# Mental and behavioral health problems among displaced Myanmar adults exhibiting suboptimal adherence to chronic disease medication treatment in Thailand

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## ABSTRACT

*Background:* People living with non-communicable diseases (NCDs) such as hypertension and diabetes are at high risk for mental health and psychosocial problems. These problems, in turn, can lead to social isolation, lower quality of life, greater health needs, and poorer health outcomes. The prevalence of NCDs is rising in humanitarian settings, where residents are already at an increased risk of mental health problems due to trauma and stressful living conditions. Yet there has been limited focus on understanding experiences and intersections between these often-co-occurring health conditions in humanitarian settings. Improving this understanding holds promise for supporting integrated care and better patient health outcomes.

*Objective:* To describe mental health problems of displaced Myanmar adults with current poor medication adherence for hypertension and/or type 2 diabetes mellitus and identify factors associated with poor mental health among this population.

*Methods:* Cross-sectional analysis of 224 adults with poor medication adherence (<70 %) for diabetes and/or hypertension treatment. Medication adherence was assessed using pill count. Demographic and physical health characteristics were collected; mental and behavioral health outcomes included a mental health symptom severity score generated based on symptoms of depression, anxiety and posttraumatic stress as well indicators of substance use. Data on sleep quality and self-efficacy for managing chronic disease were also collected. Multiple linear regression was used to identify factors associated with more severe mental health symptoms.

*Findings:* Among the 224 participants, 63.84 % were taking medication for hypertension, 17.86 % for diabetes mellitus, and 18.30 % for both. The sample was 70.98 % female and more than a third (37.5 %) were overweight or obese. Among the total sample, 29.91 % and 65.63 % reported ever using tobacco and betel nuts, respectively. In bivariate analyses, reported religious affiliation, financial situation, hypertension and diabetes comorbidity and more sleep problems were all significantly associated with poorer mental health; all of these factors other than religious affiliation remained significant in the multivariate analysis.

*Conclusions:* More than one-third of the displaced Myanmar adults who had suboptimal adherence to their chronic illness medications are living with moderate to severe mental health problems. The factors associated with more severe mental health problems were identified as having debt along with poor financial situation, having comorbid hypertension and diabetes, and having the worse scoring on the sleep problems scale. Integrating mental health support programs into chronic disease care systems is needed to help improve the overall health of this vulnerable population. Holistic approaches to improve economic and health outcomes should be considered for the people living with chronic conditions in humanitarian setting.

# 1. Introduction

Non-communicable diseases (NCDs) cause 17 million premature deaths annually, with 77 % of all NCD deaths in low- and middle-income countries (WHO, 2023). Concerns about NCD prevention and care are particularly important among displaced populations due to their increased vulnerabilities to risk factors and generally poor access to healthcare (IOM, 2018a, 2018b). Their prevalence are rising in humanitarian settings (Keasley et al., 2020), where residents are also at an increased risk of mental health problems due to trauma and stressful living conditions. Hypertension (HT) and diabetes mellitus (DM) are two of the most prevalent NCDs in humanitarian settings (Boulle et al., 2019; Keasley et al., 2020). Despite the existence of effective treatments, several constraints inhibit crisis-affected populations' access to care, leading to delayed diagnosis and difficulties in care maintenance (Al-Nimer, 2023; IOM, 2018a). A study of adults in displaced persons camps in Somalia found a 16.7 % prevalence of undiagnosed hypertension (HT) (Jayte, 2024), while a study of displaced Rohingya adults in Bangladesh found rates of 14.1 % for HT and 11 % for DM (Rahman et al., 2022). A meta-analysis of data on cardiovascular disease, a consequence of both HT and DM, among refugees and asylum speakers found the pooled incidence was higher in displaced persons than in non-refugee counterparts (Al-Rousan et al., 2022).

NCDs are chronic conditions that are typically managed with medication; thus high medication adherence is critical in their management as well as to prevent further negative health consequences associated with these conditions (Hamrahian et al., 2022). However, medication adherence remains challenging due in part to the asymptomatic nature and absence of immediate consequences associated with occasional or frequent medication non-adherence (Mohamad et al., 2021). Poor medication adherence, in turn, can lead to poorer clinical outcomes and higher healthcare resource needs (Kengne et al., 2024). There is evidence indicating that mental health conditions influence both NCD risk and treatment compliance. A study among adults with DM found that anxiety and depression were associated with higher medication non-adherence and physical inactivity (Mendes et al., 2019) while a study among adults with HT found similar associations between depression and medication non-adherence (Sjösten et al., 2013). NCD care requires a multifaceted treatment approach, including consistent medication adherence, routine health check-ups, and behaviour and lifestyle modifications (Jayte, 2024; WHO, 1996, 2023). These requirements are challenging in any context and are additionally difficult among displaced populations with comorbid mental health problems (IOM, 2018a).

Globally, 12.5 % of people are living with a mental health condition, including depression, anxiety, post-traumatic stress and substance misuse (WHO, 2022). People living with chronic physical health conditions are at an increased risk for having comorbid mental health problems. Several studies shown the high prevalence of depressive and anxiety symptoms among individuals with diabetes(Jones et al., 2016; Subramaniam et al., 2017) and hypertension(Abdelrahman et al., 2021; Bosworth et al., 2003; Gray et al., 2020) while longitudinal research has shown that depression and anxiety can predict diabetes (Engum, 2007) and hypertension (Jackson et al., 2016; Patten et al., 2009), and conversely, diabetes (Golden et al., 2008; Katon et al., 2009; Roy and Lloyd, 2012) and hypertension (García-Fabela et al., 2009) can predict depression incidence. These associations have been shown in low and middle income (LMIC) -based populations: in a study in Vietnam among people with DM, the prevalence of depressive symptoms was 23.2 % (Tran et al., 2021) while a study in Iran found prevalence rates of 59 % and 62 % for depression and anxiety, respectively, among adults with DM (Dehesh et al., 2020). When working with conflict-affected displaced populations, the evidence is strong for high prevalence of mental health conditions (Hossain et al., 2021; Porter and Haslam, 2005). People living in humanitarian contexts in particular have an increased risk of mental health conditions compared to the general population,

with meta-analytic estimates indicating that more than one in five adults living in conflict settings (22.1 %) has depression, anxiety disorder, PTSD, bipolar disorder, and/or schizophrenia (Charlson et al., 2019).

While the above literature provides a strong rationale for association between mental ill health and chronic diseases, our understanding of these relationships in humanitarian settings is insufficient. This study provides data on the severity of mental health problems and associated factors among displaced Myanmar adults living in temporary settlements on the Thai-Myanmar border who were identified as having poor adherence to their medication for HT and/or DM. The displacement of Myanmar nationals into Thailand began in the mid-1980s and remains an example of chronic displacement, with subsequent cohorts of newly displaced populations joining those who were previously displaced (Chantavanich, 2011). These settlements provide an example for how 'temporary' sites become more permanent, providing an opportunity to explore factors such as the interaction between NCD care and mental health.

# 2. Methods

This cross-sectional analysis was conducted using baseline data from a mental health intervention trial. The target population was displaced Myanmar adults with hypertension (HT) and/or diabetes mellitus (DM) who were receiving medications from clinics in a temporary shelter managed by the International Rescue Committee (IRC) Thailand between September 1, 2022, and February 29, 2024.

## 2.1. Study participants

### 2.1.1. Inclusion criteria

1) Diagnosed by a physician based on ICD-10 to have DM, or HT or DM with HT comorbidity.
2) Registered in the chronic database system of the camp for at least 6 months.
3) Poor medication adherence over the past 2 weeks (*see below*).

### 2.1.2. Exclusion criteria

1) Children under age 18 years.
2) Severe physical illness, developmental disability, or serious mental disorder that would preclude participation in a talk-based psychotherapy program.
3) Not willing to participate in the psychotherapy program that was part of the parent trial.

### 2.1.3. Recruitment procedure

Recruitment of participants began with a record check of the IRC's NCD database (Chronic database) by the IRC's Research Manager and Research Officer. The trained data collectors were provided lists of patients with HT and/or DM to interview for eligibility. Data collectors were trained by a senior health manager and the Mental Health and Psychosocial Support (MHPSS) research manager. Data collectors visited patients' houses and explained about the study based on the recruitment script for the screening process. Upon verbal agreement, data collectors used CommCare mobile application to collect sociodemographic data together with MARS-5 and pill count identification. Once potential participants were identified through review of the eligibility criteria, data collectors returned to their houses for the study baseline assessment if they provided written consent. The recruitment script information and consent forms were prepared in the local languages (S'gaw Karen and Burmese) and included an overview of the project, objectives, target population, research process, risk and benefits of the study as well as the contact details of project personnel for further inquiries.

## 2.2. Medication adherence assessments

Medication adherence criteria for study inclusion was based on pill count rate. The pill count rate was calculated using the number of pills dispensed minus to the number remaining divided by the expected number to be taken and multiplied by 100 %. Data collectors were trained to check the patients' medical book and how to calculate the expected number of medication(s) to be taken. The cut-off criteria for the parent trial for suboptimal medication adherence was defined as 70 % or lower, which means the participant took medication 11 or few days out of 14 days over the prior two weeks. The research manager double-checked with them in weekly basis for the CommCare data entry. After entering the numbers in CommCare, CommCare automatically generated the pill count percentage.

## 2.3. Mental health assessment

Mental health symptom severity was assessed using a 15-item questionnaire that measured the experience of depression, anxiety, and posttraumatic stress symptoms. The questionnaire, which was validated with adults in Myanmar (Haroz et al., 2014, 2016, 2017, 2020), was developed for both research and clinical monitoring purposes; the questionnaire manual is available from the first author (JB). Respondents were asked to report on how frequently they experienced each of the 15- symptoms within the prior two weeks, with the response options ranging from 0, "not at all", to 3, "almost all of the time" with a total score ranging from "0 to 45″. The scale has strong reliability with a Chronbach alpha of 0.94. Based on the prior validation research, a total score greater than 5 was considered the cut-off for moderate to severe mental health symptoms. Sub-scores were generated using the symptoms of depression (4-items), anxiety (5-items) and posttraumatic stress (4-items) to provide a picture of the types of mental health concerns endorsed by the study participants.

## 2.4. Demographic, behaviors and self-efficacy assessment

**Sociodemographic indicators**: included sex, age, religion, country of birth, marital status, educational attainment, duration of stay at the camp, number of household members, position in the family, migration status (have formal registration, informal registration or unregistered), support adequacy (food ration, charcoal and shelter provided by NGOs) and financial situation (with and without debt).

**Physical Health:** Data from the IRC chronic disease database was extracted for NCD disease type, chronicity, and complications. Asia Pacific Body Mass Index classification was used to classify Body Mass Index (BMI) (WHO, 2000).

**Substance misuse:** Self-reported frequency of use of alcohol, tobacco, and betel nut was collected, with responses ranging from never (0) to every day (4) over the past two weeks. Among those who reported ever using, a second question asked for self-reported daily average intake for each substance. For this second question, participants were shown a picture for how a unit was defined for each substance: alcohol use was measured by standard drink, tobacco use was measured in individual cigarettes/cigar/cheroot, and the unit for betel nut was piece (s).

**Sleep quality:** Sleep quality was assessed using the 6-item sleep scale from the Medical Outcomes Study (MOS-6), a validated brief version of the MOS-Sleep 12-item tool (Kim et al., 2013; Viala-Danten et al., 2008) and Cronbach's alpha value was 0.81. Items assess frequency of experiencing a range of positive (2 items) and problematic (4 items) sleep experiences, ranging from none of the time to all of the time (0–4) over the past two weeks. The MOS-6 was scored by first reverse-scoring the two positively worded items, then calculating the mean of all items to generate a continuous score ranging from 0 to 4, with higher scores indicating poorer sleep patterns. Cut-off scores were calculated using guidance from Kiess et al., (Harold, 1989): low (scores

0–7), moderate (scores 8–15) and high (scores >15) problem sleeping.

**Disease management self-efficacy:** Disease management self-efficacy was assessed using a 9-item scale measuring self-reported confidence in taking various actions to manage one's illness ranging from not confident at all (0) to fully confident (3). The scale was adapted based on Self-efficacy for Appropriate Medication Use Scale (SEAMS) (Risser et al., 2007) and Cronbach's alpha value was 0.74. Scores were calculated by taking the mean of all items to generate a continuous score ranging from 0 to 3, with higher scores indicating greater self-efficacy in managing chronic disease. Cut-off scores for low or moderate (0–17) vs high (18–27) self-efficacy were calculated using Kiess's theory (Harold, 1989).

## 2.5. Statistical methods

Data were analyzed using the STATA program (version 18, serial number 301,809,334,109, licensed to Khon Kaen University). Mental health severity was defined both as a binary outcome - low/no symptoms for those who scored 0–5 vs. moderate/severe symptoms for those who scored > 5 - and as a continuous outcome with higher scores indicating more severe symptoms. In addition to describing the study sample sociodemographic, behavioral factor and chronic diseases characteristics, linear regression analyses were conducted to assess the associations between these characteristics and mental health severity. Bivariate regression analysis was applied to identify significant associations between each independent variable and the mental health scale score as a continuous outcome to be used in the multivariate analysis. We used t-statistics to test individual coefficients in the multiple linear regression model. Factors with p-value less than 0.25 were evaluated for multicollinearity and considered for multivariate analysis (Bursac et al., 2008).

## 2.6. Ethical consideration

All participants provided informed oral consent in their preferred language. This study was reviewed and approved by "Khon Kaen University Ethics Committee for Human Research" based on the "Declaration of Helsinki and the ICH Good Clinical Practice Guidelines" under the reference number of HE652103.

## 3. Results

### 3.1. Demographics

While all 224 study participants were identified as having poor medication adherence, the majority of them (77.23 %) had very low adherence (less than 50 %). The majority of the sample (70.98 %) was female, and the overall sample had a median age 56 years. The sample was relatively evenly distributed among religious affiliation, with 36.61 % identified as Buddhist, 34.38 % Muslim, and 29.01 % Christian. More than half (66.96 %) were married. Nearly two-fifths (39.29 %) of the respondents had no formal education, followed by primary school (34.38 %), whereas only 1.79 % had a bachelor's or equivalent as the highest educational attainment. Participants were in households with an average 5 family members, with more than half of them reporting being the head of the household (56.25 %). Two-thirds of the participants (66.31 %) reported they did not have a good enough financial situation to meet their expenses, with more than a quarter of the total (28.13 %) sample also reporting debt (Table 1).

### 3.2. Physical and behavioural health

The majority of participants had hypertension (HT: 63.64 %) or HT and diabetes mellitus (DM: 18.30 %), while 17.86 had DM only. Using the Asian criteria for BMI, 22.32 % of the sample was overweight and 29.46 % obese. Retinopathy was the most common complication (29.91

**Table 1**
Baseline social and demographic characteristics of the displaced Myanmar adults with suboptimal adherence to NCD medication(s) (*n* = 224).

| Factors | Number (n) | Percentage (%) |
|---|---|---|
| **Sex** | | |
| Male | 65 | 29.02 |
| Female | 159 | 70.98 |
| **Age group** | | |
| < 40 | 23 | 10.27 |
| 40 - 59 | 116 | 51.79 |
| ≥ 60 | 85 | 37.95 |
| Mean (S.D) | 55.68 (12.27) | |
| Median (Min;Max) | 56 (24: 88) | |
| **Religion** | | |
| Christian | 65 | 29.02 |
| Buddhist | 82 | 36.61 |
| Muslim | 77 | 34.38 |
| **Marital status** | | |
| Single | 8 | 3.57 |
| Separated/Married but living separately | 9 | 4.02 |
| Divorced | 8 | 3.57 |
| Widowed | 49 | 21.88 |
| Married | 150 | 66.96 |
| **Educational Attainment** | | |
| No formal education | 88 | 39.29 |
| Primary | 77 | 34.38 |
| Secondary | 32 | 14.29 |
| High school or equivalence | 23 | 10.27 |
| Bachelor or equivalence | 4 | 1.79 |
| **Duration of stay at the camp (Years)** * | | |
| < 10 | 13 | 5.80 |
| 10 - 19 | 143 | 63.84 |
| ≥ 20 | 68 | 30.36 |
| Mean (S.D) | 17.45 (6.48) | |
| Median (Min;Max) | 16 (1: 35) | |
| **Number of household members** | | |
| 1 - 3 | 47 | 20.98 |
| 4 - 6 | 112 | 50.00 |
| ≥ 7 | 65 | 29.02 |
| Mean (S.D) | 5.44 (2.70) | |
| Median (Min;Max) | 5 (1: 20) | |
| **Position in the family (Can choose more than one)** | | |
| Head | 126 | 56.25 |
| Spouse | 76 | 33.93 |
| Other | 22 | 9.82 |
| **Financial situation** | | |
| Enough with savings | 2 | 0.89 |
| Enough with no savings | 82 | 36.61 |
| Not enough | 77 | 34.38 |
| Not enough with debt | 63 | 28.13 |

**Table 2**
Physical and behavioural health among displaced Myanmar adults with poor suboptimal adherence to NCD medication (s) (*n* = 224).

| Factors | Number (n) | Percentage (%) |
|---|---|---|
| **Category of Disease** | | |
| Hypertension (HT) | 143 | 63.84 |
| Diabetes Mellitus (DM) | 40 | 17.86 |
| HT and DM comorbidity | 41 | 18.30 |
| **BMI (Asian criteria)** | | |
| Underweight (<18.5 kg/m$^2$) | 16 | 7.14 |
| Normal (18.5 – 22.9 kg/m$^2$) | 74 | 33.04 |
| Overweight (23 – 24.9 kg/m$^2$) | 50 | 22.32 |
| Obesity class I (25 – 29.9 kg/m$^2$) | 66 | 29.46 |
| Obesity class II (≥ 30 kg/m$^2$) | 18 | 8.04 |
| Mean (S.D) | 24.23 (4.22) | |
| Median (Min;Max) | 23.73 (15.63: 40.79) | |
| **Complications (Can include than one)** | | |
| Renal failure | 7 | 3.13 |
| Neuropathy | 62 | 27.68 |
| Retinopathy | 67 | 29.91 |
| Ulcers | 7 | 3.13 |
| Others | 12 | 5.36 |
| **Other chronic disease** | | |
| Asthma | 8 | 3.57 |
| Muscular Skeletal Diseases | 5 | 2.23 |
| Others | 7 | 3.12 |
| **Medication nonadherence (Pill Count %)** | | |
| Moderate adherence (50–69 %) | 51 | 22.77 |
| Low adherence (25–49 %) | 43 | 19.20 |
| Very low adherence (<25 %) | 130 | 58.04 |
| Mean (S.D) | 22.85 (24.48) | |
| Median (Min;Max) | 14.29 (0: 69.64) | |
| **Disease Management Self-efficacy** | | |
| Low or moderate (0–17) | 25 | 11.16 |
| High (18–27) | 199 | 88.84 |
| Mean (S.D) | 20.73 (3.48) | |
| Median (Min;Max) | 20 (12: 27) | |
| **Sleep Scale (MOS-6)** | | |
| Low problem (0–7) | 110 | 49.11 |
| Moderate problem (8–15) | 91 | 40.63 |
| High problem (>15) | 23 | 10.27 |
| Mean (S.D) | 7.84 (5.61) | |
| Median (Min;Max) | 8 (0: 24) | |
| **Alcohol Use** | | |
| Never | 198 | 88.39 |
| Ever | 26 | 11.61 |
| **Amount of daily use among users (*n* = 26) (Unit: Standard Drink)** | | |
| Mean (S.D) | 3.40 (4.50) | |
| Median (Min;Max) | 1.75 (1: 20) | |
| **Tobacco Smoking** | | |
| Never | 157 | 70.09 |
| Ever | 67 | 29.91 |
| **Amount of daily use among users (*n* = 67) (Unit: Individual cigarette/cigar/cheroot)** | | |
| Mean (S.D) | 4.19 (4.98) | |
| Median (Min;Max) | 3 (1: 32) | |
| **Betel Chewing** | | |
| Never | 77 | 34.38 |
| Ever | 147 | 65.63 |
| **Amount of daily use among users (*n* = 147) (Unit: piece)** | | |
| Mean (S.D) | 5.54 (5.53) | |
| Median (Min;Max) | 4 (1: 30) | |

%), followed by neuropathy (27.68 %). Other chronic or congenital diseases were also found, such as asthma (3.57 %) and musculoskeletal diseases (MSD) (2.23 %). In terms of substance use, 11.6 % of respondents reported ever drinking alcohol and 29.91 % ever smoking in the past 2 weeks, while most individuals (65.63 %) reported ever chewing betelnut. Most participants reported low (49.11 %) or moderate (40.63 %) sleep problems and most (87.44 %) reported high levels of disease management self-efficacy (Table 2).

### 3.3. Mental health symptoms

The mean total mental health symptom severity scores were 5.95 (95 % CI: 4.96 to 6.94), with more than one-third of the sample (38.39 %) reporting symptom scores greater than 5, indicating presence of moderate to severe mental health symptoms (95 % CI: 55.02 to 67.79) (Table 3).

### 3.4. Factors associated with mental health symptom severity

In the bivariate analyses (Table 4), statistically significant factors

associated with higher mean mental health symptoms (continuous score) were being Muslim, reporting poor financial situation with debt, having DM or comorbid DM and HT compared with only having HT, and having moderate or high compared with low level of sleep problems. Nine factors including sex, age group, religion, number of household members, financial situation, alcohol drinking, tobacco smoking, category of disease, and sleep problems were checked for multicollinearity and were included in the multivariate analysis (Table 5). Having DM or comorbid DM and HT compared with only HT, not enough financial situation with debt, and reporting moderate or high sleep problems compared with low sleep problems all remained significant in the

**Table 3**
Mental Health Symptoms.

| Factors | Number | % | 95 % CI |
|---|---|---|---|
| **Total Mental Health Scale (15 items):** | | | |
| None to Mild (score 0–5) | 138 | 61.61 | 55.02 to 67.79 |
| Moderate to severe symptoms (score ≥ 6) | 86 | 38.39 | 32.21 to 44.98 |
| Mean (S.D) | 5.95 (7.55) | | 4.96 to 6.94 |
| Median (Min:Max) | 3 (0:42) | | N/A |
| **PTSD specific symptoms (4 items):** | | | |
| Mean (S.D) | 1.36 (2.28) | | 1.06 to 1.66 |
| Median (Min:Max) | 0 (0:12) | | N/A |
| **Depression specific symptoms (4 items):** | | | |
| Mean (S.D) | 2.14 (2.31) | | 1.84 to 2.44 |
| Median (Min:Max) | 2 (0:12) | | N/A |
| **Anxiety specific symptoms (5 items):** | | | |
| Mean (S.D) | 1.96 (2.78) | | 1.59 to 2.33 |
| Median (Min:Max) | 1 (0:14) | | N/A |

multivariate analyses.

## 4. Discussion

### 4.1. Mental health characteristics among displaced adults with suboptimal NCD medication adherence

This study revealed that displaced Myanmar adults with poor medication adherence to their hypertension (HT) and/or diabetes mellitus (DM) medication had a high prevalence of moderate to severe mental health symptoms. This is not surprising given that evidence shows that migrants with pre-migration exposure to armed conflict (Mesa-Vieira et al., 2022) and displaced persons residing in camps (Knappe et al., 2023) are more vulnerable to more severe mental health symptoms. Moreover, displacement-related stressors such as loss of possessions, separation from family members, loss of social support networks, unemployment, and dependency on aid significantly affect the mental health of the displaced persons (Miller and Rasmussen, 2017).

This study found that individuals with poor adherence for both HT and DM were at increased risk for poorer mental health compared with those with only one of these conditions, which is consistent with the growing research on the co-occurrence between NCDs and mental health problems (Dehesh et al., 2020; Tran et al., 2021). A study from Thailand (Pengpid et al., 2023) and a study done among adults with chronic diseases from Cambodia, Myanmar and Vietnam supported our finding that higher risk of depressive symptoms and anxiety symptoms were significantly associated with having comorbidities (Peltzer and Pengpid, 2016). Some studies suggested that patients with HT and DM are at a heightened risk of developing cardio-cerebrovascular diseases, which can potentially lead to cognitive impairment and impact on mental health (Akinyemi et al., 2019; Wang et al., 2021). Moreover, the physical, emotional and financial stress regarding disease conditions and medication could also affect their mental health symptoms (Tran et al., 2021).

While poor adherence and mental health problems often go hand-in-hand and may be bidirectional association, it is important to note that most of the sample (62 %) did not have either moderate or severe mental health symptoms. We also did not see any trends with degree of NCD medication non-adherence and mental health symptom severity.

### 4.2. Factors associated with more severe mental health symptoms

The findings from out study demonstrated that the participants with poor financial situation, in particular those who also reported debt, had significantly higher mental health symptom scores compared with those with a more stable financial situation. This is consistent with the identified associations between income and socioeconomic and mental health (Rashki Kemmak et al., 2021; Sasaki et al., 2021). Our study also

**Table 4**
Analyses of associations between demographic, physical and behavioral factors and mean mental health scale scores (n = 224).

| Factors | Number | Mean Mental health score | SD | Crude Mean diff. | 95 % CI | p-value |
|---|---|---|---|---|---|---|
| **Overall** | 224 | 5.95 | 7.55 | N/A | N/A | N/A |
| **Sex** | | | | | | 0.111 |
| Male | 65 | 4.69 | 6.45 | Ref | | |
| Female | 159 | 6.47 | 7.91 | 1.77 | −0.41 to 3.95 | |
| **Age (continuous)** | 224 | N/A | N/A | −0.08 | −0.16 to 0.00 | 0.059 |
| **Age group** | | | | | | 0.127 |
| ≥ 60 years | 85 | 7.70 | 9.97 | Ref | | |
| 40 – 59 years | 116 | 6.51 | 8.11 | −1.19 | −4.57 to 2.19 | |
| < 40 years | 23 | 4.72 | 5.69 | −2.98 | −6.46 to 0.50 | |
| **Religion** | | | | | | 0.002 |
| Buddhist | 82 | 4.29 | 6.04 | Ref | | |
| Christian | 65 | 5.17 | 6.02 | 0.88 | −1.53 to 3.29 | |
| Muslim | 77 | 8.38 | 9.39 | 4.08 | 1.78 to 6.39 | |
| **Marital status** | | | | | | 0.263 |
| Married | 150 | 5.55 | 7.38 | Ref | | |
| Not Married | 74 | 6.76 | 7.87 | 1.20 | −0.91 to 3.31 | |
| **Educational attainment** | | | | | | 0.451 |
| High school/ Bachelor or equivalent | 27 | 4.78 | 5.15 | Ref | | |
| Secondary | 32 | 7.72 | 9.26 | 2.94 | −0.95 to 6.83 | |
| Primary | 77 | 6.06 | 8.41 | 1.29 | −2.04 to 4.62 | |
| No formal education | 88 | 5.57 | 6.64 | 0.79 | −2.48 to 4.07 | |
| **Duration of years in community (continuous)** | 224 | N/A | N/A | 0.06 | −0.10 to 0.21 | 0.480 |
| **Duration of years in community** | | | | | | 0.873 |
| < 20 years | 156 | 5.90 | 7.39 | Ref | | |
| ≥ 20 years | 68 | 6.07 | 7.94 | 0.18 | −1.99 to 2.34 | |
| **Number of household members** | | | | | | 0.542 |
| 1 - 3 | 47 | 5.21 | 5.56 | Ref | | |
| 4 - 6 | 112 | 5.79 | 8.40 | 0.58 | −2.01 to 3.17 | |
| ≥ 7 | 65 | 6.75 | 7.26 | 1.54 | −1.31 to 4.39 | |
| **Position in the family** | | | | | | 0.604 |
| Others | 22 | 4.45 | 5.70 | Ref | | |
| Spouse | 76 | 6.28 | 7.75 | 1.82 | −1.79 to 5.43 | |
| Head | 126 | 6.02 | 7.72 | 1.56 | −1.88 to 5.01 | |
| **Migration Status** | | | | | | 0.654 |
| UN | 63 | 5.52 | 7.24 | Ref | | |
| URG | 140 | 6.30 | 7.88 | 0.77 | −1.49 to 3.03 | |
| Undocumented | 21 | 4.95 | 6.17 | −0.57 | −4.33 to 3.19 | |
| **Financial situation** | | | | | | <0.001 |

*(continued on next page)*

**Table 4** (*continued*)

| Factors | Number | Mean Mental health score | SD | Crude Mean diff. | 95 % CI | p-value |
|---|---|---|---|---|---|---|
| Enough with or without savings | 84 | 4.56 | 6.30 | Ref | | |
| Not Enough | 77 | 4.42 | 4.90 | −0.14 | −2.38 to 2.10 | |
| Not Enough with debt | 63 | 9.68 | 9.68 | 5.12 | 2.76 to 7.49 | |
| **Alcohol** | | | | | | 0.061 |
| Never | 198 | 6.29 | 7.82 | Ref | | |
| Ever | 26 | 3.35 | 4.28 | −2.95 | −6.03 to 0.14 | |
| **Tobacco Smoking** | | | | | | 0.319 |
| Never | 157 | 6.28 | 7.85 | Ref | | |
| Ever | 67 | 5.18 | 6.78 | −1.10 | −3.27 to 1.07 | |
| **Betel Chewing** | | | | | | 0.944 |
| Never | 77 | 6.00 | 8.14 | Ref | | |
| Ever | 147 | 5.93 | 7.25 | −0.07 | −2.17 to 2.02 | |
| **BMI** | | | | | | 0.623 |
| Normal | 74 | 6.58 | 7.83 | Ref | | |
| Underweight | 16 | 4.88 | 4.13 | −1.71 | −5.82 to 2.40 | |
| Overweight and Obesity | 134 | 5.73 | 7.72 | −0.85 | −3.01 to 1.31 | |
| **Category of Disease** | | | | | | <0.001 |
| Hypertension | 143 | 4.18 | 5.28 | Ref | | |
| Diabetes | 40 | 7.98 | 8.68 | 3.79 | 1.27 to 6.32 | |
| DM and HT | 41 | 10.14 | 10.56 | 5.96 | 3.46 to 8.47 | |
| **Medication nonadherence** | | | | | | 0.276 |
| Moderate (50 - 70 %) | 51 | 7.18 | 8.65 | Ref | | |
| Low (25–49 %) | 43 | 4.67 | 6.31 | −2.50 | −5.58 to 0.57 | |
| Very low (<25 %) | 130 | 5.89 | 7.44 | −1.28 | −3.74 to 1.17 | |
| **Self-Efficacy** | | | | | | 0.453 |
| Low/moderate (0–17) | 25 | 4.88 | 5.75 | Ref | | |
| High (18–27) | 199 | 6.09 | 7.74 | 1.21 | −1.95 to 4.36 | |
| **Sleep Problems** | | | | | | <0.001 |
| Low (0–7) | 110 | 3.73 | 5.88 | Ref | | |
| Moderate (8-15) | 91 | 5.93 | 5.63 | 2.21 | 0.37 to 4.04 | |
| High (>15) | 23 | 16.65 | 11.49 | 12.92 | 9.96 to15.89 | |

highlights the association between sleep problems and more severe mental health symptoms. Sleep problems such as insomnia dysregulate multiple systems involved in mental health, such as neurotransmission and hormone regulation, resulting in impaired regulation of mood, emotions, as well as cognition (Palagini et al., 2022). The relationship between sleep and mental health is complex and bidirectional. This study cannot prove the causal relationship between the variables and thus, integrated approaches on both aspects should be considered to better outcomes and improved quality of life. We also observed a higher mean mental health symptom score among individuals identifying with Islam religion, with approximately half reporting moderate to high symptoms. This finding underscores the importance of further exploration and may suggest some additional vulnerabilities not explored in this study.

### 4.3. Relevance for service integration

The high prevalence of moderate and severe mental health symptoms in our study suggested the need to expand availability of mental health services, especially within other health care systems such as NCD care programs in conflict-affected and humanitarian settings in order to support care maintenance and overall health of displaced populations. The associated factors explored by our study also highlight the needs for consideration of humanitarian aid orientated to sustainable income generation of camp residents as an important factor to potentially reduce the risk for mental health problems.

### 4.4. Limitations

The study sample only included individuals with suboptimal NCD medication adherence and as such, conclusions cannot be made about the associations between mental health and NCDs more generally. Moreover, patients might combine their previous pills with the current pills when identifying pills making pill count specificity more difficult. Finally, as a cross-sectional study, while causal relationships between potential risk factors and mental health cannot be identified, further analysis using structural equation models could allow for examination of additional pathways and relationships between the variables.

### 5. Conclusion

In our settings, more than one-third of patients with suboptimal medication adherence to their NCD medications were identified as having moderate to severe mental health problems. Factors associated with higher mental health severity included poor financial situation, having DM or comorbid DM and HT, and high sleep problems. Integrating mental health support programs into chronic disease care systems are needed to support the overall health of this vulnerable population. For instance, it is suggested to set up multidisciplinary teams

**Table 5**

Significant factors associated with mental health severity scores in the multivariate analysis (*n* = 224).

| Factors | Number | Mean | (SD) | Crude Mean diff. | Adj. Mean diff. | 95 % CI | p-value |
|---|---|---|---|---|---|---|---|
| Overall | 224 | 5.95 | 7.55 | N/A | N/A | N/A | N/A |
| **Category of Disease** | | | | | | | |
| Hypertension | 143 | 4.18 | 5.28 | Ref | Ref | | |
| Diabetes | 40 | 7.98 | 8.68 | 3.79 | 2.62 | 0.38 to 4.87 | 0.022 |
| HT+DM Comorbid | 41 | 10.14 | 10.56 | 5.96 | 3.22 | 0.92 to 5.51 | 0.006 |
| **Financial situation** | | | | | | | |
| Enough with or without savings | 84 | 4.56 | 6.30 | Ref | Ref | | |
| Not Enough | 77 | 4.42 | 4.90 | −0.14 | 0.04 | −1.94 to 2.01 | 0.972 |
| Not Enough with debt | 63 | 9.68 | 9.68 | 5.12 | 3.78 | 1.68 to 5.88 | <0.001 |
| **Sleep (MOS-6)** | | | | | | | |
| Low problem | 110 | 3.73 | 5.88 | Ref | Ref | | |
| Moderate problem | 91 | 5.93 | 5.63 | 2.21 | 1.53 | −0.23 to 3.30 | 0.089 |
| High problem | 23 | 16.65 | 11.49 | 12.92 | 10.50 | 7.50 to 13.49 | <0.001 |

that include doctors, medics, psychosocial and community health worker teams, and to equip the service providers with the skills to recognize and address mental health issues related to hypertension and diabetes. Incorporating mental health screenings into routine check-ups and implementing early intervention programs to address mental health issues could also add significant value to the existing healthcare programme.

Holistic approaches to improve economic and overall health should be considered for the people living with NCDs in humanitarian setting. Assessing sleep quality as part of routine care and providing education on sleep hygiene would be beneficial for health and well-being of the population. It would be valuable to establish robust systems for tracking health outcomes and gathering feedback to assess the effectiveness of integrated care. Using this information to make necessary adjustments and refinements will ensure the program remains responsive to the needs of displaced individuals. Supporting ongoing research and innovation can further enhance the program's ability to address the unique challenges faced by those managing chronic conditions.

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## CRediT authorship contribution statement

**Judith K Bass:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Formal analysis, Conceptualization. **Amanda Nguyen:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Kittipong Sornlorm:** Visualization, Validation, Supervision, Methodology, Formal analysis, Conceptualization. **Ye Htut Oo:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Formal analysis, Data curation. **Jarntrah Sappayabanphot:** Visualization, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Catherine Lee:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Wongsa Laohasiriwong:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Formal analysis, Conceptualization.

## 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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