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Applying the Index of Vulnerability approach to understand water insecurity and other social-ecological factors associated with depression among urban refugee youth in Kampala, Uganda

Carmen H. Logie [a,b,c,d,*], Moses Okumu [e,f], Zerihun Admassu [a], Frannie MacKenzie [a], Jean-Luc Kortenaar [g], Amaya Perez-Brumer [g], Lesley Gittings [h,i], Naimul Khan [j], Robert Hakiza [k], Daniel Kibuuka Musoke [l], Aidah Nakitende [l], Brenda Katisi [k], Peter Kyambadde [m,n], Lina Taing [b,o], Lawrence Mbuagbaw [p,q,r,s,t,u]

[a] Factor-Inwentash Faculty of Social Work, University of Toronto, Toronto, ON, M5S 1V4, Canada
[b] United Nations University Institute for Water, Environment, and Health, Hamilton, ON, L8P 0A1, Canada
[c] Centre for Gender & Sexual Health Equity, Vancouver, BC, V6Z 2K5, Canada
[d] Women's College Research Institute, Women's College Hospital, Toronto, ON, M5G 1N8, Canada
[e] School of Social Work, University of Illinois at Urbana Champaign, Urbana, Illinois, 61801, USA
[f] School of Social Sciences, Uganda Christian University, Mukono, Uganda
[g] Dalla Lana School of Public Health, University of Toronto, Toronto, ON, M5T 3M7, Canada
[h] Faculty of Health Sciences, Western University, London, ON, N6A 2K5, Canada
[i] Centre for Social Science Research, University of Cape Town, South Africa
[j] Electrical and Computer Engineering, Toronto Metropolitan University, Toronto, ON, M5B 2K3, Canada
[k] Young African Refugees for Integral Development (YARID), Kampala, Uganda
[l] International Research Consortium, Kampala, Uganda
[m] National AIDS Coordinating Program, Ugandan Ministry of Health, Kampala, Uganda
[n] Most at Risk Population Initiative (MARPI), Kampala, Uganda
[o] School of Earth, Environment and Society, McMaster University, Hamilton, ON, Canada
[p] Department of Health Research Methods, Evidence and Impact, McMaster University, Hamilton, ON, Canada
[q] Department of Anesthesia, McMaster University, Hamilton, ON, Canada
[r] Department of Pediatrics, McMaster University, Hamilton, ON, Canada
[s] Biostatistics Unit, Father Sean O'Sullivan Research Centre, St Joseph's Healthcare, Hamilton, ON, Canada
[t] Centre for Development of Best Practices in Health (CDBPH), Yaoundé Central Hospital, Yaoundé, Cameroon
[u] Division of Epidemiology and Biostatistics, Department of Global Health, Stellenbosch University, Cape Town, South Africa

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ABSTRACT

Water insecurity and other social-ecological factors may be associated with depression in low and middle-income contexts (LMICs). This is understudied among urban refugee youth in LMICs, who experience multiple forms of marginalization. We conducted a cross-sectional survey with a peer-driven sample of urban refugee youth aged 16–24 in Kampala, Uganda. We explored: the prevalence of depression (moderate, moderately severe); associations between social-ecological (structural, community, interpersonal, intrapersonal) factors and depression; and associations between an Index of Vulnerability (IoV) comprised of social-ecological stressors and depression. Among n = 335 participants (mean age: 20.8 years, standard deviation: 3.1), in multivariable analyses, longer time in Uganda, water insecurity, lower social support, parenthood, and recent intimate partner violence were associated with moderate depression; and longer time in Uganda, water insecurity, and lower social support were associated with moderately severe depression. IoV scores were associated with moderate depression among men and women, and moderately severe depression among women. The IoV scores accounted for more variance in

* Corresponding author. University of Toronto, Factor-Inwentash Faculty of Social Work, 246 Bloor St W, Toronto, ON, M5S 1V4, Canada.
E-mail addresses: carmen.logie@utoronto.ca (C.H. Logie), okumu@illinois.edu (M. Okumu), zerihun.admassu@utoronto.ca (Z. Admassu), frannie.mackenzie@utoronto.ca (F. MacKenzie), luc.kortenaar@mail.utoronto.ca (J.-L. Kortenaar), a.perezbrumer@utoronto.ca (A. Perez-Brumer), lesley.gittings@uwo.ca (L. Gittings), n77khan@torontomu.ca (N. Khan), roberthakiza2001@gmail.com (R. Hakiza), kibuukamd76@gmail.com (D. Kibuuka Musoke), clansempa@gmail.com (A. Nakitende), katisi.brenda@gmail.com (B. Katisi), kyambex@yahoo.com (P. Kyambadde), lina.taing@unu.edu (L. Taing), mbuagblc@mcmaster.ca (L. Mbuagbaw).

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moderate/moderately severe depression among women than any single indicator; among men, water insecurity was most strongly associated with moderate depression. Future research can explore strategies to address water insecurity and other social-ecological stressors to promote health and wellbeing with urban refugee youth.

1. Introduction

As of mid-2022 there were an alarming 103 million forcibly displaced persons globally (UNHCR, 2022). Persons in humanitarian contexts are disproportionately affected by mental health challenges, yet most refugees reside in low and middle-income countries (LMIC) where mental health resources can be scarce (Silove et al., 2017). Refugee youth, who account for 41% of forcibly displaced persons globally, experience psychological challenges at a higher rate than host populations due to interacting stressors such as violence, food and economic insecurity, stigma, and trauma (Frounfelker et al., 2020; Reed et al., 2012; Silove et al., 2017). Despite 74% of forcibly displaced persons residing in LMIC (UNHCR, 2022), there is limited literature on the prevalence of mental health challenges among refugee youth in LMIC, particularly in urban contexts (Frounfelker et al., 2020). Yet globally urbanization among refugees is rapidly increasing, with more than 60% of refugees living in urban areas (Park, 2016). Adolescence is typically considered to begin at puberty and end in the mid-20's; late adolescence encapsulates approximately ages 17–19 where youth are able to engage in perspective-taking and supportive relationships, and emerging adulthood spans approximately ages 18–24 and includes formation of new relationships and shifting self-perceptions and future visions based on immediately available opportunities (Bonnie and Backers, 2019; Salmela-Aro, 2011). Exposure to adversities during key neurodevelopmental periods such as adolescence, including experiencing violence before, during and following migration journeys, can have lasting harmful impacts on emotional and behavioural regulation (De Bellis, 2001; Frounfelker et al., 2020).

Uganda is a key context to examine urban refugee youth mental health. It hosts the largest number of forcibly displaced persons in Africa with over 1.5 million refugees, nearly a quarter of whom are between the ages of 15–24 (UNHCR, 2023b). In Uganda, informal settlements around the urban city of Kampala host many of its 141,581 urban refugee and displaced persons (Sabila and Silver, 2020), of whom more than one-quarter are youth aged 15–24 (UNHCR, 2023a). Widespread food, water, and sanitation insecurity, violence, and overcrowding are commonly experienced by persons living in slums and informal settlements, and these conditions can contribute to poorer physical and mental health outcomes (Ezeh et al., 2017a; Lilford et al., 2017; Subbaraman et al., 2014; Wado et al., 2022).

Although socio-environmental stressors in slums and informal settlements may harm mental health (Ezeh et al., 2017a; Subbaraman et al., 2014), including among non-refugee youth in Kampala's slums (Swahn et al., 2015, 2020, 2022), there is limited attention to refugee youth mental health in urban informal settlements in LMIC. Yet urban refugee youth are at the nexus of slum health disparities and refugee health disparities. Reviews of refugee mental health research (Turrini et al., 2017) have produced valuable evidence focused on youth in high-income contexts (Bronstein and Montgomery, 2011), unaccompanied minors in Europe (Mitra and Hodes, 2019), and refugee adults (Blackmore et al., 2020), as well as on interventions for refugee youth. Pertinent to refugee youth mental health in Uganda, one such review (Scharpf et al., 2021) included studies on refugee youth living in refugee camps/settlements (Meyer et al., 2017a, 2017b, 2020). These studies in Ugandan refugee camps identified that violence exposure was associated with increased adolescent depression and anxiety (Meyer et al., 2017a, 2017b). Other studies with urban refugee youth in Kampala reported that nearly one-third reported symptoms of depression, which was associated with violence and food insecurity (Logie et al., 2022c). As refugee youth living in urban settings in Uganda do not receive the same housing or social services as refugee settlement-based youth (Sabila and Silver, 2020), further attention to social ecological contexts of urban refugee youth mental health is warranted.

Social ecological conceptual frameworks consider the interplay between social and ecological systems, as well as the ways these systems span multilevel contexts, including structural and institutional (e.g., systems that shape access to resources), community (e.g., social support), interpersonal (e.g., relationship dynamics), and intrapersonal (e.g., individual attitudes) domains (Mcleroy and Bibeau, 1988). Such frameworks are particularly relevant to exploring mental health among urban young refugees in Kampala. To illustrate, a systematic review examined mental health risk and protective factors among refugee children and youth and identified factors spanning individual (e.g., war-related trauma), family (e.g., parental mental health challenges), and community (e.g., discrimination) levels (Scharpf et al., 2021). Other studies with youth in Kampala's informal settlements also identified structural (e.g., sanitation insecurity (Swahn et al., 2022), food insecurity (Logie et al., 2022c), social (e.g., social support (Logie et al., 2022c)) and interpersonal (e.g., intimate partner violence (Logie et al., 2022c) level factors associated with depression. An understudied structural determinant of mental health among urban refugee youth at large, and in Kampala specifically, is water insecurity.

Water insecurity affects more than 2 billion people across the world who do not have access to safely managed water supplies and services (JMP, 2021). There is a growing evidence base of the linkages between water insecurity and mental health, whereby the distress, worry, shame, reduced autonomy, elevated conflict, and uncertainty of experiencing water insecurity produce stressors that harm mental health (Wutich et al., 2020a). Food insecurity, livelihood challenges, and disruptions to family dynamics may partially account for these pathways between water insecurity and mental health issues such as depression, anxiety and hopelessness (Wutich et al., 2020a). Water insecurity is consistently associated with worse mental health outcomes across myriad global settings (Cooper-Vince et al., 2018a; Maxfield 2020; Mushavi et al., 2020; Stoler et al., 2020; Wutich et al., 2020; Workman and Ureksoy, 2017), including rural Uganda (Cooper-Vince et al., 2017, 2018b; Mushavi et al., 2020). Workman and Ureksoy found in their study in Lesotho that both food and water insecurity were associated with psycho-emotional distress, and that insufficient water access and negative perceptions of water cleanliness had unique contributions to psycho-emotional distress after accounting for both food insecurity and socio-economic status (Workman and Ureksoy, 2017), underscoring the importance of looking at mental health effects of both food and water insecurity.

Limited research has explored water insecurity and mental health with refugee youth in Uganda. A study in Bidi Refugee Settlement in Northern Uganda identified associations between water insecurity and higher levels of depression severity among refugee youth and adolescents (Logie et al., 2022b). No studies were identified that examined water insecurity and mental health with urban refugees in Kampala, yet one-fifth (19%) of Kampala residents do not have access to safe water (UMWE, 2017). It is urgent to examine water insecurity and associations with mental health among refugees: in comparison with host communities, refugee settlements are often located in places disproportionately affected by extreme weather events (including water scarcity) (Fransen et al., 2023), and in urban contexts such as in Kampala, refugees are disproportionately living in low-income areas affected by water and sanitation insecurity (Sabila and Silver, 2020).

Vulnerability, a contested term with myriad theoretical underpinnings, involves the nexus of stress exposure, capacity to cope, and

consequences of stress and illness (Brown et al., 2017; Leatherman, 2005; Tallman et al., 2019). A vulnerability lens informed by a political-ecology of health involves "an examination of structured inequalities and social relations that underlie poverty, and how they affect not only levels of illness, but also coping capacities and hence the outcomes of poor health" (p. 51) (Leatherman, 2005). Leatherman (2005) describes a *space of vulnerability* as shaped by contextually specific human-environment interactions that include social relations and meanings of poverty, global-local interactions, institutional policies and practices, resource distribution, access to opportunities, and human agency in stress coping and responses. Water and food insecurity can be understood as life domains shaped by social-ecological inequities that constrain resource access and in turn increase vulnerability to harm (Tallman, 2016). Tallman developed an Index of Vulnerability (IoV) to explore the linkages between social-ecological risks (including food insecurity, water insecurity, low social support, low social status) and poorer mental and physical health in the Peruvian Amazon (Tallman, 2016). This study found that IoV scores were associated with numerous poor health outcomes (e.g., depressive symptoms, poorer perceived health) and were a better predictor than using single life domains, in turn recommending that other scholars adapt the IoV to local contexts (Tallman, 2016).

Understanding social-ecological factors associated with depression among urban refugee youth is critical for developing contextually tailored mental health promotion interventions. This is particularly true for social ecological domains such as water insecurity that are understudied among refugees, yet most impact socially marginalized persons (Wutich et al., 2022), refugee camp contexts (Fransen et al., 2023), and people reporting low socio-economic status (Meehan et al., 2020; Stoler et al., 2020). To address key knowledge gaps regarding social-ecological factors associated with urban refugee youth mental health, we explored a) the prevalence of depression outcomes among a sample of urban refugee youth in Kampala, Uganda; b) associations between social-ecological (structural, community, interpersonal, and intrapersonal) level factors and depression outcomes; and c) associations between an Index of Vulnerability (IoV) that assesses social-ecological stressors and depression outcomes.

2. Methods

2.1. Study design and setting

We conducted a baseline survey as part a longitudinal study on mental health with urban refugee youth in Kampala from February to March 2022; this baseline survey was completed prior to implementing a mental health intervention (*Tushirikiane-4-MH*, Supporting Each Other for Mental Health) and full methods are detailed elsewhere (Logie et al., 2022a). This study is nested within the larger *Tushirikiane* HIV prevention cohort study (Logie et al., 2023). This study is a collaboration with community-based partners in Kampala, including refugee youth community-based organizations such as the key collaborator Young African Refugees for Integral Development (YARID), Ugandan research organizations, academics, community-based practitioners, and representatives from the Ugandan Ministry of Health. Community-based collaborators provided guidance and feedback throughout all phases of the study, including study design, recruitment, and survey implementation.

2.2. Participants and recruitment

Participants enrolled in *Tushirikiane* were eligible for recruitment into Tushirikiane-4-MH; we used purposive sampling methods including venue-based sampling through refugee community-based collaborators, and peer-supported sampling techniques (e.g., word of mouth by peer researchers), to recruit the *Tushirikiane-4-MH* cohort. Twelve peer researchers, who self-identify as refugee youth and have experience as health or peer educators, invited *Tushirikiane* participants to take part in the *Tushirikiane-4-MH* study, and conducted additional recruitment to engage refugees aged 16-17-years-old via community-based collaborators (e.g., YARID) and other local partners and social networks. Inclusion criteria: a) residing in one of five informal settlements in Kampala (Nsambya, Katwe, Rubaga, Kabalagala, Kansanga), b) identifying as a refugee or displaced person, or having refugee or displaced parents, d) being ages 16–24 when enrolled into *Tushirikiane*, e) owning a mobile phone, f) speaking Swahili, Luganda, Kirundi, Kinyarwanda, French or English, and g) being able to provide informed consent.

2.3. Data collection and outcome measures

Trained research assistants administered tablet-based standardized questionnaires using the SurveyCTO platform (SurveyCTO, Doblity, Cambridge, USA). Interviews were conducted in a private room at YARID's community-based agency; alternatively, participants could also request to complete the survey in a private location of their choosing in one of the study sites. Informed consent was obtained prior to survey administration. Participants had the option to stay enrolled in the *Tushirikiane* study and not participate in the *Tushirikiane-4-MH* study. There were several strategies offered to each participant to provide additional mental health support during or following the survey: 1) peer researchers were trained in mental health first aid and were available to provide any needed immediate support and referrals; they were nearby the data collection site as they helped to remind and accompany participants to meet the research assistants; 2) research assistants provided each participant with a list of local resources and referral information; c) we hired a social worker at YARID to provide counselling and any needed support to participants, and participants were provided their name and contact information. Additionally, peer researchers were available to introduce participants to the social worker if they preferred.

2.3.1. Outcome variables

The Patient Health Questionnaire-9 was used to assess depressive symptoms (Levis et al., 2019). Two depression outcomes were created using cut-off points of depression severity, including moderate depression (scores of 10 and above) and moderately severe depression (scores of 15 and above) (Cronbach's $\alpha = 0.82$).

2.3.2. Exposure variables

We assessed sociodemographic characteristics (age, gender, place of birth, highest level of education, length of time living in Uganda, relationship status) and variables reflecting *structural* (food insecurity, water insecurity), *community* (social support), *interpersonal* (relationship status, parenthood status, recent [past 3-month] intimate partner violence), and *intrapersonal* (internalized mental health stigma, self-compassion) level variables.

Structural level: Both food insecurity (Johnson et al., 2020; Lindberg et al., 2023; Whittle et al., 2015) and water insecurity (Mehta, 2016; Truelove, 2019) have been conceptualized as manifestations of structural violence, whereby social and institutional arrangements (e.g., exclusion of urban refugees from Kampala's strategic plan (Salmela-Aro, 2011), insufficient access to safely managed water in Kampala's slums (Tumwebaze et al., 2023)) constrain access to water and food resources that in turn harm health. Farmer described: "the arrangements are structural because they are embedded in the political and economic organization of our social world; they are violent because they cause injury to people" (p. e449) (Farmer et al., 2006). We assessed food insecurity using a six-item short form of the U.S. Household food security survey module (Blumberg et al., 1999) (Cronbach's $\alpha = 0.78$). Participants were categorized based on the sum of affirmative responses to the six items (total score range 0–6), where participants who scored ≤ 1 were grouped as high or marginal food security, those scoring (2–4) and (5 or 6) were grouped as "low food security," and "very low food security" respectively. Water insecurity was measured using the 12-item

household water insecurity experiences (HWISE) scale (total score range: 0–36); a score of 12 or more is considered water insecure (Young et al., 2019) (Cronbach's alpha = 0.70).

Community level: We measured social support with the eight-item modified Medical Outcomes Study Social Support Survey (mMOS-SS) that assesses instrumental and emotional support (Moser et al., 2012). The scale is rated on a 5-point Likert type ranging from 5 (strongly agree) to 1 (strongly disagree). A summed total score was transformed to a final score (ranging from 0 to 100) whereby higher scores reflect greater social support (Cronbach α coefficient was 0.89 in this study).

Interpersonal level: We assessed relationship status as a categorical variable, including no current partner, dating one partner or married, or casual dating/having multiple partners. We assessed if participants had children/dependents as a binary variable (yes/no). Recent intimate partner violence (IPV) was assessed over the past 3-months (Halim et al., 2018) using a single item question and participants were categorized as "Yes" if they experienced any form of IPV in the past 3 months, otherwise they were categorized as "No".

Intrapersonal level: Mental health stigma was measured using the brief version of the Internalized Stigma of Mental Illness (ISMI) scale (Boyd et al., 2014). This included seven items on a scale from 1 (completely disagree) to 7 (completely agree) with increased scores reflecting higher stigma (Cronbach alpha coefficient = 0.81 in this study). We assessed self-compassion with the Self-Compassion Scale for Youth (SCS–Y (Neff et al., 2021) using three items from the self-kindness domain and three items from common humanity (Cronbach alpha = 0.77). Item responses included 1 (Almost never), 2 (Not very often), 3 (Sometimes), 4 (Very often), and 5 (Almost always) with total scores ranging from 6 to 30 and higher scores indicating higher self-compassion.

Index of Vulnerability (IoV): Following Tallman's (Tallman, 2016) example of developing a multi-dimensional IoV measure of social-ecological exposures to stressors, we created a similar IoV that included 5 domains that span *structural* (food insecurity, water insecurity), *community* (social support), and *interpersonal* (parenthood, recent IPV) levels. IoV measures were explicitly selected at these social, community, and interpersonal levels that involve a) interactions with institutions and access to material resources (food, water), b) access to social support, and c) relational factors, including IPV and parenthood during young adulthood (itself associated with instability and a need for social support (Naudé and Piotrowski, 2023), as well as a potential risk for poorer social and health outcomes in LMIC (Malama et al., 2023; Toska et al., 2017a, 2020)), and not intrapersonal level factors. This framing encourages a move beyond individual-focused understandings of vulnerability toward a consideration of the social production of power and marginality that cause harm and maintain systems of domination (Tallman, 2016; Tallman et al., 2020), aligned with the spaces of vulnerability framework in political-ecology of health analyses (Brown et al., 2017; Leatherman, 2005; Tallman et al., 2019).

Following Tallman's (2016) approach, these 5 indicators for the IOV were coded as 1 (risk) or 0 (no risk) and summed to calculate an IoV score ranging from 0 (no risk) to 5 (high risk across domains). The binary (yes/no) food insecurity outcome was assessed by categorizing responses to the U.S. Household food security survey module (Blumberg et al., 1999), whereby on the scale from 0 to 6, scores ≤ 1 were coded as no food insecurity and >2 as yes (food insecurity). The binary (yes/no) water insecurity outcome was developed by categorizing responses to the HWISE scale (Young et al., 2019) whereby scores ≥ 12 were coded as yes (water insecurity) and <12 as no water insecurity. To create a binary low social support indicator, we examined tertiles on the mMOS-SS scores (Moser et al., 2012). Scores were divided into Y/N, with participants falling into the highest tertile of risk for low social support coded as "yes" (low social support) and "no low social support" if they fell into the other tertiles. Participants were coded as having children (yes/no) or reporting past 3-month IPV (yes/no).

2.4. Statistical analyses

Descriptive statistics were conducted to determine the distribution of baseline characteristics across variables. We reported continuous variables as means and standard deviations, and categorical variables as absolute values and percentages. Individuals who identified as transgender (n = 4) were included in the descriptive analysis (Table 1) but were excluded from multivariable and stratified analysis due to small sample size and the need to maintain confidentiality. Cronbach's α measures were calculated to examine the internal consistency of each scale in the current study, with values > 0.70 deemed acceptable. To assess the associations between moderate depression symptoms and moderately severe depression symptoms (categorical outcomes) and exposure variables, binary logistic regression analyses were first performed. Then, multivariable logistic regression analyses were conducted adjusting for gender and all individual factors that showed a significant association in bivariate analyses. We used pseudo-R-squared (McFadden) to measure how well our model fits the data. For instance, in multivariate models for moderate depression symptoms we adjusted for gender, length of time in Uganda, food security, water insecurity, relationship status, having children, social support and recent IPV experiences. In multivariate analyses for moderately severe depression symptoms, we adjusted for gender, length of time in Uganda, water insecurity, and social support.

To assess associations between higher IoV score with depression outcomes (moderate and moderately severe), gender stratified multivariate logistic regression analyses were conducted using age and length of time in Uganda as covariates. To compare IoV and its constituent parts on the prediction of a wider range of aforementioned mental health outcomes, separate models were run using IoV, food insecurity, water insecurity, having children, recent IPV experience and social support as independent variables and moderate and moderately severe depression outcomes as dependent variables, controlling for age and length of time in Uganda. Finally, x-standardized odd ratio was examined to make the odds ratio independent of the units of the original variables and comparable using the *listcoef* command. A two-sided p-value of less than 0.05 was considered statistically significant. Data were analyzed using Stata 17.0 (StataCorp, College Station, TX).

2.5. Ethical considerations

All participants provided informed consent. The *Tushirikiane-4-MH* protocol was approved by Research Ethics Boards at the University of Toronto, Mildmay Uganda, and Uganda National Council for Science and Technology.

3. Results

3.1. Sample demographics and quantitative results

A total of 335 refugee youth participants were included in the *Tushirikiane-4-MH* baseline survey. Baseline characteristics and gender differences are reported in Table 1. The mean age of respondents was 20.8 years (SD: 3.01); nearly half (47.2%) were cisgender women, 51.6% were cisgender men, and four participants (1.2%) were transgender. Most were from the Democratic Republic of Congo (DRC) (77.8%). Nearly half (46.4%) reported less than secondary school as the highest-level of education, over one-third (40.6%) had completed some secondary school, and 13.0% had completed secondary school or higher. Over one-third (43.9%) were unemployed. The prevalence of water and food insecurity was high, with 59.1% of the participants reporting water insecurity and 91.9% reporting any level of food insecurity (31.9% low food security; 60.0% very low food security) (Table 1).

A third of participants (31.5%) scored above the cut-off point of 10, reflecting moderate depression symptoms, while 11.4% scored above the cut-off point of 15, reflecting moderately severe depression

Table 1
Baseline demographic characteristics of refugee and displaced youth enrolled in the Tushirkiane-4-MH study in Kampala, Uganda stratified by gender (n = 335).

Characteristic	Total N (%), or mean (SD)	Young women N (%), or mean (SD)	Young men N (%), or mean (SD)	P-Value
Total	335	158 (47.2)	173 (51.6)	
Socio-demographic variables				
Age, years	20.8 (3.01)	20.4 (2.76)	21.0 (3.18)	0.056
Place of birth[n = 10]				0.650
Democratic Republic of Congo	253 (77.8 %)	122 (77.2)	129 (79.1)	
Burundi	34 (10.5%)	17 (10.8)	16 (9.8)	
Uganda	14 (4.3 %)	9 (5.7)	5 (3.1)	
Other countries[A]	24 (7.4 %)	10 (6.3)	13 (8.0)	
Length of time living in Uganda				0.982
< 1 year	2 (0.6 %)	1 (0.6)	1 (0.6)	
1–5 years	105 (31.3 %)	50 (31.7)	55 (31.8)	
6–10 years	142 (42.4%)	65 (41.1)	75 (43.3)	
>10 years	86 (25.7%)	42 (26.6)	42 (24.3)	
Relationship status[n = 1]				0.004
No current partner	133 (39.8)	77 (48.7)	55 (32.0)	
Dating one partner/ married	154 (46.1)	66 (41.8)	86 (50.0)	
Casual dating/multiple partners	47 (14.1)	15 (9.5)	31 (18.0)	
Employment status				0.466
No employment	147 (43.9 %)	63 (39.9)	83 (48.0)	
Student	91 (27.1 %)	48 (30.3)	43 (24.9)	
Employed (paid/ unpaid)	69 (20.6 %)	33 (20.9)	35 (20.2)	
Other	28 (8.4%)	14 (8.9)	12 (6.9)	
Highest level of education [n = 12]				0.047
Less than secondary school	150 (46.4)	82 (53.9)	67 (40.1)	
Some secondary school	131 (40.6)	53 (34.9)	76 (45.5)	
Secondary school or higher	42 (13.0)	17 (11.2)	24 (14.4)	
Mental health indicators				
PHQ-9 depression mean score[n = 11]	7.23 (5.42)	7.53 (5.5)	6.79 (5.3)	0.227
Moderate depression symptoms[a n = 11]				0.117
Yes	222 (68.5)	99 (65.1)	123 (73.2)	
No	102 (31.5)	53 (34.9)	45 (26.8)	
Moderately severe depression symptoms[b n = 11]				0.394
Yes	287 (88.6)	133 (87.5)	152 (90.5)	
No	37 (11.4)	19 (12.5)	16 (9.5)	
Structural level factors				
Water insecurity mean score [n = 13]	13.5 (9.96)	13.2 (9.9)	13.8 (10.1)	0.599
Water insecure [n = 13]				0.470
No	132 (40.9)	66 (43.1)	65 (39.2)	
Yes	190 (59.1)	87 (56.9)	101 (60.8)	
Food security[n = 3]				0.769
High or marginal food security	27 (8.1%)	12 (7.7%)	14 (8.1%)	
Low food security	106 (31.9%)	53 (33.9%)	52 (30.2%)	
Very low food security	199 (60.0%)	91 (58.3%)	106 (61.6%)	
Community level factor				
Social support[n = 5]	58.5 (21.3)	58.12 (20.86)	59.16 (21.79)	0.664
Interpersonal level factors				
Have children[n = 1] (parenthood)				0.002
No	298 (89.2)	132 (83.5)	162 (94.2)	
Yes	36 (10.8)	26 (16.5)	10 (5.8)	
Recent (past 3-month) IPV experience				0.361
No	310 (92.5)	150 (94.9)	160 (92.5)	
Yes	25 (7.5)	8 (5.1)	13 (7.5)	
Intrapersonal level factors				
Internalized mental health stigma[n = 3]	30.5(5.8)	31.02(6.1)	29.9 (5.4)	0.072
Self-compassion[n = 4]	20.3 (4.1)	19.9 (3.8).	20.6 (4.3)	0.139

SD: standard deviation; n = missing values; [a] = PHQ cut off score ≥ 10; [b] = PHQ cut off score ≥ 15. In total analysis, transgender persons were included. In the gender stratified analyses, transgender persons were not included. Other countries [A] include: Kenya, South Sudan, Rwanda, Tanzania and Somalia.

symptoms (Table 1).

While socio-demographic variables were largely similar between young men and young women participants, there were several differences by gender observed. For instance, men reported higher education levels, being significantly more likely to have some secondary education (men: 45.5%, women: 34.9%, p = 0.047) and to have completed secondary school (men: 14.4%, women: 11.2%; p = 0.047). Most participants reported not having children (89.2%), and young women were significantly more likely to report having children than young men (women: 16.5%, men: 5.8%; p = 0.002).

Bivariate and multivariable analyses findings regarding the associations between depression symptoms and socio-demographic factors (age, country of birth, length of time in Uganda, relationship status, education level), *structural level* (water insecurity, food insecurity), *community level* (social support), *interpersonal level* (having children [parenthood], IPV), and *intrapersonal level* (mental health stigma, IPV self-compassion) are reported in Table 2 and Table 3.

3.2. Socio-demographic and social-ecological factors associated with moderate depression symptoms

Factors associated with increased odds of moderate PHQ-9 depression scores (≥10) in bivariate analyses were length of time in Uganda (longer time resulted in higher odds of depression), higher food insecurity, higher water insecurity, lower social support, having children, and recent IPV experiences (Table 2). In multivariable analysis, after controlling for gender and factors significantly associated with moderate depression in bivariate analyses, the longer time participants had lived in Uganda was associated with higher odds of moderate depression. For instance, participants who lived in Uganda over 10 years (adjusted Odds Ratio [aOR]: 2.91, 95% Confidence Interval [CI]: 1.22–6.96; p = 0.016), and from 6 to 10 years (aOR: 4.12, 95% CI: 1.88–9.02; p < 0.001), had elevated odds of depression compared to those living in Uganda less than 5 years. *Structural level:* Water insecurity was associated with nearly 8-fold higher odds of reporting moderate depression in adjusted analyses (aOR: 7.71, 95% CI: 3.65–16.26; p < 0.001). *Community level:* Higher social support was also associated with lower odds of depression in adjusted analyses (aOR: 0.98; 95% CI: 0.96–0.99; p = 0.003). *Interpersonal level:* Participants with children were almost four times more likely to experience moderate depressive symptoms than respondents with no children (aOR: 4.20, 95% CI: 1.47–12.01, p = 0.007) in adjusted analyses. Participants reporting recent IPV experiences were over three times more likely to report moderate depression than those who did not experience IPV in adjusted analyses (aOR: 3.52; 95% CI: 1.03–11.98; p = 0.044).

3.3. Socio-demographic and social-ecological factors associated with moderately severe depression symptoms

Factors associated with higher odds of moderately severe PHQ-9

Table 2
Prevalence and social-ecological factors associated with moderate depression symptoms among refugee and displaced youth participants in the Tushirkiane-4-MH study in Kampala, Uganda (n = 320).

Variable	No moderate depression symptoms N (%), or mean (SD)	Moderate depression symptoms N (%), or mean (SD)	Crude model OR (95% CI)	P-Value	Adjusted model OR[a] (95% CI)	P-Value
Socio-demographic variables						
Gender				0.118		0.386
Men	123 (55.4)	45 (45.9)	Ref		Ref	
Women	99 (44.6)	53 (54.1)	1.46 (0.91, 2.36)		1.33 (0.69, 2.53)	
Age, years	20.63 (2.84)	20.92 (3.31)	1.03 (0.95, 1.12)	0.420		
Place of birth [n = 10]						
Democratic Republic of Congo	167 (78.4)	77 (79.4)	Ref			
Burundi	26 (12.2)	7 (7.2)	0.58 (0.24,1.40)	0.229		
Uganda	7 (3.3)	4 (4.1)	1.24 (0.35, 4.36)	0.738		
Others [A]	13 (6.1)	9 (9.3)	1.50 (0.62, 3.66)	0.372		
Length of time in Uganda						
< 5 years	88 (39.6)	15 (15.3)	Ref		Ref	Ref
6–10 years	84 (37.8)	52 (53.1)	3.63 (1.90, 6.94)	**<0.001**	4.12 (1.88, 9.02)	**<0.001**
>10 years	50 (22.6)	31 (31.6)	3.64 (1.79, 7.38)	**<0.001**	2.91 (1.22, 6.96)	**0.016**
Highest level of education						
Less than secondary school	108 (49.5)	37 (40.7)	Ref			
Some secondary school	80 (36.7)	45 (49.4)	1.64 (0.97, 2.77)	0.063		
Secondary school or higher	30 (13.8)	9 (9.9)	0.88 (0.38, 2.01)	0.755		
Relationship status						
No current partner	85 (38.5)	45 (45.9)	Ref		Ref	
Dating one partner/ married	99 (44.8)	45 (45.9)	0.86 (0.52, 1.42)	0.554	0.74 (0.38, 1.44)	0.378
Casual dating/multiple partners	37 (16.7)	8 (8.2)	0.41 (0.18, 0.95)	**0.038**	0.37 (0.13, 1.07)	0.066
Structural level factors						
Food security						
High or marginal food security	22 (10)	4 (4.1)	Ref			
Low food security	55 (25)	46 (46.9)	4.60 (1.48, 14.31)	**0.008**	3.58 (0.85, 15.02)	0.081
Very low food security	143 (65)	48 (49)	1.85 (0.61, 5.63)	0.281	0.72 (0.17, 3.04)	0.652
Water insecurity						
No	115 (54)	15 (15.8)	Ref		Ref	Ref
Yes	98 (46)	80 (84.2)	6.26 (3.39, 11.56)	**<0.001**	7.71 (3.65, 16.26)	**<0.001**
Community level factor						
Social support	62.1 (22.7)	51.2 (16.0)	0.97 (0.96, 0.99)	**<0.001**	0.98(0.96, 0.99)	**0.003**
Interpersonal level factors						
Have children (young parenthood)						
No	207 (93.2)	77 (79.4)	Ref		Ref	
Yes	15 (6.8)	20 (20.6)	3.58 (1.75, 7.35)	**<0.001**	4.20 (1.47, 12.01)	**0.007**
Recent (past 3-month) IPV experience						
No	214 (96.4)	86 (87.8)	Ref		Ref	
Yes	8 (3.6)	12 (12.2)	3.73 (1.47, 9.45)	**0.005**	3.52 (1.03, 11.98)	**0.044**
Intrapersonal level factors						
Mental health stigma	30.1(6.1)	31.4(4.8)	1.04(0.99, 1.09)	0.065		
Self-compassion	20.6 (4.3)	19.7 (3.5)	0.95 (0.89,1.01)	0.079		

Note: SD, standard deviation; OR: odds ratio; ref, reference: IPV-Intimate partner violence. CI: confidence intervals: Other[b]-(Kenya, South Sudan, Rwanda, Tanzania and Somalia); [a]Adjusted model conducted using logistic regression controlling for gender, length of time in Uganda, food security, water insecurity, relationship status, have children, social support and recent IPV experience.

depression scores (≥15) in bivariate analyses included: length of time in Uganda, higher education level (some secondary vs. less than secondary school), water insecurity, and having children (Table 3). In multivariable analyses, living in Uganda for more than ten years was associated with more than five times higher odds of reporting moderately severe depressive symptoms compared to living in Uganda for less than five years (aOR: 5.21, 95% CI: 1.59–17.06, p = 0.006). *Structural level*: Water insecurity was associated with nearly 8-fold higher odds of moderately severe depression symptoms compared with water security (aOR: 7.77; 95% CI: 2.28–26.49; p = 0.001). *Community level:* Higher social support was marginally associated with lower odds of moderately severe depression (aOR: 0.98, 95% CI: 0.96–1.00, p = 0.05).

3.4. Index of vulnerability (IoV) findings

The mean IoV score of respondents was 2.42 (SD: 1.32); men (2.47, SD-1.35) reported higher IoV scores compared to women (2.37, SD-1.29), yet this difference was not statistically significant (p = 0.5030) (Table 4). Both men (aOR: 1.71, 95% CI: 1.27–2.30, p < 0.001) and women (aOR: 2.40, 95% CI: 1.68–3.41, p < 0.001) with higher IoV scores had a higher odds of reporting moderate depressive symptoms than those with lower IoV scores (Table 5). Women with higher IoV scores were twice as likely to report moderately severe depressive symptoms than those with lower scores (aOR: 2.02, 95% CI: 1.25–3.29, p = 0.004) in adjusted analysis. The IoV was not significantly associated with moderately severe depressive symptoms (aOR: 1.35, 95% CI: 0.89–2.04, p = 0.156) among men.

In terms of magnitude, IoV was associated with largest increase in risk of reporting moderate and moderately severe depressive symptoms in women. However, water insecurity was associated with the largest change in moderate depressive symptoms in men. No predictor was significantly associated with major depressive symptoms in men (Table 5).

IoV scores, water insecurity, and social support had the most

Table 3
Prevalence and factors associated with moderately severe depression symptoms among refugee and displaced youth enrolled in the Tushirkiane-4-MH study in Kampala, Uganda (n = 320).

Variable	No moderately severe depression symptoms N (%), or mean (SD)	Moderately severe depression symptoms N (%), or mean (SD)	Crude model OR (95% CI)	P-Value	Adjusted model OR[a] (95% CI)	P-Value
Socio-demographic variables						
Gender				0.396		0.376
Men	152 (53.3)	16 (45.7)	Ref		Ref	
Women	133 (46.7)	19 (54.3)	1.36 (0.67, 2.75)		1.42 (0.65, 3.09)	
Age, years	20.78 (2.97)	20.17 (3.11)	0.93 (0.83, 1.05)	0.255		
Place of birth						
Democratic Republic of Congo	215 (78.2)	29 (82.8)	Ref	Ref	–	
Burundi	31 (11.3)	2 (5.7)	0.48 (0.11, 2.10)	0.329	–	
Uganda	8 (2.9)	3 (8.6)	2.78 (0.70, 11.08)	0.147	–	
Others[b]	21 (7.6)	1 (2.9)	0.35 (0.05, 2.72)	0.318	–	
Length of time in Uganda						
< 5 years	99 (34.7)	4 (11.4)	Ref		Ref	
6–10 years	121 (42.5)	15 (42.9)	3.07 (0.99, 9.54)	0.053	2.70 (0.84, 8.74)	0.097
>10 years	65 (22.8)	16 (45.7)	6.09 (1.95, 19.04)	**0.002**	5.21 (1.59, 17.06)	**0.006**
Highest level of education						
Less than secondary school	135 (48.7)	10 (31.2)	Ref			
Some secondary school	106 (38.3)	19 (59.4)	2.42 (1.08, 5.42)	**0.032**		
Secondary school or higher	36 (13)	3 (9.4)	1.13 (0.29, 4.30)	0.863		
Relationship status						
No current partner	109 (38.4)	21 (60)	Ref			
Dating one partner/ married	130 (45.8)	14 (40)	0.56 (0.27, 1.15)	0.115		
Casual dating/ multiple partners	45 (15.8)	0				
Structural level factors						
Food security						
High or marginal food security	24 (8.5)	2 (5.7)	Ref			
Low food security	81 (28.6)	20 (57.1)	2.96 (0.65, 13.59)	0.162		
Very low food security	178 (62.9)	13 (37.1)	0.88 (0.19, 4.12)	0.867		
Water insecurity						
No	127 (46.2)	3 (9.1)	Ref		Ref	Ref
Yes	148 (53.8)	30 (90.9)	8.58 (2.56, 28.78)	**<0.001**	7.77 (2.28, 26.49)	**0.001**
Community level variable						
Social support	59.8 (22.1)	50.6 (12.7)	0.98 (0.96, 0.99)	**0.019**	0.98 (0.96, 1.00)	0.05
Interpersonal level variables						
Have children (young parenthood)						
No	254 (89.4)	30 (85.7)	Ref			
Yes	30 (10.6)	5 (14.3)	1.41 (0.51, 3.91)	0.508		
Recent (past 3-month) IPV experience						
No	267 (93.7)	33 (94.3)	Ref			
Yes	18 (6.3)	2 (5.7)	0.90 (0.20, 4.05)	0.890		
Intrapersonal level variables						
Mental health stigma	30.3 (5.9)	32.2 (3.9)	1.07 (0.99, 1.14)	0.071		
Self-compassion	20.4 (4.2)	19.6 (3.4)	0.95 (0.87,1.04)	0.251		

Note: SD, standard deviation; OR: odds ratio; ref, reference: IPV-Intimate partner violence. CI: confidence intervals**:** Other[b] (Kenya, South Sudan, Rwanda, Tanzania, and Somalia); [a]Adjusted model conducted using logistic regression controlling for gender, length of time in Uganda, water insecurity, and social support.

significant associations with both depression outcomes in terms of predictive range. As shown in Table 6, there are four possible predicted outcomes between men and women. IoV was significantly associated with three out of four outcomes (women's moderate depressive symptoms, women's moderately severe depressive symptoms, men's moderate depressive symptoms).

4. Discussion

Our study with urban refugee youth in Kampala revealed social-ecological stressors, including *structural* (water insecurity), *community* (low social support), and *interpersonal* (parenthood, recent IPV) level factors, were associated with depression outcomes. We adapted the Index of Vulnerability (IoV) to include *structural*, *community*, and *interpersonal* levels of social-ecological stressors, and found this IoV was associated with moderate depression among young men and young women, and moderately severe depression among young women. While the IoV was the strongest correlate of both depression outcomes among young women, water insecurity was the strongest correlate of moderate depression among young men—and none of the IoV domains were associated with severe depression among young men. In sum, our findings suggest the IoV may be a particularly helpful tool for identifying depression among urban refugee young woman compared to assessing a singular life domain. Water insecurity emerged as strongly linked with urban refugee young men's depression, and further research could focus on identifying additional mental health predictors among urban refugee young men. Findings have implications for research and practice to advance urban refugee youth mental health in LMIC.

Our findings build on prior research documenting associations between water insecurity and poorer mental health, extending this important linkage to urban refugee youth in Kampala who may be at the nexus of slum health disparities (Ezeh et al., 2017a; Lilford et al., 2017; Subbaraman et al., 2014; Wado et al., 2022) and refugee mental health disparities (Frounfelker et al., 2020; Reed et al., 2012). Our findings

Table 4
Distribution of the Index of Vulnerability and constituent variables in the Tushirkiane-4-MH study with urban refugee youth in Kampala, Uganda (n = 335).

Variables	Mean (SD)			P-value
	Men	Women	Overall	
Index of Vulnerability and constituent domains				
Index of Vulnerability (IoV)	2.47 (1.35)	2.37 (1.29)	2.42 (1.32)	0.5030
Food insecurity [n = 3]				0.881
No	14 (8.1%)	12 (7.7%)	27 (8.1%)	
Yes	158 (91.9%)	144 (92.3%)	305 (91.9%)	
Water insecurity [n = 13]				0.470
No	65 (39.2%)	66 (43.1%)	132 (41.0%)	
Yes	101 (60.8%)	87 (56.9%)	190 (59.0%)	
Social support [n = 5]				0.798
High social support	98 (57.3%)	91 (58.7%)	190 (57.6%)	
Low social support	73 (42.7%)	64 (41.3%)	140 (42.4%)	
IPV Experiences				0.361
No	160 (92.5%)	150 (94.9%)	310 (92.5%)	
Yes	13 (7.5%)	8 (5.1%)	25 (7.5%)	
Have children (parenthood) [n = 1]				**0.002**
No	162 (94.2%)	132 (83.5%)	298 (89.2%)	
Yes	10 (5.8%)	26 (16.5%)	36 (10.8%)	
Mental Health Outcomes				
Moderate depressive symptoms [n = 11]				0.117
No	123 (73.2%)	99 (65.1%)	222 (68.5%)	
Yes	45 (26.8%)	53 (34.9%)	102 (31.5%)	
Moderately severe depressive symptoms [n = 11]				0.394
No	152 (90.5%)	133 (87.5%)	287 (88.6%)	
Yes	16 (9.5%)	19 (12.5%)	37 (11.4%)	

Note: SD−standard deviation, IoV-Index of Vulnerability, IPV- Intimate partner violence. In overall analysis, transgender participants were included but in gender stratified analyses, they were not included.

Table 5
Multivariate logistic regression analyses of moderate and moderately severe depression on the Index of Vulnerability by gender in the Tushirkiane-4-MH study with urban refugee youth in Kampala, Uganda (n = 320).

Variable	Moderate depression		Moderately severe depression	
	Adjusted model OR (95% CI)		Adjusted model OR (95% CI)	
	Men	Women	Men	Women
Index of Vulnerability (IoV)	1.71 (1.27, 2.30)**	2.40 (1.68, 3.41)**	1.35 (0.89, 2.04)	2.02 (1.25, 3.29)**
Age, years	1.01 (0.89, 1.14)	0.95 (0.82, 1.09)	0.87 (0.73, 1.03)	0.92 (0.76, 1.11)
Length of time in Uganda				0.863
< 5 years	Ref	Ref	Ref	Ref
6–10 years	5.16 (1.84, 14.46) **	2.85 (1.03, 7.92)*	1.20 (0.25, 5.72)	6.41 (0.76, 53.97)
>10 years	5.82 (1.88, 18.04)**	2.59 (0.85, 7.88)	5.54 (1.31, 23.33)*	7.95 (0.89, 70.62)

Note: OR: odds ratio; Ref, reference: IoV-Index of Vulnerability. CI: confidence intervals**:** Adjusted model conducted using logistic regression controlling for age, and length of time in Uganda. *p ≤ 0.05, **p ≤ 0.01.

corroborate prior Ugandan research on these linkages between water insecurity and depression identified with non-refugee adults in rural settings (Cooper-Vince et al., 2017, 2018b; Mushavi et al., 2020) and refugee youth in a rural refugee settlement in Northern Uganda (Logie et al., 2022b). Despite water shortages being reported among 41% of Uganda's population at large (JMP, 2021) and among one-fifth of Kampala's urban residents (UMWE, 2017), water insecurity is understudied in relation to refugee mental health and youth mental health at large in Uganda. Yet research in Kampala's informal settlements documents low access to safely managed drinking water and sanitation services and calls for increased distribution, reliability, and proximity of piped waters to households (Tumwebaze et al., 2023), suggesting that the access and perceived cleanliness domains of water insecurity linked with depression in Lesotho (Workman and Ureksoy, 2017) may also be relevant in this context. Qualitative and mixed-methods approaches could better explicate how water insecurity manifests with urban refugee youth and subsequent pathways to depression.

Our study results expand upon past research on social-ecological factors associated with depression among refugee youth. Living in Uganda for a longer time was a socio-demographic factor associated with moderate and moderately severe depression; a systematic review with refugee youth reported mixed findings regarding time since displacement and mental health (Scharpf et al., 2021). Our finding may reflect the worsening of health over time following immigration that has been reported in other contexts (Elshahat et al., 2022; Statistics Canada et al., 2020), resulting from cumulative stress experiences from poverty, language barriers, discrimination, and resource (e.g., food, water, housing) scarcity. Ongoing contexts of adversity and daily stressors, including poverty and unemployment, in refugee hosting countries may exacerbate pre-migration stressors and worsen mental health outcomes (Miller and Rasmussen, 2017; Riley et al., 2017; Silove et al., 2017). At the *community* level, we found lower social support was linked with increased depression, aligning with prior research with urban refugee youth in Uganda (Logie et al., 2022c) as well as systematic review findings on post-migration refugee youth mental health protective factors that include social support (Scharpf et al., 2021). Future research could look at the nuances of social support that affect refugee youth mental health, for instance peer support and/or school connectedness (Scharpf et al., 2021). Regarding *interpersonal* factors, our finding that IPV was associated with depression corroborates prior research in Uganda documenting associations between violence exposure and depression in a refugee camp settlement (Meyer et al., 2017a, 2017b) and in urban refugee contexts (Logie et al., 2022c). This may be due to traumatic and psychological stress reactions to violence (Sardinha et al., 2022), including stress reactions that disrupt neural systems and result in dysregulation of cognition, mood, behaviour, and sleep patterns (Slavich and Irwin, 2014).

We found that youth who were parenting were more likely to report depression than non-parenting youth; this has been reported in prior research with urban refugee young women in Kampala (Malama et al., 2023). Future research can further examine social-ecological predictors of depression among parenting refugee youth; for instance, research with non-refugee South African adolescent mothers report low social support, abuse, and community violence were predictors of mental health disorders (Steventon Roberts et al., 2022). Importantly neither of the *intrapersonal* level variables we examined (mental health stigma, self-compassion) were associated with depression outcomes, underscoring the need to attend to relational, community and structural-level level factors to promote mental health in urban refugee LMIC contexts.

An important contribution of our study is the adaptation of an Index of Vulnerability (IoV) (Tallman, 2016) to examine multi-level stress exposures linked with urban refugee youth depression, reflecting a

Table 6
Comparisons between the Index of Vulnerability and constituent parts in predicting mental health outcomes in the Tushirkiane-4-MH study in Kampala, Uganda (n = 320).

	Standardized Odds Ratio – ORx					
	Index of vulnerability	Food insecurity	Water insecurity	Low social support	IPV experiences	Have children
Women						
Moderate depression	3.08**	1.76*	1.86**	1.19**	2.58*	1.82**
Severe depression	2.48**	–	1.51*	1.04*	0.74	1.27
Men						
Moderate depression	2.08**	1.22	2.92**	1.49*	1.22	1.33
Severe depression	1.50	0.96	–	0.66	–	1.08

Note: ORx - standardized odd ratio, IoV- Index of Vulnerability. IPV-Intimate partner violence. Each cell is a separate model controlling for age and length of time in Uganda. *p ≤ 0.05, **p ≤ 0.01.

political ecology approach to vulnerability (Leatherman, 2005; Tallman et al., 2019). While prior reviews have looked at the prevalence (Blackmore et al., 2020; Bronstein and Montgomery, 2011), intervention approaches (Cowling and Anderson, 2023; Hodes and Vostanis, 2019; Purgato et al., 2018), and social-ecological correlates (Bronstein and Montgomery, 2011; Scharpf et al., 2021; Tam et al., 2017) of refugee youth mental health, few have assessed multi-level risk exposures across life domains. Our finding that the IoV is a better predictor of depression for refugee young women than any singular life domain assessed signals the importance of assessing how this multi-dimensional measure may capture the additive and multiplicative effects of these co-occurring *structural*, *community*, and *interpersonal* level vulnerabilities that reflect a specific *space of vulnerability* (Leatherman, 2005; Tallman et al., 2019). While evidence exists that each of the individual variables in the IoV are associated with depression, including food insecurity and low social support (Logie et al., 2022c), water insecurity (Cooper-Vince et al., 2017, 2018b; Mushavi et al., 2020), IPV (Meyer et al., 2017a, 2017b), and parenthood during youth (Malama et al., 2023), we demonstrate that refugee young women's risk for depression increases with vulnerabilities experienced across multiple life domains. Value additions of the IoV analyses include: a) offering a simple, interpretable method to communicate findings to a range of stakeholders; b) identifying what IoV domains matter most for each level of depression by gender to inform interventions; and c) building on the standardized IoV approach by showing its applicability to a different context, population, and life domains (Tallman et al., 2019).

Our IoV findings also document the salience of assessing interconnected and cooccurring factors that increase susceptibility to poor mental health. In gender aggregated multivariable analyses, food insecurity was not significantly associated with depression, yet in the IoV gender disaggregated analyses food insecurity was significantly associated with moderate depression among young women—but not among young men. This points to the importance of assessing gender differences in depression correlates, particularly for life domains where there may be gender inequities: while water insecurity and low social support were associated in the IoV analyses with moderate depression among both young men and women, food insecurity, IPV, and having children were only significantly associated with moderate depression among young women. This reflects gender inequities that result in increased exposure to food insecurity (Broussard, 2019; Wutich and Brewis, 2014) and IPV (García-Moreno et al., 2015) among young women vs young men, and the social and economic marginalization of parenting young women in Sub-Saharan Africa ((Malama et al., 2023; Toska et al., 2017a, 2020). In Uganda, teen and unmarried pregnancy is often stigmatized, and young mothers may experience family and friend rejection, school expulsion, forced marriage, and loss of future dreams, underscoring the need for community mobilization and family support (Webb et al., 2023). Future work can examine if age at first parenthood among refugee youth is linked with differential mental health outcomes.

Gender-based analyses (Tannenbaum et al., 2016) can also inform future research to better identify what multi-level factors relevant to an IoV might better capture the most salient predictors of depression among urban refugee young men in Kampala. As several of the indicators in the present study's IoV, as discussed above, may disproportionately result in stress among young urban refugee women in Kampala, we need to better identify what stressors harm young urban refugee men's mental health in this context. This is particularly important as we did not find gender differences in depression outcomes; a systematic review with refugee youth found mixed results regarding gender differences in prevalence across a range of mental health challenges (Scharpf et al., 2021). Future research could also examine what dimensions of water insecurity are causing psychosocial stress for refugee young men in Kampala (Cooper-Vince et al., 2017; Mushavi et al., 2020; Tsai et al., 2016; Wutich et al., 2020a), while also examining strategies to ameliorate water insecurity for urban refugee youth in this context. The gender differences in social-ecological correlates we identified also have implications for gender-tailored interventions. For instance, gender differences emerged in developing and evaluating mental health interventions among adults in a refugee settlement context in Northern Uganda, signalling the need to attend to gender differences when addressing depression (Tol et al., 2018a, 2018b, 2020). Similarly, approaches to promote mental health among Ugandan refugee youth noted sports for development approaches only resulted in benefits for boys (Richards et al., 2014), while a creative play group only improved girls' mental health (Bolton et al., 2007). Clear attention needs to be paid in co-developing mental health interventions with urban refugee young women, and urban refugee young men, to ensure that their lived realities and priorities as shaped by gender norms, roles, and expectations (Tannenbaum et al., 2016) are integrated into any initiative.

5. Study limitations and strengths

There are several study limitations. First, the non-random sampling precludes generalizability to all urban refugee youth in Kampala, or urban Uganda. Further, as this study only included urban refugee youth, we are unable to determine the impact of refugee status on mental health, and it is plausible that other young people living in the same informal settlements could experience comparable mental health outcomes due to the shared social-environmental contexts and slum health effects (Lilford et al., 2017). However a multicounty representative sample of refugee and host communities in East Africa, including Uganda, found a significantly higher prevalence of estimated depression among refugees than host populations and a dose-response relationship between violence exposure and poor mental health (Pozuelo et al., 2023), suggesting that refugee youth do have important mental health needs. Second, the cross-sectional design precludes ascertaining causality regarding predictors of depression. As we conducted this as a

baseline survey prior to an intervention, we only used this singular time point to avoid inadvertently assessing intervention effects. Third, the variables included in this study, as noted in our findings, reflect a gender bias toward including social-ecological factors that disproportionately affect young women vs. young men, resulting in this study not identifying variables associated with severe depression among young men. Fourth, the inclusion criteria requiring mobile phone ownership was due to this study preceding a digital clinical trial, however we may have excluded the most marginalized urban refugee youth affected by the digital divide and in turn reproduced inequities in research participation (Wirtz et al., 2022). Finally, we did not apply a syndemics approach that has been used in prior studies on co-occurring food and water insecurity and depression in Kenya (Boateng et al., 2022) and Lesotho (Workman and Ureksoy, 2017) that examine interactions between social and health disparities and mental health outcomes (Mendenhall et al., 2021; Singer and Council, 1996). Future syndemics-focused research can examine if food insecurity, water insecurity, and IPV cluster to worsen depression.

Despite these limitations, to our knowledge this study is unique in looking at water insecurity and its linkages with depression among urban refugee youth and findings have implications for assessing water insecurity as a social determinant of mental health in Kampala's informal settlements at large, and among refugees in both urban and rural settlements in LMIC. This study is also unique in adapting an Index of Vulnerability to identify social-ecological stressors linked with urban refugee young women's depression outcomes in a LMIC. Findings can inform integration of mental health programming alongside support services for young parents, peer social support programs, IPV screening, and water and food insecurity services.

6. Conclusions

Our findings point to socially produced marginality (Tallman, 2016; Tallman et al., 2020) among urban refugee youth in Kampala that harms mental health and signals the need to centre social justice to advance mental health equity. This aligns with calls to promote the rights and access to health and social services among persons living in LMIC slums at large (Alaazi and Aganah, 2020) and among refugee youth specifically (Frounfelker et al., 2020). Findings signal the importance of assessing water insecurity as a predictor of mental health among water-insecure residents in Kampala (and elsewhere), including and expanding beyond urban refugee youth, and the potential of water-security focused interventions in reducing psychosocial stress that in turn could improve mental wellbeing (Wutich et al., 2020a). Further identifying causal mechanisms from water insecurity to urban refugee youth's mental health can help to inform mental health interventions that concurrently advance water security (Wutich et al., 2020a). Gender-based analyses (Tannenbaum et al., 2016) can guide future urban refugee youth mental health research. Priorities for future humanitarian mental health research include integration and mainstreaming with other sectors, including water and sanitation and social protection (Tol et al., 2023), and such a focus can help to address the social-ecological vulnerabilities associated with risk of depression among urban refugee youth in Kampala.

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CRediT authorship contribution statement

Carmen H. Logie: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing. **Moses Okumu:** Data curation, Investigation, Project administration, Writing – review & editing. **Zerihun Admassu:** Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. **Frannie MacKenzie:** Project administration, Supervision, Writing – review & editing. **Jean-Luc Kortenaar:** Data curation, Project administration, Supervision, Writing – review & editing. **Amaya Perez-Brumer:** Funding acquisition, Investigation, Writing – review & editing. **Lesley Gittings:** Project administration, Supervision, Writing – review & editing. **Naimul Khan:** Funding acquisition, Project administration, Writing – review & editing. **Robert Hakiza:** Conceptualization, Data curation, Funding acquisition, Investigation, Project administration, Supervision, Writing – review & editing. **Daniel Kibuuka Musoke:** Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing. **Aidah Nakitende:** Project administration, Supervision, Writing – review & editing, Investigation. **Brenda Katisi:** Investigation, Project administration, Supervision, Writing – review & editing. **Peter Kyambadde:** Conceptualization, Funding acquisition, Writing – review & editing. **Lina Taing:** Investigation, Writing – review & editing. **Lawrence Mbuagbaw:** Formal analysis, Funding acquisition, Supervision, Writing – review & editing.

Declaration of competing interest

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

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