus on mental health aspects and give recommendations for practitioners and decision-makers on addressing mental health in water service delivery.

We reviewed the existing published works (42) assessing psychological impacts of deficient drinking water services in low-income settings. We then identified and compared the different mechanisms causing negative mental health outcomes described in them. For these purposes, we used a water insecurity experience -model and the vulnerability-stress model of clinical psychology. Next, we probed key international and national guiding documents of the water sector to analyse how mental health issues resulting from poor services are addressed today.

We found that according to the literature, poor quality and quantity of water was predictably one of the most important psychosocial stressors to users. Surprisingly, however, various kinds of water-service-related inequalities (e.g. between genders, communities or socio-economic groups) showed up as equally significant stressors. Our analysis with the vulnerability-stress model furthermore indicates that insufficient drinking water services may predispose to common mental disorders particularly through external stress.

Existing field guidelines have evolved to highlight the values of non-discrimination and participation, whilst mental health aspects remain ignored. This should not be the case. Therefore, practices for addressing mental health effectively in documentation and water service development should be further researched. But already in the light of the existing literature, we urge stakeholders to focus more on the negative mental health impacts of unequal service provision for users and nearby people left without improved services.

1. Mental health — emerging concern in water sector

Drinking water interventions aim ultimately at promoting human health and wellbeing. Reduction of waterborne diseases, especially diarrhoea, has typically been the focus of these projects while mental health has received significantly less attention. However, in the [Constitution of the World Health Organization \(1948\)](#), health is defined as “a state of complete physical, mental and social wellbeing”. Thus, physical health and disease prevalence alone are insufficient indicators of human health. Mental health is also an integral part of the Sustainable Development Goal 3 regarding “Good Health and Wellbeing” ([UN, 2015](#)).

During the past two decades, several studies have reported negative mental health outcomes of inadequate drinking water services. These outcomes include for example concerns on water scarcity and perceiving water service unfairness ([Bisung and Elliott, 2017a](#); [Wutich et al., 2020](#)). Furthermore, there is evidence that water insecurity predisposes to common mental disorders ([Aihara et al., 2016](#); [Boateng et al., 2022](#); [Brewis et al., 2019a](#); [Cooper-Vince et al., 2018](#); [Mushavi et al., 2020](#); [Simiyu et al., 2022](#); [Workman and Ureksoy, 2017](#)). As conventional water interventions are primarily designed to promote physical health, they do not necessarily aim at reducing psychosocial distress ([Stevenson et al., 2016](#); [Thomas and Godfrey, 2018](#)). Mental disorders may moreover reduce the ability to benefit from improved drinking water services

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(Slekiene and Mosler, 2019). Therefore, a broad understanding of drinking-water-service-related psychosocial distress and mental disorders is a necessary precondition for developing services that consider the mental health of their customers.

The terms “drinking water project” and “intervention” are used interchangeably in water research, and they commonly refer to improvement or protection of drinking water sources and distribution compared to a certain target level. Those target levels are often determined based on global guidelines and principles including Sustainable Development Goals, the Joint Monitoring Program (JMP) service ladder (WHO and UNICEF, 2018) and United Nations’ resolution on Human Rights to Water and Sanitation (OHCHR et al., 2010). Along with global guidelines, national water strategies set the targets of the projects. Current research does not report whether the guiding documents address psychosocial distress caused by poor or unequal services.

In this paper, we present a brief overview of all the published scientific literature on inadequate drinking water services and mental health and compare the severity of drinking-water-service-related psychosocial stressors. Furthermore, we address the connection between these stressors and diagnosable mental disorders in context of the vulnerability-stress model of clinical psychology and psychopathology. Finally, we assess the guidance given by global and regional documentation on adequate drinking water services in regard to mental health and wellbeing. Based on our findings, we propose improvements for the contextualisation, documentation, and the implementation of drinking water projects.

2. Comparing psychosocial stressors is the key

Despite the recent emergence of related literature, the volume of research on water and mental health is still rather limited and the causality between inadequate drinking water services and psychosocial distress has not been thoroughly addressed. Regardless of the lack of evidence of the causal connection, several studies argue for negative mental health outcomes of water insecurity (e.g., Bisung and Elliott, 2017a; Wutich et al., 2020). In their case studies, Stevenson et al. (2016) as well as Thomas and Godfrey (2018) found that access to improved water sources did not reduce the distress related to inadequate drinking water services. These results indicate that psychosocial distress is not always related to the quality, quantity, and distribution of clean drinking water, but rather to more abstract dimensions of water insecurity such as unfairness, unpredictability, and social tensions regarding water supply.

Over the past two decades, not more than two review articles have focused on collecting the research on water and mental health and classifying different water-related stressors. In their scoping review, Bisung and Elliott (2017a) divided water-related stressors into four different subcategories including financial stressors, those related to physical access, social stressors and the ones related to perceived inequalities. Wutich et al. (2020) in turn used more precise classification by identifying seven stressors related to material deprivation, physical health, shame, lost opportunities, conflicts, and inequality. Along with the two articles, Brewis et al. (2020) and Wutich et al. (2022a) discuss mental health in their review type articles on biocultural studies of household water insecurity and water insecurity in U.S. colonias communities along the Mexico border. All these works are fundamental conversation-starters, but do not compare stressors to provide practitioners or decision-makers practical insight into which ones to primarily focus on. With limited intervention funds, all psychosocial aspects cannot be considered, and some prioritisation is necessary. For this pragmatic purpose, we have written up this brief review.

Applying the framework of Wutich et al. (2020), we identified six psychosocial stressors related to inadequate drinking water services. This paper compares the significance of these stressors in relation to literature on mental health impacts of inadequate drinking water services. We aimed at compiling the complete English language scholarship

on the topic. Studies addressing only sanitation and hygiene services were excluded as we focus solely on drinking water services. Secondly, the scope of this paper is restricted to low and lower middle-income settings in which water insecurity is a daily challenge. Therefore, studies on psychosocial impacts of single water crises or natural disasters were not included in our selection. Thirdly, studies focusing primarily on water-related behaviour or behaviour change were left out. Finally, the four aforementioned review type articles (Bisung and Elliott, 2017a; Brewis et al., 2020; Wutich et al., 2022a, 2020) were excluded because they mainly summarise the existing literature.

Using a Scopus search, we identified all related literature using the search term “water” combined with the following mental health describing terms: “mental”, “feel-”, “stress-”, “distress-”, “insecur-”, “psycho-”, “emotion”, “anxi-”, “depress-”, “worr-”, “fear”, “angr-/anger”, “sad-” and “frustrat-”. The terms were searched by article title. To reduce the enormous amount of search results, we excluded unrelated articles by using Boolean operators with some frequently appearing unrelated search words. To ensure no relevant articles were removed, we compared the search results to a manually compiled list of 27 key articles. The yielded search results (1189 articles) were processed with the above-mentioned relevance criteria by two independent researchers to reduce bias, as suggested by Xiao and Watson (2019). In cases of disagreement, consensus was reached via discussion. Based on article titles and abstracts, the number of articles was narrowed down to 54 articles. Based on the whole texts, we eventually kept 40 articles. Furthermore, the set of articles was completed with two articles from the manually compiled list that were not available in the Scopus database. The final set of 42 articles is presented in Fig. 1.

Worries regarding drinking water scarcity, service costs and water-borne diseases are predictably relatively common in water-scarce regions (material deprivation & physical health in Fig. 1). Nevertheless, several studies argue that quantity and quality of available drinking water alone are rather weak predictors of mental health impacts of drinking water services (Brewis et al., 2021; Maxfield, 2020; Wutich and Ragsdale, 2008). Fig. 1 shows that inequality is the most frequently mentioned psychosocial stressor in studies addressing drinking water and mental health (inequality in Fig. 1). The finding is surprising as physical needs are almost invariably set above psychosocial needs when addressing wellbeing. However, the importance of each psychosocial stressor varies significantly based on the state of drinking water services as well as general living conditions (Rosinger et al., 2021; Wutich et al., 2013). Furthermore, in their study Wutich et al. (2020) emphasise that the psychosocial stressors tend to affect mental health interactively rather than independently. For example, perceived unfairness can cause conflicts and reinforce the experience of shame. Physical needs should therefore not be substituted but complemented with psychosocial ones when improving drinking water services.

3. From psychosocial stress to mental disorders

The articles analysed above (Fig. 1) focused commonly on general psychosocial stress instead of mental disorders. Some studies have however found evidence of the relationship between inadequate drinking water services and common mental disorders such as depression and anxiety (Aihara et al., 2016; Boateng et al., 2022; Brewis et al., 2019a; Cooper-Vince et al., 2018; Mushavi et al., 2020; Simiyu et al., 2022; Workman and Ureksoy, 2017). Furthermore, the need to differentiate acute and chronic mental health impacts of water insecurity has been identified in some studies (Bisung and Elliott, 2017a; Wutich and Ragsdale, 2008). All in all, the risk for mental disorders appears to be especially significant in materially deprived areas but they often remain underdiagnosed (Matlala et al., 2018; Rathod et al., 2017). Although improvements in drinking water sources and distribution would reduce psychosocial stress, they do not necessarily affect chronic mental health outcomes. Thus, the potential relationship between inadequate drinking water services and mental disorders should be addressed applying a

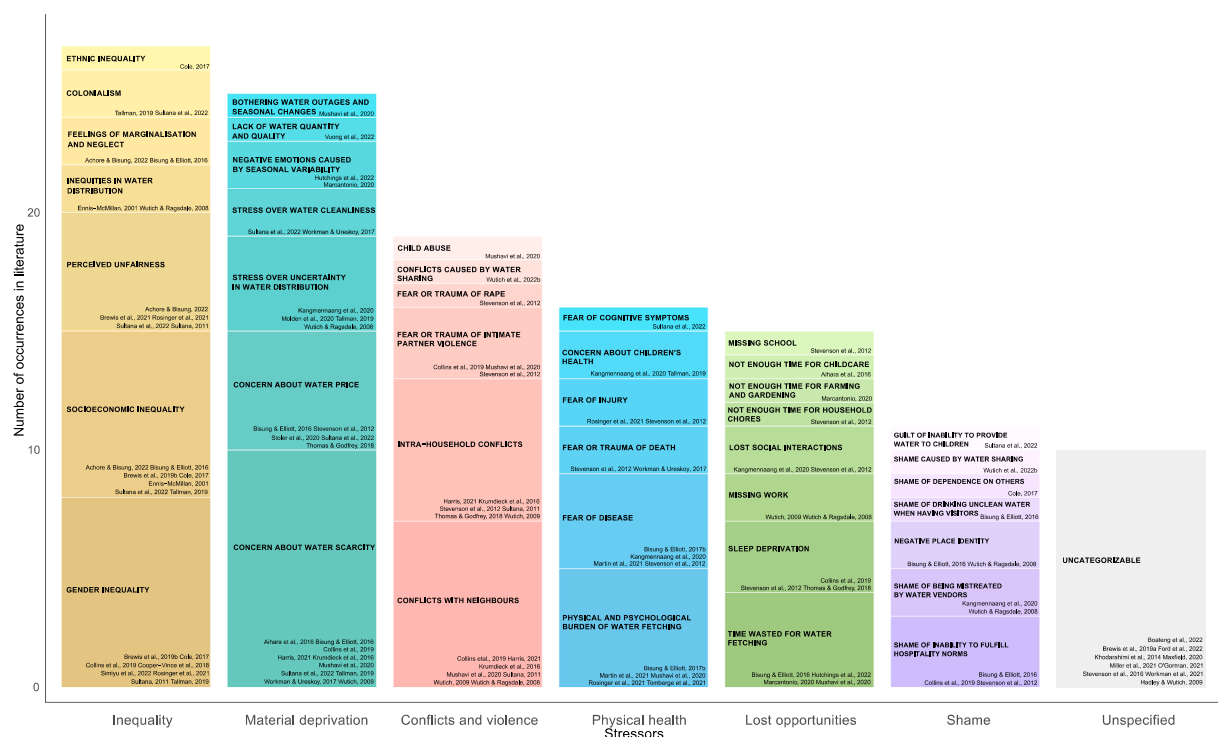


Fig. 1. Prevalence of psychosocial stressors and their sub-stressors in existing literature on mental health effects of inadequate water services. The y-axis represents how many times we interpreted any sub-stressor (in capital letters on the columns) to be found in the literature. The studies where the sub-stressors were found are named on the columns. The four review-type articles published on the topic (described in the text) were excluded from the figure as they summarise the findings of others.

suitable psychological framework.

In their study on mental health impacts of climate change, [Thoma et al. \(2021\)](#) suggest that the vulnerability-stress model of clinical psychology in addition to ecopsychology could be employed for understanding the connection between environmental issues and mental disorders. Ecopsychology focuses primarily on nature connectedness and emotions stemming from environmental change, while the onset and treatment of mental disorders is the focus of clinical psychology ([Thoma et al., 2021](#)). The vulnerability-stress model is a central tool in clinical psychology that aims at explaining the onset of mental disorders resulting from individual and internal vulnerability combined with external stress ([Hankin and Abela, 2005, 34–35](#)). We used the model to examine whether the psychosocial stressors presented in [Fig. 1](#) predispose to the two most common groups of mental disorders: depression and anxiety disorders. We adapted the model for the drinking water service context, and it is presented in [Fig. 2](#).

Although, according to [Hankin and Abela \(2005, 34–35\)](#), individual vulnerability is typically considered relatively permanent, inadequate drinking water services may indirectly strengthen social and cognitive vulnerabilities (clouds in [Fig. 2](#)). They define the overall vulnerability of a person as a combination of biological, psychological, social, and cognitive factors such as genetic inheritance, personality, attachment relationships and cognitive paradigms. They also state that biological and psychological factors are primarily determined at birth or in early childhood. Therefore, only social, and cognitive vulnerability factors are included in our drinking water service specific vulnerability-stress model. Insecure relationships constitute the most common social vulnerability factor predisposing to both depression and anxiety disorders ([Hankin and Abela, 2005, 263–266 & 304–308](#)). Thus, we argue that the following drinking-water-service-related stressors may reinforce social vulnerability: intra-household conflicts, intimate partner violence and child abuse. Moreover, the following stressors may reinforce negative cognitive bias, a form of cognitive vulnerability: shame and guilt, lost opportunities, and negative place identity ([Fig. 2](#)).

As [Fig. 2](#) illustrates, inadequate drinking water services can predispose to common mental disorders primarily through external stress. The external stress factors are either acute or chronic environmental circumstances that may further increase the risk of developing the disorders. Typical stress factors that predispose to depression are dangerous events, loss, and disappointment ([Goodyer, 2001](#)). Factors that predispose to anxiety disorders vary more but tend to include future-orientated worries ([Hankin and Abela, 2005, 313–314](#)). Existing mental disorders can also reinforce external stress ([Hankin and Abela, 2005, 245–288](#)). In case of inadequate drinking water services, the aforementioned factors correspond most directly to the following stressors in [Fig. 1](#): fear of disease, fear or trauma of death, lost opportunities, intra-household conflicts, intimate partner violence, child abuse, and concern about water scarcity ([Fig. 2](#)).

4. Mental health in water sector guidelines

As pointed out, water service developments should consider mental health to maximise overall health of water service users. To reach this goal, mental health ought to be addressed in the guiding documents of the field which commonly justify the targets of water interventions. At present, the most momentous global guidelines are the Sustainable Development Goals (SDGs) ([UN, 2015](#)). SDG3 (Good Health and Well-being) and SDG6 (Clean Water and Sanitation) are typically cited in the context of improving drinking water services. SDG3 includes a specific target 3.4 for preventing and treating mental disorders and promoting mental health. Target 6.1 of SDG6 focuses on drinking water and states that “universal and equitable access to safe and affordable drinking water for all” should be achieved by 2030.

Other international key sector guidelines are the Right to Water ([OHCHR et al., 2010](#)), the Joint Monitoring Program (JMP) water service ladder ([WHO and UNICEF, 2018](#)) and the [WHO WASH strategy for 2018–2025 \(2019\)](#). On top of these, important guidelines include continent wide water strategies i.e., those of the [Asian \(2018\)](#) and

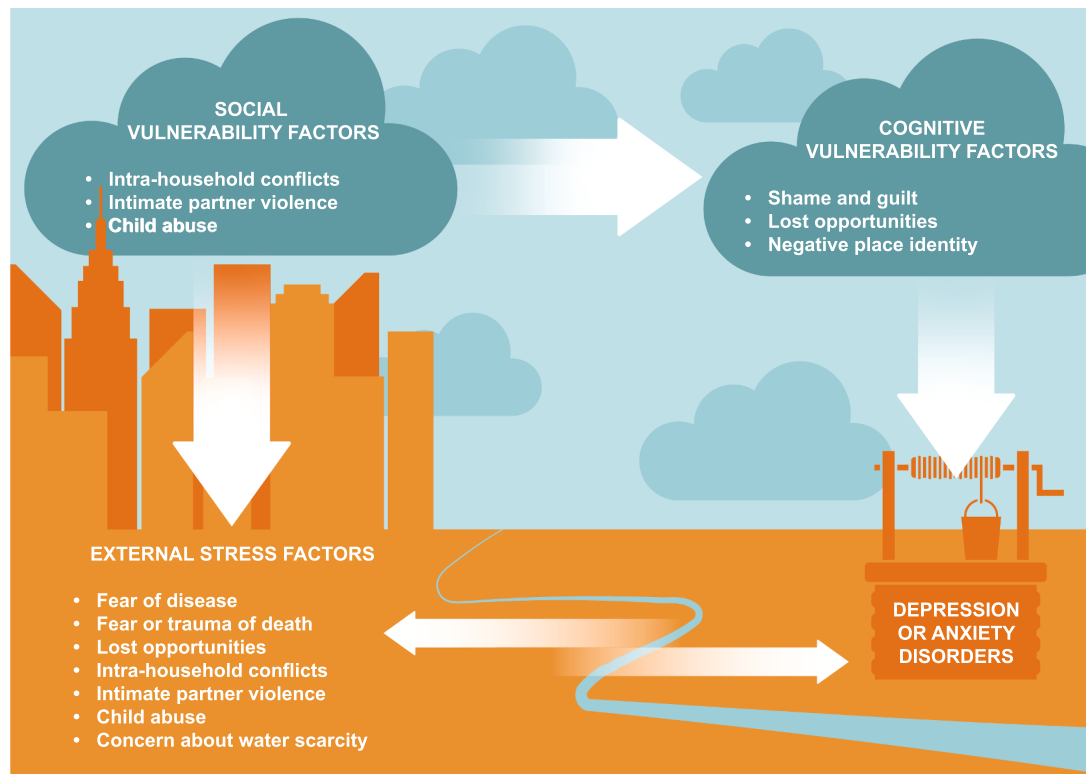


Fig. 2. The vulnerability-stress model applied for the drinking water services context. The clouds (top of figure) represent the cognitive and social vulnerabilities an individual might have, which predispose to depression or anxiety disorders. The external stress factors in the bottom left corner are acute or chronic circumstances that may further increase the risk of developing the disorders or their symptoms. As the white arrows illustrate, existing vulnerabilities of individuals (clouds, top of figure) and external stressors (bottom left corner) interactively affect the development of a mental disorder. Moreover, the causality between external stress and mental disorders works both ways because existing mental disorders may strengthen the effects of external stressors. The well (bottom right corner) represents the onset of depression or anxiety disorders.

African Development Banks (2021), as well as countries' own water strategies. The selected documents included water strategies of the dozen most populous countries in the world that have a current national water strategy accessible in English: Ethiopia (2022, draft), USA (2022), Pakistan (2018), and Bangladesh (2014). We went through the above-mentioned documents to study whether they address mental health impacts of inadequate drinking water services.

We found that the word “health” was used widely in all the documents, but it seemed to refer only to physical health, as we found no words discussing mental wellbeing. Similar to our scientific literature search, we searched for “mental”, “feel-”, “stress-”, “psycho-”, “emotion-”, “anxi-”, “depress-”, “worr-”, “fear”, “angr-/anger”, “sad-” and “frustrat-”, but did not find them in the context of water service users' wellbeing in any of the documents. The emotion-describing words “shame” “dignity/dignified”, and “stigma” were often used in the context of hygiene and/or sanitation, but very seldomly in relation to water services. “Equal-”, “equit-” and “includi-” were widely used throughout all documents, indicating that there is currently a strong focus on non-discrimination within the water sector. At least one of the words “participat-”, “relation-”, “collaborat-” and “ownership” were mentioned in each document, indicating that the participatory aspect of water services is a value that water policymakers agree with. This value also resembles SDG6b aiming at participation of communities in water matters. The words pointing to non-discrimination and cooperation can be interpreted to refer to the social wellbeing. Therefore, it could be argued that only the mental aspect of health (as described by WHO) is disregarded in the guiding documents of the field, whilst physical and social health are thoroughly considered.

Some of the mental health words absent in the water strategies were however discussed in the *Eliminating discrimination and inequalities in*

access to water and sanitation by UN Water (2015). Nevertheless, mental health implications were only indirectly mentioned in the document. For example, when discussing the possibility of rape on water fetching trips, it was discussed matter-of-factly without reference to any emotional consequences. The worry of such occurrences possibly happening as well as the emotional trauma after them are nevertheless devastating, not just the incident itself. This applies also to water sufficiency: the occurrence of not having enough water is not alone troublesome, but also the worry of how and when it might affect users' health. We argue that these kinds of mental health implications should be addressed more directly in the guiding documents and subsequently in the interventions of the water sector.

5. Strengthening the dialogue

Our literature review indicates that over the past two decades, several ethnographic studies have given insight into the experiences of people lacking access to safe drinking water. According to these studies, drinking-water-related psychosocial stress stems not only from the quantity and quality of available drinking water but also from interpersonal difficulties, lost opportunities, and inability to meet societal norms. Surprisingly, systemic inequality and perceived unfairness appeared to be the most important explaining factors of drinking-water-related psychosocial stress. Moreover, some studies argue for the relationship between inadequate drinking water services and diagnosable mental disorders. Our theoretical analysis with the vulnerability-stress model supports these arguments.

In our study, it became apparent that mental health issues need to be raised to a new level both in research and in guiding documents. There is already a clear consensus in the scholarship that mental health should be

more widely considered in the development of drinking water services. The effectiveness of water interventions in terms of mental health could be measured using tools such as Hopkins symptom checklist (HSCL) for depression and anxiety disorders (Workman and Ureksoy, 2017). More alarmingly, the current drinking water guidelines fail to mention mental health altogether. Based on our analysis, we propose that it should be included in the guiding documents of the drinking water sector. As the current research does not sufficiently describe how it should be addressed in practice, further research efforts are required.

Developments of drinking water services should consider inequality as a predisposing factor for psychosocial stress and mental disorders. According to several studies, water projects should be more sensitive to power dynamics that may also be amplified by such projects (Achore and Bisung, 2022; Brewis et al., 2020; Shunglu et al., 2022). Local development of drinking water services may reinforce perceived unfairness in neighbouring regions and households (Rosinger et al., 2021). Although the needs of marginalised groups are already considered in most water projects, inclusiveness and equality of water governance and institutions should still be improved (Achore and Bisung, 2022; Brewis et al., 2021; Shunglu et al., 2022). Brewis et al. (2021) state that developing mental health-friendly drinking water services requires primarily fair water institutions. Rosinger et al. (2021) further emphasise that conducting water interventions from the outside can increase the lack of control of the service users. To achieve these goals, dialogue between researchers and other actors of the water sector should be strengthened.

Our results have certain limitations. The scope of our review is relatively large, and the research designs of the included articles vary significantly in terms of the type of residential area, geographical circumstances and level of the drinking water services. Therefore, the results do not necessarily apply in each context, but they give an overview of the current literature. Secondly, the body of literature does not equally cover all types of psychosocial stressors and mental disorders. Finally, as the field of inadequate WASH services and mental health is rather small, a few authors have published a significant portion of the included articles. Consequently, the results may be biased based on the research settings or the perspectives of single authors.

6. Conclusion

The literature on negative mental health impacts of inadequate drinking water services has expanded during the past twenty years. There is now enough evidence to urge water sector practitioners and decision-makers to address these issues in intervention design and guiding documents of the field. To encourage this process, we summarised the existing works (42) on the topic in this paper. On the basis of our brief review, we can draw the three following recommendations for practitioners and decision-makers:

- **Align with WHO definition of health:** The effects of water interventions on affected people's mental health should be thoroughly examined in future research and, ideally also, in intervention design. Psychological tools such as the vulnerability-stress model may be useful in making them more effective in improving overall (physical, mental, and social) health and wellbeing as defined by WHO. This should be the goal of all such interventions.
- **Consider inequality:** Insufficient drinking water services threaten users' mental health through various identified mechanisms. Stress caused by lack of safe water was predictably identified as one of the most important factors, but water-service-related inequalities were surprisingly as significant. Especially institutional and local inequality requires elevated attention in water service development.
- **Revisit guidelines:** The appropriate inclusion of mental health aspects in national and international water sector guidelines should be discussed amongst the field. Concurrently, this is lacking, as the existing documentation highlights physical health aspects as well as the soft

values of non-discrimination and participation while mental health is completely ignored.

CRedit authorship contribution statement

A. Toivettula: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Visualization. **O. Varis:** Conceptualization, Writing – review & editing, Supervision, Funding acquisition. **R. Vahala:** Conceptualization, Writing – review & editing. **A. Juvakoski:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Visualization, Project administration, Supervision.

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

Data availability

No data was used for the research described in the article.

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