An integrated physical and mental health awareness education intervention to reduce non-communicable diseases among Syrian refugees and Jordanians in host communities: A natural experiment study

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ABSTRACT

The Syrian crisis has had a devastating impact on displaced populations and among host communities in neighboring countries such as Jordan. Many of these individuals are at risk for non-communicable diseases (NCD) and mental health disorders, yet do not have access to services designed to manage or prevent these conditions. The purpose of this study was to examine the efficacy of a non-communicable disease (NCD) awareness educational intervention and an integrated NCD and mental health education intervention on reducing cardiovascular disease (CVD) risk among Jordanians and displaced Syrians.

This natural experiment study was conducted in three health centers in Irbid, Jordan with 213 Syrian participants and 382 Jordanians. Participants were assigned to one of three study conditions: the Healthy Community Clinic (HCC), a non-communicable disease educational intervention; the HCC with added mental health awareness sessions; standard healthcare. CVD risk factors were assessed at baseline, 12 and 18 months.

The HCC education group yielded significant improvements in three CVD risk factors including: body mass index (BMI) −1.91 (95% CI: −2.09, −1.73); systolic blood pressure (SBP) −12.80 mmHg (95% CI: −16.35, −9.25); and diastolic blood pressure (DBP) −5.78 mmHg (95% CI: −7.96, −3.60) compared to standard care. The HCC-mental health treatment arm also demonstrated significant improvements in BMI, SBP, and DBP compared to standard care. Significant improvements in fasting blood glucose −20.32 (CI: −28.87, −11.77) and HbA1c −0.43 (−0.62, −0.24) were also illustrated in the HCC-mental health treatment arm. The HCC-mental health group sustained greater reductions in CVD risk than the HCC education group at 18-months.

This study is among the first to our knowledge illustrating an integrated health and mental health educational intervention can reduce CVD risk among Syrian refugees and Jordanians. Continued investment and research in CVD prevention interventions is needed to enhance health, reduce costs, and have lasting benefits for conflict-affected individuals and communities.

1. Introduction

Since 2012, armed conflict in Syria has displaced over 12 million people, with more than half of those exiled fleeing the country (United Nations Refugee Agency, 2019). Neighboring countries in the Middle East and Europe have taken in the bulk of displaced Syrians disp in what has been described as the worst refugee crisis since World War II (Cousins, 2015). Jordan has accepted 1.3 million displaced Syrians, more than any other country save for Turkey and Lebanon (Annual Report, 2018; United Nations Refugee Agency, 2019; Al-Majali et al., 2016). This influx of refugees has strained economic and social structures in Jordan such as the job market and local healthcare and social

services systems (Francis, 2015). Notably, the inundation of refugees has limited healthcare access to individuals with chronic physical and mental health conditions (Francis, 2015; Doocy et al., 2015; Wells et al., 2016).

Non-communicable diseases (NCDs) pose a significant public health challenge in low and middle income countries (LMICs); particularly in those, such as Jordan, that have accommodated a substantial number of refugees (Alwan et al., 2011; Slama et al., 2017; Jobanputra et al., 2016; Friel et al., 2011). According to the World Health Organization, NCDs are attributed to 41 million deaths every year, accounting for 71% of global deaths (World Health Organization. Noncommunicable diseases, 2018). Jordan, a middle income country that has been affected by recent conflict, reports a higher percentage than the global average with 78% of the populations mortality attributed to NCDs, with cardiovascular disease accounting for on third of those deaths (World Health Organization. Noncommunicable diseases (NCD) country profile, 2018; Al-Nsour et al., 2007). A study of Syrian refugees in Jordan found that more than half of households had at least one family member with an NCD, including hypertension (9.7%), arthritis (6.8%), diabetes (5.3%), chronic respiratory diseases (3.1%), and cardiovascular disease (3.7%) (Doocy et al., 2015). Furthermore, a study of Syrian refugees outside of refugee camps in Jordan estimated that approximately 60,041 adults have at least one NCD (Rehr et al., 2018).

NCDs are highly co-morbid with mental health diagnoses (Druss and Walker, 2011). Poor mental health exacerbates modifiable NCD disease risk factors such as inactivity, tobacco use, or lack of energy or motivation (Patel et al., 2013). Alternatively, an NCD diagnosis such as cardiovascular disease, cancer, or diabetes can trigger mental health symptoms such as depression, anxiety, or post-traumatic stress (Stein et al., 2019). World Mental Health Surveys found that individuals with heart disease were 2.2 times more likely to be diagnosed with anxiety disorders and 2.1 times as likely to experience mood disorders (Stein et al., 2019).

2. Integrated mental health and NCD prevention interventions

Considering the high comorbidity of NCD's and mental health related disorders, scholars have called for integrated care models designed to prevent and/or treat co-morbid medical conditions (Ngo et al., 2013; Patel and Chatterji, 2015; Collins et al., 2017). Ngo and colleagues (Ngo et al., 2013) noted such models should include primary care providers and community health workers to collaboratively teach patients about illnesses, treatment, and risk factors; provide brief evidence-based intervention; and educate patients on self-management skills. Researchers and practitioners have begun to develop integrated NCD and mental health intervention approaches, yet there is little evidence to support these models (Druss and Walker, 2011). One study conducted in the United States (U.S.) of a primary care-based intervention designed for patients with co-morbid major depression and diabetes provided screening, treatment, and education. Findings illustrated improved systolic blood pressure, low density lipoprotein (LDL), total cholesterol, depression, and glycated hemoglobin. Further, gains in the primary outcomes of the study were greater than those in other trials that treated single conditions such as diabetes, hypertension, or depression (Katon et al., 2010). Other studies on integrated care, all of which show a benefit for physical and mental health, have also been conducted in high income countries and not focused on refugees (Patel and Chatterji, 2015; Huang et al., 2013). Thus, questions about populations in LMICs and refugees remain.

Our study explored the impact of the Healthy Community Clinic (HCC) a health awareness educational intervention designed to reduce the risk of NCDs, and the HCC with added mental health awareness sessions (HCC-MH) among Syrians and Jordanians in a border community in Jordan. The primary research objectives of this three-arm study were two-fold: (United Nations Refugee Agency, 2019) to explore the impact of the HCC with displaced Syrians and Jordanians diagnosed or

at risk for an NCD; and (Cousins, 2015) to examine the synergistic effect of an integrated HCC-MH awareness intervention in primary health clinics in Jordan. Our primary hypothesis was that participation in the HCC would lead to greater reductions in CVD risk factors than standard care. Our secondary hypothesis was that participation in the integrated HCC-MH intervention would lead to greater reductions in systolic (SBP) and diastolic (DBP) blood pressure, blood glucose, and body mass index (BMI) than among those who participated in the HCC or standard care. It was hypothesized that the HCC-MH would lead to greater reductions in these CVD risk factors because of the association between chronic stress and high blood pressure, blood glucose, and obesity (Marcovecchio and Chiarelli, 2012; Do Yup Lee and Choi, 2015). The HCC and the HCC-MH intervention are described below.

3. Methods

3.1. Overview and study design

We used a natural experiment study design examining: HCC health awareness education intervention (HCC); the HCC health awareness education intervention with added mental health sessions (HCC-MH); and standard care in three community health clinics in Irbid, Jordan, that treat both Syrian refugees and Jordanians. Practical considerations (e.g., costs, acceptability to patients or providers, prior participation in the HCC) made a randomised control trial unfeasible. Therefore, clinics that had not previously received the HCC intervention were matched based upon demographics and one intervention arm was assigned to each of the three clinics. Through assignment of each clinic to one condition, contamination of participants was minimized (Axelrod and Hayward, 2006). The HCC-MH intervention was determined based on the clinic's proximity to a facility that provided mental health services. The assignment of the HCC-MH intervention in close proximity to a mental health clinic allowed for referrals in the case a participant in the mental health awareness sessions needed additional psychological services. None of the participants enrolled in the HCC-MH intervention reported using mental health services prior to participation in the intervention.

3.2. HCC intervention

HCC is a community-based health awareness educational intervention designed to manage and/or prevent NCDs at the primary health care level. The HCC was developed in 2011 through a collaborative effort between a Jordanian non-profit, the Royal Health Awareness Society, and the Jordanian Ministry of Health (MoH). Since its development in 2011, the HCC has been delivered in MoH health centers throughout Jordan (Royal Health Awareness Society. Healthy Community Clinic, 2017). The HCC educates patients at risk or diagnosed with NCDs on disease management and prevention. It aims to reduce NCD-related deaths and increase health awareness among patients. The HCC is delivered as a group work model with approximately 20 participants in each group. Participants take part in 20 interactive awareness sessions over a period of one year, covering the following topics: diabetes, hypertension, cardiovascular diseases, obesity, nutrition, importance of physical activity, reproductive health, asthma, and smoking. In each session, participants receive education about NCD prevention as well as individual and community level strategies to improve health. Each session lasts approximately 45 min and patients attend two sessions per month (see table 1 for description of intervention). The facilitators were masters' level trained health awareness educators employed by the Royal Health Awareness Society (RHAS) of Jordan and nurses at the local Ministry of Health (MoH) clinics.

3.3. HCC plus mental health intervention

The HCC plus mental health intervention (HCC-MH) included the

Table 1
Description of Study Arms.

Standard Care	i. Data collection at three time points (Baseline, 12, 18 months).
	ii. At each data collection time point participants had a brief conversation with physician about health during previous month
HCC	i. Twenty 45-minute health education sessions.
	Topics included:
	• diabetes
	• hypertension
	• asthma
	• cardiovascular disease
	• reproductive health
	• healthy nutrition
	• smoking
	ii. Group nutrition and physical fitness counselling.
	i. Data collection at three time points (Baseline, 12, 18 months)
HCC + Mental Health	i. Twenty 45-minute health education sessions.
	Topics included:
	• diabetes
	• hypertension,
	• asthma
	• cardiovascular disease
	• reproductive health
	• healthy nutrition
	• smoking
	ii. Four mental health awareness sessions.
	Topics included:
	• common reactions to traumatic stress
	• coping with grief and trauma
	• strategies to reduce stress (e.g. mindfulness, exercise)
	• strategies to increase positive coping
	iii. Group nutrition and physical fitness counselling.
	ii. Data collection at three time points (Baseline, 12, 18 months).

HCC with an additional four sessions delivered in the first six months of the intervention. The HCC was adapted to the HCC-MH in spring of 2016 through a collaboration between mental health experts employed by RHAS, Americares (a U.S. based humanitarian relief organization), and university researchers. The mental health sessions integrated culturally relevant material and evidence-informed approaches to increase awareness of mental health and provide participants with tangible coping skills to reduce emotional distress.

The MH component of the HCC intervention used a combination of psychoeducation and solution-focused techniques to increase partici-pants' capacity to identify and cope with potential mental health related symptoms (Lukens and McFarlane, 2004; Walter and Peller, 2013). Psychoeducation included information and discussion on physical and emotional traumatic stress reactions, grief and trauma, and strategies to reduce stress and increase positive coping. Information on individual and collective coping strategies to alleviate stress and trauma symptoms was also integrated into each session. A solution-focused approach was used in each session to strengthen self-efficacy (i.e., confidence) around coping strategies and to help participants take an active role in ampli-fying individual, familial, and community strengths and resources. The solution-focused approach encouraged participants to envision how they would like things to be and devise the steps they need to take to reach their goals. Further, the solution-focused approach emphasized envisioning change over focusing on problems, therefore building ca-pacity to amplify participants' strengths (Walter and Peller, 2013; Kim, 2008).

The facilitators of the integrated HCC-MH health intervention were masters' level trained health awareness educators who had previously been trained in and delivered the HCC intervention and took part in an additional three-day training on the mental health awareness sessions. The training, facilitated by the principal investigator of the study, included a background on general mental health and psychosocial support (MHPSS) programming in humanitarian settings, program design, facilitation, and implementation.

3.4. Standard care

Standard care included routine clinic visits to renew prescriptions for NCDs as needed and a short conversation with the physician about participants' health during the previous month. Table 1 provides a description of the study arms.

3.5. Selection and description of participants

Participants were recruited from three MoH centers in Irbid, Jordan between February and April 2017. The treating MoH physicians at the health centers referred eligible patients to the study, and flyers with information about the study were posted at the health centers. The HCC and HCC-MH interventions were delivered between April 2017-April 2018. Data were collected at three time points between April 2017 and October 2018 with 600 participants served in three study clinics in Irbid, which were between 35 and 65 km away from the Syrian border and where a significant number of Syrian refugees reside (Annual Report, 2018). During enrollment in the study, participants reported their health status and if they had been diagnosed with an NCD. The nurses enrolling participants also collected the following information: age, family health history, weight, height, fasting blood glucose, and blood pressure.

Individuals were eligible for the study if they were: between 18 and 75 years old; utilized services at the health centers between January and April 2017; and were at risk for or diagnosed with an NCD. Standards used for patients to be included in the study followed the most recent American College of Cardiology (ACC), American Diabetes Association (ADA), and the American Heart Association (AHA) guidelines for car-diovascular and diabetes risk and diagnoses including: obesity, defined as BMI $\geq$ 30; fasting plasma glucose $\geq$ 100 ml/dl (prediabetes according to the ADA guideline); systolic blood pressure $\geq$ 120 mmHg and/or diastolic blood pressure $\geq$ 80 mmHg (elevated blood pressure according to the 2017 ACC guideline); self-reported uncontrolled dyslipidemia, cholesterol > 240 mg/dl, LDL > 190 mg/dl (hypercholesterolemia ac-cording to the 2018 ACC/AHA guideline); high-density lipoprotein (HDL) less than 40 mg/dl and/or TG > 500 mg/dl; asthma; diabetes; and hypertension (American Diabetes Association, 2019; Whelton et al., 2018). Participants were excluded from the study if they experienced the following: renal dysfunction; congestive heart disease or chronic heart failure; functional disability; uncontrolled resistant hypertension defined as blood pressure remaining above the threshold despite life-style modifications and concurrent use of at least three antihypertensive medications from different classes, with one being a diuretic assessed by self-report; pregnant women; receiving psychotherapy; or uncontrolled hypothyroidism.

A total of 694 were recruited, however, 94 were excluded because they did not fit the inclusion criteria. All participants consented to take part in the study prior to data collection. Glucometers and laboratory tests were provided as incentives for study participation. The gluc-ometers were provided after participants completed the final measure-ment time point and the laboratory tests were completed at three time points throughout the study period. The Jordanian Ministry of Health and the first author's institutional review board approved study pro-cedures prior to data collection. Figure one presents the recruitment chart.

3.6. Measures

Measurements included anthropometric measures and laboratory tests. The research team in Jordan collected the measures at three time points: time 0 (baseline: prior to participation in the HCC and HCC-MH), time 1 (12 months: immediately after participation in the intervention) and time 2 (18 months: six months after completion of the intervention). Demographic items included nationality, gender, age, income, educa-tion, and number of years living in Jordan. Prior to data collection the

principal investigator trained the research team in data collection, consenting procedures, confidentiality of data, research ethics, and study methodology.

Laboratory tests occurred in the mornings allowing patients to fast overnight (a minimum of eight hours). Phlebotomists trained in the research protocol at MedLabs, a Jordanian based medical laboratory, collected the following blood tests according to standard protocol: fasting blood glucose (FBG), glycated hemoglobin (HbA1c), LDL, HDL, cholesterol, and triglycerides (Medlabs. LabWise 5, 2019). At each time point 3 ml of blood was collected and each tube was clearly marked with the volume of blood to be collected. Diastolic (DBP) and systolic (SBP) blood pressure were taken on the right upper limb; the participant sitting upright in a chair with their back straight and on their bare arm so the nurse was able to insert 2 fingers between the cuff and the skin. The first reading was taken after the participant rested for five minutes sitting down and the second taken after 10 min. Weight (measured in kilograms) was also collected at each time point. Body Mass Index (BMI) was calculated using the standard formula (BMI-weight (kg)/height (m^2)).

3.7. Statistical analyses

Descriptive statistics of participants were calculated for each intervention arm. Chi square and ANOVA analyses examined demographic differences between study arms. Because the data are repeated measures for the same individuals collected at different time points, we employed a multi-level model to account for correlations within individuals across time, and correlations between individuals within the same time point (e.g. Participant 1, Participant 2, Participant 3, within time 2). We included fixed effects for subject and for time and estimate the following model:

$$Y_{it} = \beta_0 + \beta_1 X_{Arm1} + \beta_2 X_{Arm2} + \gamma_1 X_{Arm1\_post} + \gamma_2 X_{Arm2\_post} + \alpha_i + \delta_t + \varepsilon_{it}$$

Y_{it} represents the outcome for subject i at time t. *Arm1* represents the HCC intervention arm, and *Arm 2* represents the HCC-MH intervention arm. The outcomes are continuous therefore, we estimated linear regression models. X_{Arm1} and X_{Arm2} represent binary variables indicating that the participant received intervention at 12 months from baseline, while X_{Arm1_post} and X_{Arm2_post} indicate that the participant was six months post-intervention (18monthsfrombaseline). β_1 and β_2 represent the intervention effects for HCC and HCC-MH. γ_1 and γ_2 represent the intervention effects at six months post intervention (18 months) for HCC and HCC-MH. The subject level fixed effects $\alpha_i$controls for heterogeneity across individuals, such as education, gender, or income. The time level fixed effects δ_t controls for general trends across time. We used the statistical software *R* (version 3.5.1) to estimate the results.

4. Results

Participants numbered 600 (see Fig. 1 for the recruitment chart). There were 213 (35.6%) Syrian participants and 382 (63.9%) Jordanian. Among the sample, participants were primarily female (69.8%), made less than 200 Jordanian Dinar (equivalent to 282 U.S. Dollars) per month (48.5%), and were unemployed (76.7%). The largest group was between 45 and 54 years old (31.0%). Table 2 presents demographic details.
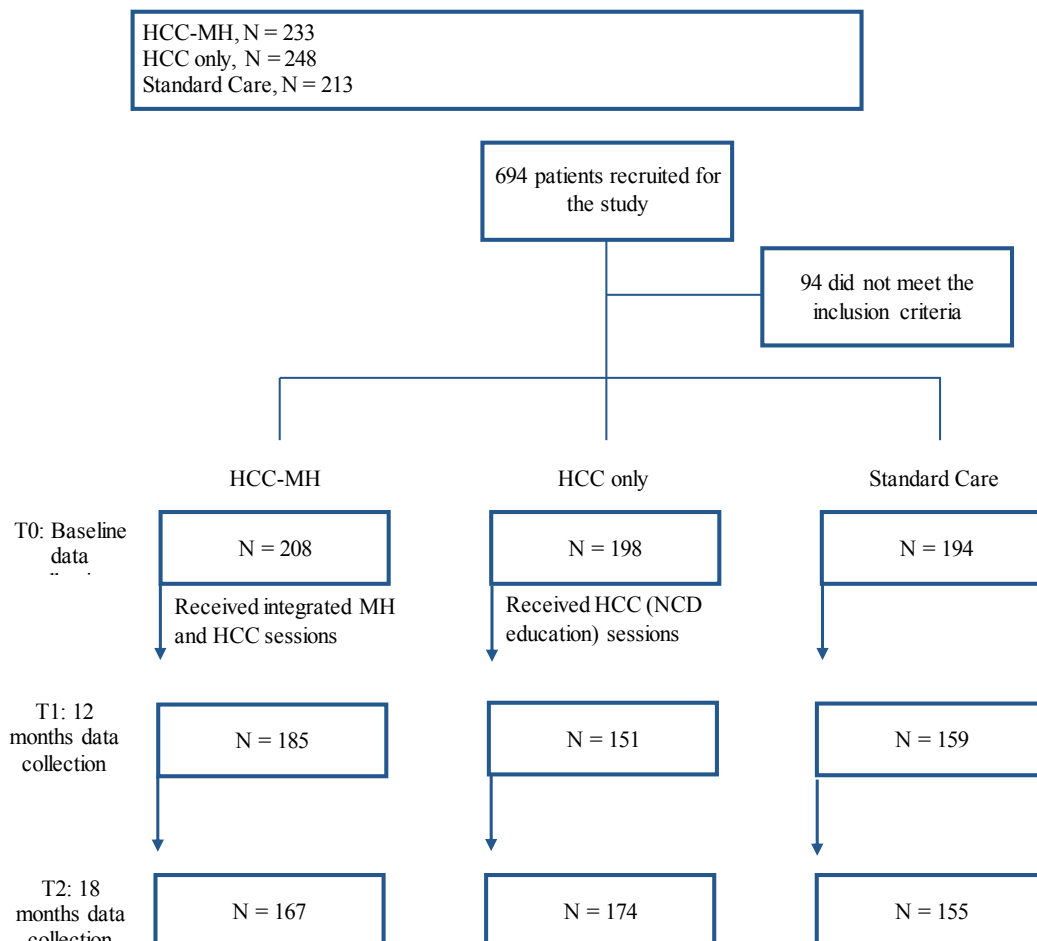

Fig. 1. Recruitment Chart.

Table 2
Demographics.

	Arm 1: HCC	Arm 2: HCC + MH	Arm 3: Standard Care	Total	Chi Square
	N (%)	N (%)	N (%)	N (%)	
Gender[1]					
Male	67 (33.8%)	54 (26.1%)	59 (30.4%)	418 (69.8%)	3.03 ns
Female	130 (65.7%)	153 (73.9%)	135 (69.6%)	180 (30.1%)	
Nationality[2]					
Jordanian	125 (63.1%)	135 (65.5%)	122 (62.9%)	382(63.9%)	6.39 ns
Syrian	71 (35.9%)	71 (34.5%)	71 (36.6%)	213(35.6%)	
Age					
18–25	6 (3.3%)	21 (10.9%)	12 (7.3%)	39 (7.2%)	
26–34	17 (9.3%)	26 (13.5%)	26 (15.9%)	69 (12.8%)	
35–44	46 (25.3%)	43 (22.4%)	30 (18.3%)	119 (22.1%)	22.65*
45–54	65 (35.7%)	59 (30.7%)	43 (26.2%)	167 (31.0%)	
55–64	33 (18.1%)	27 (14.1%)	27 (16.5%)	87 (16.2%)	
65+	14 (7.7%)	16 (8.3%)	26 (15.9%)	56 (10.4%)	
Marital Status					11.43 ns
Single	5 (2.6%)	11 (5.5%)	13 (6.9%)	29 (5.0%)	
Married	169 (87.1%)	170 (85.0%)	151 (80.3%)	490 (84.2%)	
Divorced	1 (0.5%)	1 (0.5%)	5 (2.7%)	7 (1.2%)	
Widowed	16 (8.2%)	17 (8.5%)	18 (9.6%)	51 (8.8%)	
Occupation					12.67 ns
Unemployed	141 (74.6%)	165 (82.9%)	132 (72.1%)	438 (76.7%)	
Employed	35 (18.5%)	25 (12.6%)	41 (22.4%)	101 (17.7%)	
Self-Employed	12 (6.3%)	7 (3.5%)	6 (3.3%)	25 (4.4%)	
Employer	1 (0.5%)	2 (1%)	3 (1.6%)	6 (1.1%)	
Monthly Income					17.73 ns
Less than 200	85 (44.0%)	113 (55.7%)	86 (45.5%)	284 (48.5%)	
200–500	87 (45.1%)	83 (40.9%)	78 (41.3%)	247 (42.4%)	
500–1,000	13 (6.7%)	4 (2%)	17 (9%)	35 (5.8%)	
1,000–2,000	2 (1.0%)	2 (1%)	3 (1.6%)	7 (1.2%)	
2,000 +	3 (1.6%)	1 (0.5%)	5 (2.6%)	9 (1.5%)	
Education					33.91*
Uneducated	19 (9.6%)	35 (17.2%)	25 (12.9%)	79 (13.3%)	
Elementary	47 (23.7%)	38 (18.6%)	38 (19.6%)	123 (20.6%)	
Secondary	37 (18.7%)	45 (22.1%)	24 (12.4%)	106 (17.8%)	
Preparatory	12 (6.1%)	24 (11.8%)	14 (7.2%)	50 (8.4%)	
High school	51 (25.8%)	42 (20.6%)	42 (21.6%)	135 (22.7%)	
2- year college	20 (10.1%)	14 (6.9%)	25 (12.9%)	59 (9.9%)	
Bachelor	7 (3.5%)	6 (2.9%)	18 (9.3%)	31 (5.2%)	
Masters or Higher	2 (1.0%)	0 (0%)	4 (2.1%)	6 (1.0%)	
					ANOVA
Number of Family in household (mean)					
	5.87 (2.58)	5.62 (2.53)	5.41 (2.53)	5.64 (2.53)	19.28 ns

*p < .05
[1] 1 missing data (n = 1) in HCC arm and (n = 1) in HCC-MH arm are not reported
[2] missing data (n = 3), Palestinian (n = 1) and Egyptian (n = 1) are not reported

4.1. Intervention effects

Among the 9 CVD risk factors, the HCC intervention arm demonstrated 3 improved measurements whereas the HCC-MH intervention arm demonstrated 8 improved measurements compared to the standard care arm at the end of the intervention (12 months). Improved CVD risk measures in- the HCC intervention arm included a significant decrease in BMI −1.91 (p < .001); SBP −12.80 mmHg (p < .001) and; DPB −5.78 mmHg (p < .001). Improved CVD risk measures in the HCC-MH intervention arm included: decreased FBG −20.32 mg/dL (p < .001); BMI −3.98 (p < .001); SBP −14.49 mmHg (p < .001); DBP −11.41 mmHg (p < .001); triglycerides −42.03 mg/dL (p < .001); total cholesterol −20.51 mg/dL (p < .001); and HbA1c −0.43% (p < .001); as well as increased HDL 4.24 mg/dL (p < .001).

At the 18-month measurement (follow-up, six months post intervention), the HCC intervention maintained 2 significant CVD risk outcomes: BMI −1.96 (p < .001) and; SBP −5.18 mmHg (p < .01). The HCC-MH intervention arm maintained 7 improved CVD risk outcomes: LDL −14.63 mg/dL (p < .001), FBG −34.21 mg/dL (p < .001), BMI −4.08 (p < .001), SBP −8.76 mmHg (p < .001), DBP −6.17 mmHg (p < .001), and HbA1c −0.55% (p < .001) and increased HDL 6.01 mg/dL (p < .001). The analyses indicated the HCC-MH intervention arm had greater lasting effects. Table 3 presents the means of CVD risk measurements from the beginning of the intervention (baseline), the end of the intervention (12 months), and six months after the end of participation in the intervention (18 months). Table 4 presents the intervention effects.

4.2. Differences between intervention arms

A second goal of the present study was to examine intervention differences between HCC and HCC-MH intervention arms. We thus tested the intervention differences and present the summary of the results in Table 5. We found that HCC-MH had consistently better effects on CVD risk measures than HCC. For 8 out of the 9 measures we found stronger effects for the HCC-MH compared to the HCC. These included LDL, HDL, FBG, BMI, DBP, triglycerides, total cholesterol, and HbA1c. We also found that HCC-MH had significantly better post-intervention (18-month) effects on the same measurements. Table 5 presents differences between intervention arms.

5. Discussion

Addressing the NCD and mental health burden in Arab countries and specifically among displaced populations has posed a significant challenge to host countries and humanitarian organizations (16, 35–37). Our

Table 3
Means of outcome measures at baseline, 12 and 18-months.

	HCC (Mean, SD)	HCC-MH (Mean, SD)	Standard Care (Mean, SD)
BMI			
Baseline	32.10 ± 5.49	30.54 ± 6.62	31.65 ± 6.91
12-months	30.97 ± 5.25	27.65 ± 5.60	32.12 ± 6.47
18-months	30.25 ± 5.02	26.85 ± 5.07	31.64 ± 6.48
Systolic blood pressure (SBP) (mmHg)			
Baseline	134.33 ± 16.78	133.16 ± 23.78	134.21 ± 22.72
12-months	120.1 ± 10.88	119.55 ± 6.04	131.8 ± 17.27
18-months	125.36 ± 11.81	120.48 ± 10.96	130.39 ± 21.25
Diastolic blood pressure (DBP) (mmHg)			
Baseline	81.65 ± 9.83	85.32 ± 13.34	82.27 ± 11.69
12-months	76.22 ± 5.99	76.45 ± 5.06	83.52 ± 11.47
18-months	78.45 ± 9.45	76.59 ± 8.45	80.38 ± 12.82
High-density lipoprotein (HDL) (mg/dL)			
Baseline	45.83 ± 14.06	43.48 ± 11.30	44.37 ± 11.63
12-months	44.06 ± 13.34	51.34 ± 10.45	45.1 ± 12.19
18-months	42.14 ± 11.73	47.93 ± 11.33	41.91 ± 11.22
Low-density lipoprotein (LDL) (mg/dL)			
Baseline	105.96 ± 33.24	113.97 ± 32.50	112.86 ± 38.08
12-months	106.12 ± 35.36	95.43 ± 26.50	102.28 ± 32.65
18-months	103.42 ± 30.09	94.36 ± 28.63	107.47 ± 34.71
Fasting blood glucose (mg/dL)			
Baseline	106.92 ± 51.54	119.01 ± 64.47	123.66 ± 56.19
12-months	109.33 ± 52.61	95.70 ± 22.95	126.62 ± 59.44
18-months	111.22 ± 63.01	93.47 ± 33.37	133.80 ± 78.67
Glyceride (mg/dL)			
Baseline	172.69 ± 89.70	166.4 ± 90.90	177.76 ± 82.97
12-months	194.53 ± 97.42	114.91 ± 44.25	192.52 ± 94.75
18-months	179.09 ± 87.11	151.97 ± 60.45	165.96 ± 74.03
Cholesterol (mg/dL)			
Baseline	183.63 ± 37.18	189.99 ± 39.55	193.32 ± 43.68
12-months	186.86 ± 37.53	150.55 ± 31.25	185.76 ± 40.38
18-months	180.78 ± 36.86	179.56 ± 37.16	183.1 ± 39.09
Glycated hemoglobin (HbA1c) (%)			
Baseline	6.54 ± 1.44	6.53 ± 1.84	6.67 ± 1.86
12-months	6.24 ± 1.58	5.69 ± 0.88	6.60 ± 1.90
18-months	6.24 ± 1.68	5.91 ± 1.11	6.54 ± 1.84

Table 4
Changes in CVD risk outcome measures at 12 and 18-months of HCC and HCC-MH interventions in comparison to standard care.

CVD risk outcome measures	N	12-months: HCC	12-months: HCC-MH	18-months: HCC	18-months: HCC-MH
		Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)
BMI	516	−1.91*** (−2.09, −1.73)	−3.98*** (−4.16, −3.80)	−1.96*** (−2.16, −1.76)	−4.08*** (−4.28, −3.88)
SBP (mmHg)	526	−12.80*** (−16.35, −9.25)	−14.49*** (−17.96, −11.02)	−5.18** (−9.21, −1.14)	−8.76*** (−12.79, −4.74)
DBP (mmHg)	523	−5.78*** (−7.96, −3.60)	−11.41*** (−13.55, −9.27)	−1.30 (−3.78, 1.19)	−6.17*** (−8.66, −3.67)
LDL (mg/dL)	520	10.87*** (5.20, 16.53)	−5.11 (−10.65, 0.42)	2.65 (−3.79, 9.1)	−14.63*** (−21.07, −8.2)
HDL (mg/dL)	525	−3.23*** (−4.95, −1.50)	4.24*** (2.56, 5.93)	-0.94 (−2.90, 1.03)	6.01*** (4.05, 7.98)
FBG (mg/dL)	519	−2.13 (−10.88, 6.62)	−20.32*** (−28.87, −11.77)	−1.91 (−11.87, 8.05)	−34.21*** (−44.16, −24.26)
TG (mg/dL)	517	1.58 (−12.52, 15.68)	−42.03*** (−55.82, −28.24)	15.38 (−0.69, 31.45)	−4.34 (−20.36, 11.69)
TC (mg/dL)	525	10.72*** (3.97, 17.48)	−20.51*** (−27.10, −13.91)	7.55 (−0.14, 15.24)	−3.01 (−10.70, 4.67)
HbA1c (%)	526	0.07 (−0.12, 0.26)	-0.43*** (−0.62, -0.24)	−0.15 (−0.36, 0.07)	-0.55*** (−0.77, −0.33)

Notes: a. * p < .05; ** p < .01; *** p < .001.
b. The differences in number of observations are due to missing data patterns.
c. SBP = Systolic blood pressure; DBP = Diastolic blood pressure; LDL = Low-density lipoprotein; HDL = High-density lipoprotein; FBG = Fasting blood glucose; TG = Triglyceride; TC = Total cholesterol.
d. Low scores on all outcome measures except HDL indicate reduction in CVD risk.
e. We tested interaction effects between nationality (i.e., Syrian, Jordanian) and treatment effects and no systematic differences were detected. Thus, we report the results together.

Table 5
Comparison of HCC and HCC-MH interventions at 12 and 18-months.

CVD risk outcome measures	12-months (p-value)	18-months (p-value)
LDL	HCC-MH > HCC ***	HCC-MH > HCC ***
HDL	HCC-MH > HCC ***	HCC-MH > HCC ***
FBG	HCC-MH > HCC ***	HCC-MH > HCC ***
BMI	HCC-MH > HCC ***	HCC-MH > HCC ***
SBP	N.S.	N.S.
DBP	HCC-MH > HCC ***	HCC-MH > HCC ***
TG	HCC-MH > HCC ***	HCC-MH > HCC *
TC	HCC-MH > HCC ***	HCC-MH > HCC **
HbA1c	HCC-MH > HCC ***	HCC-MH > HCC **

Notes: a. N.S. p > .05; * p < .05; ** p < .01; *** p < .001.
b. HCC > HCC-MH indicates that HCC led to a better-desired outcome than HCC-MH, and HCC-MH > HCC indicates that HCC-MH led to a better-desired outcome.

study is among the first to compare the effects of an integrated intervention in a Jordanian border community that hosts a significant number of Syrian refugees. Such Table 4 studies have been challenging for two reasons. First, studies require the cooperation of local organizations to target the relevant population for interventions. Second, while it is easier to survey displaced populations (Jobanputra et al., 2016; Avogo and Agadjanian, 2010) it is difficult to obtain biomarkers because such procedures require collaboration with local medical services. Through a collaboration between RHAS, local health clinics, university partners, and Americares, an international NGO, we were able to not only implement the intervention but also collect data on biomarkers.

We found that both the HCC health promotion intervention and the integrated HCC-MH intervention yielded significant reductions in CVD risk measures for Syrian refugees and Jordanians delivered in a primary care setting. While both intervention arms illustrated significant benefits for participants, the integrated HCC-MH model appeared to have greater sustained results.

Immediately post-intervention, both intervention arms yielded significantly greater reductions in BMI, SBP and DBP than the standard care arm. The integrated HCC-MH arm, however, illustrated greater changes in HDL, FBG, triglycerides, total cholesterol, and HbA1C than the HCC and standard care arms. Six months after the intervention was completed, the integrated HCC-MH arm sustained significant

improvements on almost all the CVD risk measures. Average BMI, for example, reduced from 30.54 at the baseline to 27.65 at the end of the intervention (12 months), and 26.85 at six-month post-intervention. There may be a number of contextual factors that drove these improvements in the integrated HCC-MH arm. First, there were four added sessions in HCC-MH arm of the study, meaning participants in the integrated arm received a greater number of sessions. Another consideration is the mental health sessions taught tangible coping skills to improve mental health such as deep breathing exercises and walking which can also improve physical health (Callaghan, 2004; Horowitz, 2010). Katon et al (Katon et al., 2010) showed similar positive physical health outcomes in integrated health intervention. They reported patients illustrated a 1% or greater reduction in HbA1c and 10 mmHg or greater reduction in systolic blood pressure. In our study, we also found decreases of 0.55% in HbA1c and 8.76 mmHg decrease in SBP six months after the HCC-MH intervention.

5.1. Implications for policy and future research

Our study findings have important implications for policy and future research with regards to NCD prevention and mental health promotion in Arab countries such as Jordan that accommodate a large number of refugees. As the Jordanian government increases healthcare costs to treat and individuals with chronic conditions, financial constraints are one of the main barriers for access to healthcare (UNHCR, 2018a, 2018b). Making interventions such as the HCC and HCC-MH readily available to marginalized groups such as low-income Jordanians and Syrian refugees may help reduce the burden of physical health-related difficulties in these populations. According to a 2014 UNHCR survey, over 40% of Syrian households in Jordan suffered from at least one noncommunicable disease and more than half of chronic health seekers received their healthcare at public health facilities (Doocy et al., 2016). Future studies should examine the cost benefit of these interventions to understand if the improved health outcomes lead to reductions in health costs such as hospitalization and excessive medical use.

We also found greater physical health benefits for the integrated mental health and NCD awareness intervention than the NCD awareness only intervention. Few studies have examined integrated interventions such as this, particularly within displaced populations. Further research may also consider comparing an integrated model such as the HCC-MH intervention with more intensive treatments to determine differences in outcomes, feasibility, affordability, and cost-effectiveness.

Studies have also illustrated that NCD patients who lived in households with higher incomes are twice as likely to seek care than those in the lowest quintile income (Rehr et al., 2018). Our study was conducted in Irbid, where poverty rates are high, and a significant number of Syrian refugees live. Health and mental health promotion interventions should continue to target similar communities, where poverty is high and healthcare is limited.

5.2. Limitations

The main limitation is that we were unable to randomise the groups. We offset this limitation by two methods: choosing clinics matched by demographics and utilizing fixed-effects models to control for time-invariant unobserved heterogeneity by individuals (e.g., gender, age, socioeconomic status). However, there is still the possibility that there are unobserved characteristics that are correlated with the geography of the clinics. Despite this limitation, this study shed significant new light on the value of integrated mental health awareness and NCD health promotion interventions in a middle-income country that hosts significant numbers of refugees.

6. Conclusion

A major advance of this study was determining the efficacy of an integrated NCD and mental health prevention intervention in a highly vulnerable, conflict-affected population. While we found the HCC intervention had a positive impact, adding mental health sessions introduced a synergistic effect. As ample research has noted, individuals in conflict-affected LMICs often do not seek care for physical and mental health ailments due to cost of care or lack of awareness (Al-Rousan et al., 2018). Given the high cost of health care, our study suggests lifestyle modification interventions such as the HCC and HCC-MH may help reduce the burden of NCD related disorders in conflict-affected populations such as Syrian refugees in Jordan. Continued investment and research in health and mental health promotion interventions may therefore be an important component to enhance the quality of life, reduce costs, and have lasting benefits for conflict-affected individuals and communities.

7. Role of funding source

Glaxo Smith Kline was not involved in any aspect of the research.

8. Ethics committee approval

University of Illinois IRB Protocol Number: 17,390.

9. Clinical trials registry number

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Tara M. Powell: Conceptualization, Project administration, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing. **Shang-Ju Li:** Conceptualization, Project administration, Formal analysis, Investigation, Methodology, Visualization, Writing - original draft, Writing - review & editing. **Yuan Hsiao:** Data curation, Formal analysis, Software, Visualization, Writing - original draft, Writing - review & editing. **Michelle Thompson:** Conceptualization, Project administration, Writing - original draft. **Aseel Farraj:** Data curation, Project administration, Resources, Writing - original draft. **Mariam Abdoh:** Data curation, Project administration, Resources, Writing - original draft. **Rami Farraj:** Project administration, Resources, Writing - original draft.

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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2021.101310.

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