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UNIVERSITY OF CALIFORNIA SAN DIEGO

SAN DIEGO STATE UNIVERSITY

The Relationship of Psychosocial Stress on Palestinian Adolescent Blood Pressure Levels and
the Acceptability of Mobile Health Tools in Palestine

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of

Philosophy

in

Public Health (Health Behavior)

by

Dina Hamideh

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2024

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This dissertation of Dina Hamideh is approved, and it is acceptable in quality and form for publication on microfilm and electronically.

Chair

University of California San Diego

San Diego State University

2024

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Lee, Jasmine, Hamideh, Dina, Nebeker, Camille "Qualifying and quantifying the precision medicine rhetoric" BMC Genomics, 20.1 (2019)

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ABSTRACT OF THE DISSERTATION

The Relationship of Psychosocial Stress on Palestinian Adolescent Blood Pressure Levels and
the Acceptability of Mobile Health Tools in Palestine

by

Dina Mohammed Hamideh

Doctor of Philosophy in Public Health (Health Behavior)

University of California San Diego, 2024
San Diego State University, 2024

Professor Tala Al Rousan, Chair

Background

The political determinants of health are pronounced in the Palestinian community, particularly among adolescents, due to Israeli military occupation. Understanding how these determinants as structural violence, forced displacement, discrimination, and marginalization role on the health and health management of Palestinian adolescents is crucial. This dissertation examines the relationship of psychosocial stressors on Palestinian adolescent blood pressure and the acceptability of mobile health interventions in the region.

Methods

A multi-method cross-sectional study was conducted in Palestinian adolescents and their families living in refugee camps, cities, and villages across Palestine. A sample of 720 Palestinian adolescents were sampled through schools and centers from November 2022 to January 2023. Blood pressure, anthropometric, and psychosocial measures were collected. Psychometric and ordinal logistic regression analyses assessed the relationships between psychosocial factors, refugee status, and blood pressure. Moreover, qualitative interviews among 13 Palestinian families were conducted to assess the acceptability of mobile health adoption for health management in Palestine.

Results

The overall prehypertension and hypertension prevalence for this participant sample was three and two and half times the global average. There were significant inverse relationships between refugee status, prehypertension and hypertension for females and males suggesting sex-specific differences among refugee and non-refugee groups when assessing blood pressure levels (Chapter 1).

Chapter 2 demonstrated that high blood pressure levels were associated with different psychosocial factors differing by encampment experience.

Chapter 3 showed that there are potential benefits of mobile health adoption for self-management of stress and diverse health outcomes among adults and youth with health conditions as cardiovascular disease and diabetes; However, the adaptation of interventions prior to implementation are crucial to account for contextual factors to avoid introducing risk of harm to the Palestinian population.

Conclusion

Our research demonstrated that higher blood pressure levels among Palestinian adolescents varied by refugee status, types of settler colonial violence, and cultural resistance.

Further, living under Israeli military occupation challenges the acceptability of adoption of mobile health interventions for managing non-communicable diseases in Palestine. Future longitudinal research must consider experiences in encampments among Palestinian adolescents to understand how psychosocial factors relate to cardiovascular health and guide health intervention implementation.

CHAPTER 1- The “Pressure” of Being an Adolescent in Palestine: Prevalence of Prehypertension and Hypertension

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Abstract

Introduction

Prolonged exposure to forced displacement has adverse impacts on overall health, including hypertension. Over 27% of adults in Palestine are reported as hypertensive with limited knowledge of hypertension rates among Palestinian refugee populations including adolescents, residing in occupied West Bank, Palestine. This study assessed the relationship between refugee status, prehypertension and hypertension among this population.

Methods

This cross-sectional study was conducted among Palestinian adolescents residing in refugee camps, villages, and cities. A random sample of adolescents were recruited through schools from November 2022 to January 2023. Anthropometric measurements including blood pressure (mmHg), heart rate (BPM), body fat (%), height (cm), body weight (kg) and survey questionnaires were collected. Ordinal regression models were used to assess the relationship between refugee status, prehypertension, and hypertension while controlling for age and sex. Additionally, the interaction between refugee status and sex and its relationship on the prevalence of prehypertension and hypertension was examined.

Results

A total of 706 Palestinian adolescents (refugees= 377, [39.4 % females, 60.6 % males] and non-refugees= 329 [39.9% females, 60.1% males]) aged 13-17 (median= 14 years) were enrolled. The overall prevalence of prehypertension and hypertension in the sample was 26% and 14%; respectively. Overall, the prevalence of prehypertension [Refugees=25.5% vs. non-refugees= 27.0%] and hypertension [Refugees=12.7% vs. non-refugees= 16.0%] despite refugee status. Overall, there was no association between refugee status and hypertension categories in unadjusted models, or models adjusting for age and sex [AOR 0.88; 95% CI= 0.65-1.20]. The interaction in the regression models suggested an association between refugee status, prehypertension and hypertension for females and males. Among females, refugees had 1.75 [95%CI=1.04-2.95] times higher odds of higher blood pressure than non-refugees after adjusting for age. In contrast, male refugees had 40 percent lower odds [AOR = 0.6; 95% CI = 0.41-0.88] of having higher blood pressure than male non-refugee counterparts.

Conclusions

The overall prehypertension and hypertension prevalence for this participant sample was high despite the adolescent's refugee status denoting an alarming public health burden in this understudied population. Inverse relationships of high blood pressure among male and females by refugee status were seen in this sample. Future studies should consider the assessment of encampment experience alongside sex-differences that may drive cardiovascular health disparities in adolescent Palestinians to contribute to SDGs Target 3.4 adopted by United Nations.

Introduction

The long-term and intergenerational health effects of forced displacement on youth are evident and include the risk of developing chronic health conditions such as diabetes, hypertension, and cardiovascular disease (CVD).^{1–3} Vulnerable exiled populations have the highest non-communicable disease burden, particularly in the Middle East and North African region (MENA).⁴ MENA holds the second-highest age-standardized prevalence rate for adult Cardiovascular disease mortality with hypertension accounted as one of the prominent risk factors.⁵ Studies on MENA populations show that refugee populations have higher odds of hypertension compared to MENA adult non-refugee populations.⁶ Palestine is among this region, where 38% of deaths are due to CVD with limited refugee-specific data in refugees residing in Palestine.⁷

The consequences of forced displacement have demonstrated devastating long-term physical and mental health burdens on refugee populations, including among Palestinian adolescent refugees residing in Palestine.⁸ Palestinian refugees are the largest population of refugees in the world.⁹ Since the Nakba (Catastrophe) in 1948, more than 6 million Palestinians have been violently exiled from their homes for the creation of the state of Israel and reside in refugee camps in occupied West Bank, Gaza, Syria, Jordan, and Lebanon.¹⁰ Occupied West Bank serves as a home to at least 846,465 registered refugees out of the 2.5 million refugees residing in Palestine where current adolescents are third generation refugees born in encampment.¹¹ Both Palestinian refugees (i.e., exiled from 1948 and 1967 Palestine) and non-refugee counterparts (i.e., Palestinians residing in occupied West Bank and Gaza not exiled from 1948 and 1967 borders) are exposed to chronic distress due to living under Israeli military occupation.¹² Compounded by living in harsh conditions within refugee camps, which includes overcrowded living spaces, inadequate sanitation facilities, and limited access to basic needs, chronic distress is exacerbated in Palestinian refugee populations specifically.¹² The

development of psychological and behavioral symptoms as depression, psychological distress, and anxiety are common outcomes of chronic stress and have shown to increase the risk for hypertension.¹³ The diverse effects of chronic distress have shown to increase blood pressure and neuroendocrine response to acute stress and decrease blood pressure and neuroendocrine response in response to chronic stress by increasing basal blood pressure.¹⁴

Hypertension among adolescents is a global prevalent health condition, with female youth displaying higher odds of developing hypertension.^{14–16} Studies suggest sex-based variation between psychosocial and physical experiences in response to stress, violence, and trauma between men and women, linking to mental well-being and physiological outcomes.^{17–19} Gettler et al., found that refugee men had lower chronic inflammation than refugee women.²⁰ Chronic inflammation has been shown to affect long-term trajectories for cardiovascular disease.²¹ However, limited research has examined the relationship of sex-differences and refugee status with hypertension in adolescents, including Palestinian refugee adolescents.

Early stages of high blood pressure, known as prehypertension, in youth frequently progresses to adult hypertension.^{22,23} Early detection and intervention for high blood pressure is crucial as this condition influences cardiovascular morbidity and mortality in adulthood alongside health outcomes like diabetes and dyslipidemia.^{24–26} The global average prevalence of hypertension is 4% with an alarming average of 12.6% in Arab countries.^{27–29} Recent studies suggest that Palestine is among these Arab countries with an increasing rate of high blood pressure ranging from 26.3 to 59.3 percent among Palestinian youth (i.e., ages 9-12 and 16-17) residing in the occupied West Bank region of Palestine.^{30–32} An estimated 105,000 refugee adolescents reside in Palestine,³³ however little is known about the relationship of refugee status on Palestinian adolescent blood pressure. Therefore, the objectives of this study were to:

- 1) examine the prevalence of prehypertension and hypertension in Palestinian adolescent refugee and non-refugee populations residing in occupied West Bank, Palestine and

- 2) assess the relationship of refugee status and sex on prehypertension and hypertension in the Palestinian adolescent population in occupied West Bank, Palestine.

Methods:

Study Design

A cross-sectional study was conducted from November 1, 2022, to January 10, 2023, to explore the prevalence of prehypertension and hypertension in Palestinian adolescent refugee populations (refugee) compared to non-refugee (non-refugee) counterparts residing in occupied West Bank, Palestine.

Setting, sampling, and selection of participants

A stratified random sample of 706 Palestinian adolescents [377 refugee, 329 non-refugees] ages 13 to 17 residing in refugee camps, cities, and villages among 4 regions throughout the occupied West Bank (i.e., Ramallah, Bethlehem, Nablus, Hebron) were recruited. The four regions were selected based on geographical location, population density, and refugee camp presence. Sampling occurred at two stages: Palestinian Ministry of Education (PMOE) Government schools and refugee camp community centers connected to UNRWA schools were randomly selected across the region using lists provided by the PMOE and refugee camp community directors. Once schools and community centers agreed to participate, a list of students in grade levels 8 to 11 per each selected school and community center was provided to the investigator to randomly select to recruit to participate in the study. Inclusion criteria included: ages 13-17 and attending government or UNRWA schools. Most Palestinian adolescents attend either UNRWA or PMOE government schools in West Bank where free education is offered; UNRWA schools in occupied West Bank were founded to serve refugee students, specifically.²⁹

An information pamphlet providing details about the study and a consent form presented in Arabic was sent home with students to provide to caregivers (i.e., parent/legal guardian) to

review alongside their children who expressed interest in study enrollment. Caregiver and student consent were provided prior to enrollment in the study. Data collection was conducted in local community centers after school hours within each specified region.

Ethical considerations

Ethical approval was granted from the institutional review boards of University of California San Diego, An-Najah National University, and San Diego State University. Palestinian Ministry of Education and Refugee Camp Community Board approvals were granted prior to study initiation.

Sample Size

Sample was selected to detect differences in the prevalence of prehypertension and hypertension among Palestinian adolescent refugees compared to Palestinian adolescent non-refugees such that 95 % percent confidence interval had a precision of ± 5 %. A sample of 692 participants was originally calculated [379 refugees and 313 non-refugees]. The sample was calculated if adolescent Palestinian refugees have at least a 10 percent greater prevalence rate of elevated blood pressure and hypertension (i.e., 36 % CI 31% to 41 %) in comparison adolescent Palestinian non-refugee counterparts (i.e., 26% CI 21% to 31%). This sample size aligns with the literature focused on elevated blood pressure research in Palestinian adolescent populations.^{28,30,34,35} Over sampling (i.e., allocation ratio 1.12) among the refugee population strata was conducted to account for the refugee status exposure among adolescents given both refugee and non-refugee adolescents experience geopolitical violence. G-Power 3.1.9.4 was used for the power calculation.

Survey

Participants were asked to complete socio-demographic surveys in which collected information as: sex (Male or Female), age (13-17 years), school grade level (8-11), caregiver occupation (employed or unemployed), place of residence (refugee camp, city, village), family history of hypertension (yes vs no), physical activity level (0 to 1 time a week, 2-3 times a week,

4 or more times a week),³⁶ refugee status (registered refugee or non-refugee), and school type (UNRWA school or PMOE government school).

Anthropometrics

Participants were asked to have three consecutive measures of body weight (kg), height (cm), and body fat (%). Using a measuring tape, the height of the participant was measured and programmed into the body composition scale alongside their sex at birth prior to obtaining the participant's weight and body fat percentage. Participants were asked to step on body composition scale without shoes and the average weight (kg) and body fat percentage was used for record.

Blood Pressure

Trained research staff recorded three consecutive blood pressure readings with an appropriately sized cuff in the right upper arm with the student in a sitting position with a gap of at least 3 minutes per reading.¹⁴ Students were asked to refrain from caffeine intake for 4 hours prior to measurement. Trained staff also instructed students to keep their legs uncrossed and feet on floor during blood pressure measurement. Blood pressure measurements were recorded as continuous measures. All three systolic (SBP) and diastolic blood (DBP) pressure measures were considered to obtain the mean SBP and DBP. Blood pressure categories were defined as: normal blood pressure (i.e., <120/<80 mmHg), prehypertension (i.e., 121/<80 to 129/<80 mmHg) and hypertension (i.e., ≥130/≥80 mmHg).¹⁴

Data analysis

All analyses were conducted by R statistical software.³¹ All tests of significance were two-sided and have a p-value of < 0.05. Descriptive statistics included the mean and standard deviation for all continuous variables and percentages for categorical variables by refugee status. Bivariate analyses with t-tests and χ^2 for continuous and categorical variables; respectively compared participant characteristics by refugee status. To assess relationships (i.e., with age, hypertension status, with blood pressure level categories (i.e., normal, elevated,

hypertension)) ordinal regression models were performed. The normal blood pressure (e.g., $\leq 120/80$) was used as a reference category to which other blood pressure category levels were compared. Further, interaction terms were included to assess the relationship of refugee status by sex on the prevalence of prehypertension and hypertension. The strength and direction of predictors associated with prevalence of elevated BP and hypertension were demonstrated using odds ratios and confidence intervals by refugee status.

Results

General Characteristics of Study Participants

A total of 706 students aged 13 to 17 years (Table 1) had completed the study and 695 students had valid blood pressure data with 3 repeated readings (98.4%). Of these students, there was a significant difference in age of students enrolled between refugee and non-refugee groups ($p < 0.001$) (Table 1).

In total, the student sample reported 10.5 % reside in a city, 38.4% reside in villages, and 50.7% reside in refugee camps. Refugee students reported lower monthly family income i.e., less than \$300 a month (38%) compared to non-refugee students (11.4%) ($p < 0.001$) (Table 1). Most students reported that they conduct physical activity at least 2 or more times a week (60% refugee students and 56.4% non-refugee students). Overall, 36% (refugee (32.1%) and non-refugee (32.8%)) of the student sample reported a family history of hypertension. The distribution of percent of body fat percentage was similar in refugees (body fat percentage [SD], 24% (9)) and non-refugee counterparts (body fat percentage [SD], 25 % (10)) (Table 1 and Figure 3).

Prevalence of Prehypertension and Hypertension by Refugee Status and Sex

The overall prevalence of prehypertension and hypertension for the total sample was 26% and 14%, respectively (Table 1). Refugee students in the sample had a similar prevalence of prehypertension [25.5% vs. 27.0%] and hypertension [12.7% vs. 16.0%] as non-refugee students (Table 1). As shown in Figure 1, overall, the male students showed a higher

percentage of prehypertension (refugee=22.8%, non-refugee=14.3%) and hypertension (refugee=32.1% and non-refugee=21.4%) compared to prehypertension (refugee=29.9%, non-refugee=19.4%) and hypertension (refugee=10.4%, non-refugee=7.8%) among female students ($P < 0.0001$). Female refugees in the sample displayed a higher prevalence of prehypertension and hypertension (29.9%, 19.4%) compared to female non-refugee students (10.4%, 7.8%) (Figure 1). In contrast, a higher percentage of prehypertension and hypertension prevalence was displayed in male non-refugee students (32.1%, 21.4%) compared to male refugee students (22.8%, 14.3%) (Figure 1).

Overall, Table 2 showed there was no association between refugee status and hypertension categories in unadjusted models, or models adjusting for age and sex. As presented in Figure 2 and Table 2, there is a significant association between refugee status, prehypertension and hypertension by sex after adjusting for age demonstrating higher odds of prehypertension and hypertension in female refugees compared to female non-refugees and lower odds of prehypertension and hypertension in male refugees compared to male non-refugees in the participant sample.

Discussion

This cross-sectional study documents the burden of prehypertension and hypertension among a sample of Palestinian refugee and non-refugee adolescents residing in the occupied West Bank region of Palestine. Unadjusted prevalence rates of prehypertension and hypertension were similar in the overall sample despite refugee status. The lack of significant difference in prevalence rates among both groups may be due to the study sample having more 13-year-old refugee adolescents compared to non-refugee counterparts resulting in the need to adjust for age in the regression models. The prevalence rates in this study were like two previous studies assessing prehypertension and hypertension in Palestinian non-refugee youth ages 10 to 13 and 16 to 18 years residing in the cities of Tubas, Jenin, and Nablus within occupied West Bank where prevalence rates were slightly higher by 7% and 5%.^{31,32} Further, a

study focused on Syrian Refugee youth ages 10-17 residing in refugee camps in Jordan shared similar findings.³² Refugees are predicted to have earlier symptoms of prehypertension and hypertension per average year of age compared to non-refugees,³⁷ however limited data is available on adolescent refugee lifestyle behavior, effects of encampment on youth, and its relationship to blood pressure.³⁵ Studies focused on delineating modifiable risk factors of hypertension as psychosocial stress and lifestyle challenges in refugee children and adolescents are needed.

Although we observed a lack of significant association between refugee status and blood pressure in the overall sample, female refugees had 75 % higher odds of having higher blood pressure compared to female non-refugees. Moreover, male refugees had 40% lower odds of having higher blood pressure compared to male non-refugees. Although comparative data is limited, a study assessing associated mental health challenges on hypertension in female African Refugees in Durban, South Africa demonstrated higher odds of hypertension among female refugees who experienced at least one adverse childhood experience (ACEs) denoting a relationship between sex and encampment experience.³⁸ Ho et al., 2024 shared similar findings suggesting sex-selective consequences for pubertal and physical maturation and mental health trajectories in female adolescents that experience threatening experiences of adversity compared to male counterparts.³⁹ Similarly, Ainamani et al., 2020 found gender differences on the exposure to different war-related traumatic events and its risks to development post-traumatic stress disorder showing Congolese refugee women in Uganda to have higher severity of PTSD when experiencing low and moderating levels of traumatizing events.⁴⁰ Further, findings from Gettler et al., showed refugee men were less likely to have elevated chronic stress markers as C-reactive protein levels and Epstein-Barr virus antibody titers compared to refugee women;⁴¹ Elevation of such markers have been linked with the risk for cardiovascular disease and mortality.^{42,43} Gettler et al., continued to explain that such findings may be due to female refugees experiencing greater psychosocial and physiological burden from chronic stress and

trauma in which relates to poorer immune function; Further, the variance in exposure and vulnerability of women compared to men regarding violence, trauma, and abuse may be a contributing component to the wellbeing among males and females among the refugee population. Additionally, studies have shown anthropometric, metabolic, and cardiovascular differences between girls and boys during the adolescence;³⁹ girls have higher adrenal androgen concentrations and greater adiposity than boys in adolescence which can account for differences in insulin sensitivity and may affect blood pressure levels.⁴⁴ Such factors as measuring insulin sensitivity alongside psychosocial factors contributing to chronic stress in diverse sex and gender groups should be accounted for in future analyses to grasp further understanding on its impact on cardiovascular health.

In this study, the average body fat percentage among both groups were within acceptable health ranges for adolescents⁴⁵challenging the previous literature suggesting that the root cause of high blood pressure is adiposity in addition to factors that raise systemic vascular resistance. Studies have shown the relationship between insulin resistance and higher blood pressure on vascular resistance in adolescents with higher adiposity, however insulin can also cause hypertension through stimulation of the sympathetic nervous system and increase renal sodium retention, modulation of calcium transport, and consequent induction of hypertrophy of vascular smooth muscle.⁴⁶ Perceived stress experienced by individuals has been shown to activate the sympathetic nervous system which in turn activates the adrenal glands.⁴⁷ It has been documented in the literature that stress increases the severity and prevalences of hypertension.^{48,49} Palestinian adolescents live under constant stress under Israeli military occupation; This includes constant exposure mental distress in an environment characterized by ongoing daily stressors as settler colonial violence (e.g., imprisonment, shootings, tear gas, beating and killing of Palestinian civilians), economic (e.g., scarcity of employment opportunities and high rate of poverty), and social stressors (e.g., inability to move freely between the Palestinian territories due to Israeli occupation restrictions, shutting off water and electricity,

crowded living spaces, and lack of recreational facilities).^{50,51} Future studies should assess the longitudinal relationship of chronic stress in Palestine and its relationship on cardiovascular health.

Implications

With 26% and 14% of the participant sample having prehypertension and hypertension, these data suggest that this sample of Palestinian adolescents have three and two and a half times the global average prehypertension and hypertension prevalence rates, respectively.^{27,52} This denotes an alarming public health burden in this understudied population that needs to be mitigated.⁵³ Early identification of adolescents and children at high risk of adult hypertension and cardiovascular disease alongside early behavioral and pharmacological intervention is essential for combating the global burden of hypertension.⁵⁴

Further, these data suggest sex differences among adolescents living in encampment and non-camp settings. Female adolescent refugees in the sample had higher odds of having higher blood pressure compared to female non-refugee counterparts. Male refugees showed lower odds of having higher blood pressure compared to male non-refugee counterparts. Future research needs to include the assessment of diverse lifestyle and psychosocial factors related to encampment and non-encampment experiences among boys versus girls to account for the differences in relationship to blood pressure prior to deploying behavioral interventions.

Limitations

The limitations of this study need to be considered. The sample was imbalanced by age among refugee and non-refugee groups, resulting in a larger sample of 13-year-old refugees compared to non-refugee counterparts.⁵⁵ The original sampling technique included stratification of the sample by age and refugee status while recruiting through schools across the region. Lists by grade level were provided to randomly select students, however most UNRWA schools did not have grade levels 10 through 12 and most refugee students transitioned to PMOE schools for grades 10 through 12. Given this, there was not an ethical solution to randomly

select by refugee status in lists provided by PMOE for grades 10 through 12. To minimize this limitation, the research team did their best to work with psychosocial centers in the refugee camps to meet sample size given refugee status.

Measurement error during blood pressure and anthropometric measures can come from diverse factors that may influence the validity and reliability of the measures. Measurement errors as technique errors as improper placement of the blood pressure cuff, physiological errors as white coat hypertension, or instrumentation errors using tools as bioelectrical impedance scale to measure body fat percentage can contribute to error in estimating the true association of the measures. To minimize the risk of measurement error, all research staff trained on the study protocol and were instructed to take 3 measures of blood pressure, weight, height, and body fat percentage.¹⁴ Further, sample weighting techniques were not conducted to assess the likelihood of inclusion when providing population-based prevalence estimates. This is due to the geopolitical circumstances in the region contributing to limited census data. While the study's sampling technique ensured to recruit adolescents across the region, regions such as Jenin, Tulkarem, East Jerusalem, and Gaza were not easily accessible. Such regions are home to some of the largest refugee camps in Palestine and experience higher rates of military attack launches on civilian populations.

Conclusion

High blood pressure in adolescents is a predictor of future risk of cardiovascular diseases and other chronic health outcomes. This study documents the disproportionately high prevalence of high blood pressure among Palestinian adolescents residing in occupied West Bank, Palestine. Prehypertension and hypertension are critical health issues in this sample of participants and need to be attended to in Palestinian adolescents in Palestine to minimize the risk of adult hypertension and cardiovascular disease. Further research focused on the assessment of sex/gender differences of blood pressure levels and inflammatory markers based

on encampment status should be considered prior to designing future interventions addressing cardiovascular health disparities in Palestinian adolescent refugees residing in Palestine.

Tables

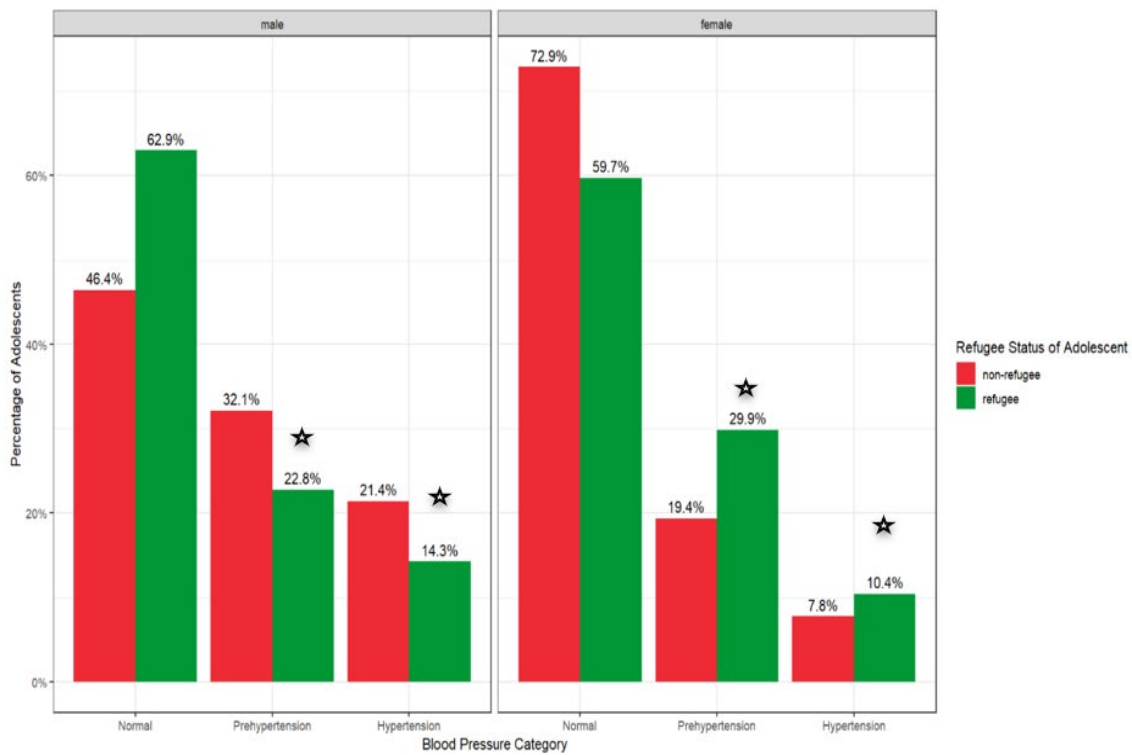
Table 1-Participant Demographics and Characteristics by Refugee Status

Characteristic	Non-refugee Students	Refugee Students	P-value
Sample size (n)	329	377	
Age (mean (SD))	14.73 (1.34)	14.16 (1.28)	<0.001
Age (years (n (%)))			<0.001
13	81 (24.7)	164 (43.6)	
14	65 (19.8)	79 (21.0)	
15	88 (26.8)	67 (17.8)	
16	50 (15.2)	41 (10.9)	
17	44 (13.4)	25 (6.6)	
Sex (n (%))			0.937
-Female	131 (39.9)	148 (39.4)	
-Male	198 (60.1)	229(60.6)	
Residence (n (%))			<0.001
City	56 (17.1)	18 (4.8)	
Village	256 (78.3)	15 (4.0)	
Refugee Camp	15 (4.6)	343 (91.2)	
Grade (n (%))			<0.001
8	85 (26.1)	191 (51.8)	
9	64 (19.6)	66 (17.9)	
10	96 (29.4)	59 (16.0)	
11	41 (12.6)	49 (13.3)	
12	40 (12.3)	4 (1.1)	
Monthly Family Income (n (%))			<0.001
Less than \$300	35 (11.4)	106 (37.9)	
\$301-650	62 (20.1)	88 (31.4)	
\$651 or more	211 (68.5)	86 (30.7)	
Family History of High Blood Pressure (n (%))	124 (32.8)	132 (32.1)	0.923
Mean Body Fat (%(SD))	25 (9)	24 (10)	0.251
Weekly Physical Activity Status (n (%))			0.159
0 to 1 Times	140 (43.6)	146 (40.0)	
2-3 Times	113 (35.2)	154 (42.2)	
4 or more times	68 (21.2)	65 (17.8)	
Heart rate (mean (SD))	86.12 (11.99)	87.28 (13.09)	0.222
Blood pressure category (n (%))			0.357
Normal	186 (57.1)	228 (61.8)	
Prehypertension	88 (27.0)	94 (25.5)	
Hypertension	52 (16.0)	47 (12.7)	

Table 2- Association Between Refugee Status and High Blood Pressure by Sex (Interaction Analysis)

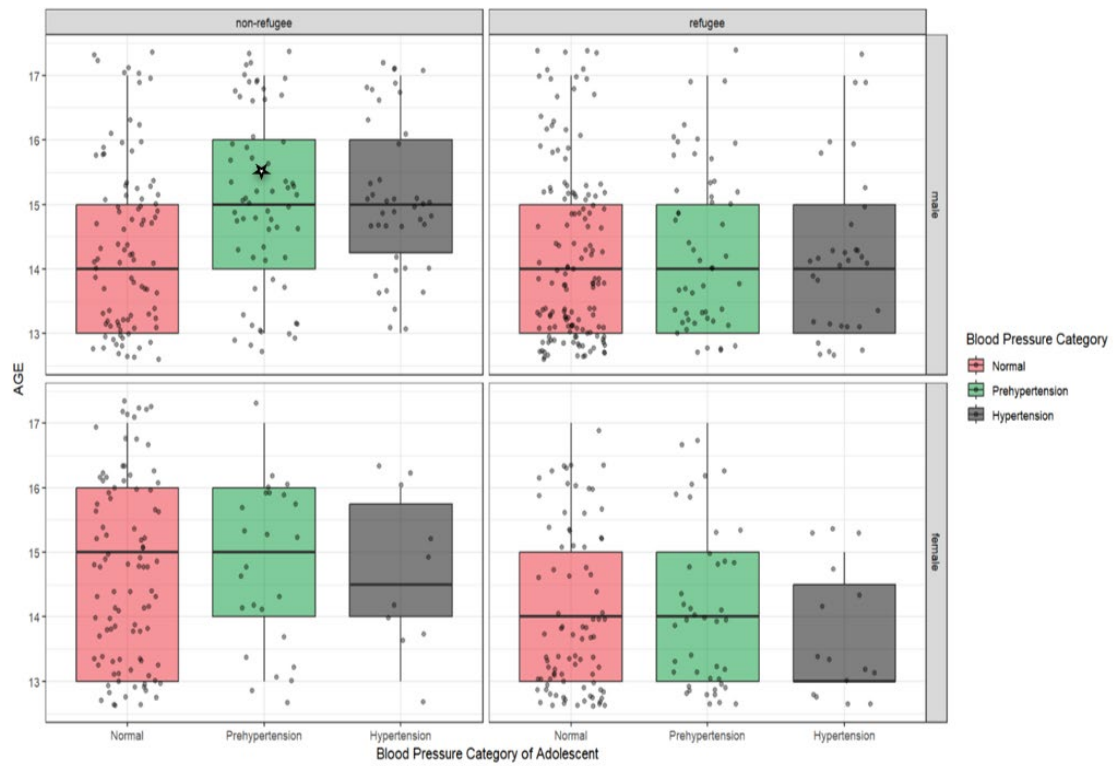
Population	Adjusted Odds Ratio	95 % Confidence Interval
<i>Refugee Status</i>		
Refugees	0.88	0.65-1.20
<i>Interaction model between Refugee Status and Sex</i>		
Female refugees	1.75	1.04-2.95
Male refugees	0.6	0.41-0.88

Figures with Figure Legends



★ Statistically significant

Figure 1- Prehypertension and Hypertension Prevalence among Palestinian Adolescents Residing in Occupied West Bank, Palestine by Refugee Status and Sex



★ Statistically significant

Figure 2- Association between Age and Blood Pressure Status Among Palestinian Adolescents Residing in Occupied West Bank, Palestine, Stratified by Sex and Refugee status

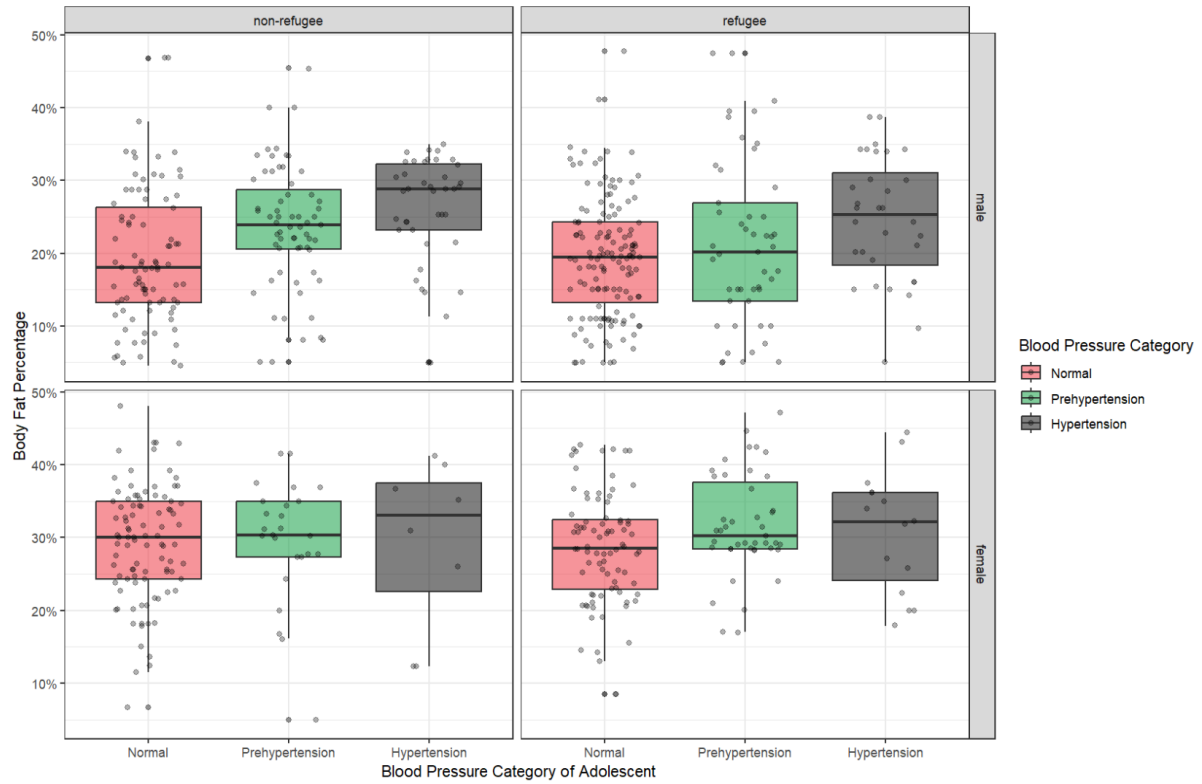


Figure 3-Blood Pressure Category and Body Fat Percentage of Palestinian Adolescents Residing in Occupied West Bank, Palestine Stratified by Refugee Status and Sex

CHAPTER 1 ACKNOWLEDGMENT

I would like to acknowledge my committee for their unconditional support of this research proposal. Instead of questioning the feasibility of this project, we worked together to make it feasible. Thank you for believing me when others gave up.

I would also like to acknowledge Drs. Zeena Salman as an external advisor who helped provide guidance throughout the dissertation and my lab members Lamees, Lana, Nargis, Mariam, Baseel, and Marcos who helped support my project.

Chapter 1, will be submitted for publication of its material. I, Dina Hamideh was the primary investigator and author of this material in this chapter. Hamideh, Dina; Strong, David; Al Zabadi, Hamzeh; Mahmoud, Lamees; Bandoli, Gretchen; Alcaraz, John; Crespo, Noe; Hamideh, Baseel; Real, Marcos; Ahmadi, Nargis; Mansour, Mariam; Al Rousan, Tala are coauthors on this chapter.

Chapter 2- The “Pressure” of Living Under Military Occupation: A Cross-sectional Study Evaluating the Relationship of Psychosocial Factors with High Blood Pressure Among Palestinian Adolescents.

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Abstract

Background

Palestinian adolescents face heightened psychosocial stress due to exposure to settler colonial violence in the occupied West Bank, including refugee camps. With high blood pressure (HBP) rates among Palestinian adolescents being higher than the global average, we examined the relationship between psychosocial factors (i.e., 13-month exposure to settler colonial violence, perceived stress, perceived resilience, and anxiety and depression symptoms, and coping) and HBP. We further assessed whether the relationship between psychosocial stress and HBP differed among refugee adolescents living in camps compared to non-refugee adolescents living in communities in the occupied West Bank region of Palestine.

Methods

A cross-sectional study of a random sample of Palestinian adolescents aged 13 to 17 years stratified by refugee status, age and sex were sampled through schools and centers across occupied West Bank from November 2022 to January 2023. BP measurements (mmHg), categorized into normal BP (i.e., <120/<80 mmHg), prehypertension (121/<80 to 129/<80 mmHg), and hypertension (i.e., ≥130/≥80 mmHg) and a survey questionnaire including socio-demographics and psychosocial factor measures were collected. Psychometric and ordinal logistic regression analyses were conducted to assess the relationship between each

psychosocial factor identified during psychometric analyses, refugee status, and BP while adjusting for age and sex.

Findings

A total of 706 adolescents (refugees= 377 and non-refugees= 329 (40% female, 60% male)) aged 13-17 (median= 14 years) participated. Bivariate analyses showed that psychosocial factors as settler colonial violence on neighbors/friends [AOR (95%CI)= non-refugees =1.94(1.36-2.78) vs refugees =0.51(0.36-0.74)], settler colonial violence including tear gas or sounds of bombs [non-refugees =1.24(1.02-1.52) vs refugees =0.80(0.66-0.98)], and depression symptoms [non-refugees = 1.65(1.11-2.47) vs refugees =0.74(0.57-0.94)] were inversely related by refugee status. Moreover, adaptive coping [0.72(0.51-0.99)] and cultural resistance resilience [0.76 (0.63-0.90)] were associated as protective factors in the refugee group on HBP levels. Multivariate analyses controlling for all psychosocial factors also showed inverse relationships by refugee status in which, settler colonial violence on neighbors and friends [(refugees= 0.54(0.31-0.93)) vs (non-refugees=1.85(1.07-3.18))] and settler colonial violence to the individual's home [(refugees= 2.28(1.01-5.12)) vs (non-refugees=0.44(0.20-0.99))] were associated with HBP in both groups, while depression symptoms [2.02(1.01-4.06)] were independently associated with higher blood pressure in non-refugees.

Interpretation

HBP among this Palestinian adolescent sample demonstrated inverse relationships between diverse psychosocial factors by refugee status. Future longitudinal research must consider the differences between encampment and non-encampment exposures over time to understand its impact on cardiovascular health.

Introduction

Hypertension is the main cause of 9.4 million deaths worldwide and 80% of these deaths occur in low-and-middle income countries.⁵⁶ In Palestine the prevalence of hypertension among adults is 27.6% and hypertension is the most common cause of death.^{57–59} Additionally, Palestinian youth ages 9-13 displayed a hypertension prevalence ranging from 26.3% to 46%, compared to 3.7% of adolescents in the United States and 12.6% in other Arab countries in the region (i.e., Saudi Arabia, Egypt, Algeria, Lebanon, Iraq).^{60,61} Previous research has suggested genetics, poor diet, physical inactivity, psychological, and social factors as risk factors for high blood pressure (i.e., prehypertension (i.e., 121/<80 to 129/<80 mmHg) and hypertension (i.e., $\geq 130/\geq 80$ mmHg)). However, psychosocial factors that may relate to the disproportionately high prevalence of hypertension among Palestinian adolescents have yet to be examined as potential predictors.^{62–64} Psychosocial factors that contribute to hypertension may include experiences of forced displacement, discrimination, and structural violence experienced by Palestinians enacted by Israeli settlers and military forces (i.e., settler colonial violence).⁶⁵

Since the start of the systemic displacement and ethnic cleansing of Palestinians in 1948, known as the Nakba or catastrophe, over 6 million Palestinians have been and continue to be forcibly displaced from their homes due to Israeli settler colonial violence. This has led Palestinians living in 1948 and 1967 borders of Palestine to forcibly seek refuge in camps across occupied West Bank, Gaza, Syria, Jordan, and Lebanon.⁶⁶ Currently, occupied West Bank hosts 19 refugee camps accommodating 890,000 registered refugees, alongside 3 million non-refugees, and 630,000 Israel settlers residing in neighboring villages and cities.^{11 67} Israeli settler colonization has long-term health impacts on Palestinian adolescents living in occupied West Bank, East Jerusalem, and Gaza including poor mental health and physical disability.^{68,69} Palestinian non-refugee and refugee adolescents are exposed to mental distress through frequent settler colonial violence (e.g., militarized Israeli checkpoints, imprisonment, shootings, tear gas, beatings), economic disadvantages (e.g., scarcity of employment opportunities,

poverty), and social stressors (e.g. restriction of movement, unreliable access to water and electricity, crowded living spaces).^{58,70,71} Such experiences are shown to impact adolescent development, mental health, and cardiovascular health.⁷²

Stress is a risk factor for hypertension.⁷³ Traumatic events from settler colonial violence are commonly witnessed by the Palestinian adolescents, especially by those in refugee camps within occupied West Bank. A study in 2018 found that children residing in internally displaced camps in occupied West Bank commonly report traumatic stress from seeing images of killed and wounded people on TV (90%), shootings and bombardment on neighborhood streets (85.2%), and the arrest or kidnaping of a friend or relative by Israeli military (77.8%).⁷⁴ Additionally, more than 53,000 Palestinian children have been detained by Israel since 1967 with more than a 140 percent increase in child detentions during 2021 compared to the previous years.⁷⁵

Psychological stress emerges from a dynamic interaction between an individual's ability to cope and the demands of their environment.⁷⁶ There is growing research interest in examining the process of adaptation to war, trauma, and discrimination as well as children's resilience when experiencing such adversity.⁷⁷ Coping with these experiences plays a mediating role in the relationship between the stress and trauma and the psychological wellbeing of survivors of violence.^{78,79} A qualitative study conducted in occupied West Bank exploring resilience processes in Palestinian refugee families living under Israeli occupation found that family resilience was connected by generations of indigenous cultural constructs of Sumud (perseverance), Muqawama (cultural resistance to military occupation), and Awda (a return to cultural roots despite ongoing and historical settler colonialism).^{79,80} Findings show that these cultural constructs of resilience influence positive coping strategies including adaptation, problem solving, acceptance, patience, social support, and relying on religious-faith in Palestinian populations residing in Palestine.^{79,81}

While substantial literature focuses on the mental health impact of war and violence across refugee groups, very little is known about how Palestinian adolescent refugee and non-refugee experiences with Israeli settler colonial violence, forced displacement, distress, perceived resilience, coping and mental wellbeing symptoms impact high blood pressure (prehypertension (i.e., 121/<80 to 129/<80 mmHg) and hypertension (i.e., $\geq 130/\geq 80$ mmHg)). To fill this gap, we aim to elucidate the relationship between psychosocial factors as exposure to Israeli settler-colonial violence, forced displacement, distress, perceived resilience, coping, and mental wellbeing symptoms relationship with high blood pressure levels among refugee adolescents residing in refugee camps compared to their non-refugee counterparts residing in neighboring villages and cities in the occupied West Bank region of Palestine.

Methods

Study Design

A multi-center cross-sectional study was conducted from November 1, 2022, to January 10, 2023, to assess the relationship between psychosocial risk and protective factors and high blood pressure among Palestinian adolescent refugee populations compared to non-refugee counterparts residing in occupied West Bank, Palestine.

Setting, sampling, and selection of participants

A stratified random sample of 706 Palestinian adolescents [377 refugees, 329 non-refugees] ages 13 to 17 residing in refugee camps, cities, and villages among 4 regions throughout occupied West Bank (i.e., Ramallah, Bethlehem, Nablus, Hebron) were sampled from Palestinian Ministry of Education (PMOE) government schools and United Nation Relief Works Agency (UNRWA) schools within the specified regions. The four regions were selected based on geographical location, population density, and refugee camp presence. Sampling occurred at two stages: Government schools and refugee camp community centers connected to UNRWA schools were randomly selected across the region using lists provided by the PMOE and refugee camp community directors. Once schools and community centers agreed to

participate, a list of students in grade levels 8 to 11 per each selected school and community center was provided to the investigator to randomly select to recruit to participate in the study. Inclusion criteria included: ages 13-17 and attending government or UNRWA schools. Most Palestinian adolescents attend either UNRWA or PMOE government schools in occupied West Bank where free education is offered; UNRWA schools in occupied West Bank were founded to serve refugee students, specifically.¹¹

A consent form and study information sheet translated in Arabic was provided by the study team to the students to provide to parent/legal guardians to review and discuss with their children who expressed interest in study enrollment once randomly selected. Parent/legal guardian and student consent were obtained prior to study enrollment. Data collection was conducted by trained research staff in local community centers after school hours within each enrollment region.

Ethical considerations

Ethical approval was granted from the institutional review boards of University of California San Diego, An-Najah National University, and San Diego State University. Palestinian Ministry of Education and Refugee Camp Community Board approvals were granted prior to study initiation.

Sample Size

The sample size was calculated to detect differences in prehypertension and hypertension among Palestinian adolescent refugee and non-refugee populations with a significance level of .05 and a power of 80 %. Based on the literature, the sample size anticipated 10 percent difference in prehypertension and hypertension prevalence rates between both adolescent groups (i.e., Refugees= 36 % CI 31% to 41 % vs Non-refugees= 26% CI 21% to 31%). The sample size calculation resulted in a required sample size of at least 692 participants (379 refugee participants and 313 non-refugee participants). Additional sampling (i.e., allocation ration 1.12) among refugee population strata was conducted to account for

refugee status exposure of settler colonial violence given both refugee and non-refugee populations are exposed to settler colonial violence to a level. G-power 3.1.9.4 was used for sample size power calculation.

Theoretical framework

Lazarus and Folkman's Transactional model is recognized for understanding stress pathways and emphasizing the relationship of cognitive, environmental, and behavioral strategies for coping with stress and its health implications.⁸² The model identifies two key factors influencing stress responses: 1) the perceived threat of the stressor (i.e., primary appraisal) and 2) the assessment of how to manage the stressor (i.e., secondary appraisal). In Palestinian adolescents, the primary appraisal focuses on perceived stress from settler colonial violence, while secondary appraisal encompasses ways in which social encounters, kinship relations and networks influence resilience that mediate coping mechanisms and can aid distress management;⁸³ Coping plays a mediating role in managing stress and its threat to an individual's health.⁸² Studies have shown that Palestinian cultural factors of resilience are associated with social relationships and community survival.⁸³ This model offers insights into the psychosocial factors' relationship on Palestinian adolescent well-being, including blood pressure, guiding interventions to foster resilience and healthy coping strategies (Supplement I, Figure 8).

The Lazarus and Folkman Stress, Coping and Adaptation model was adapted to consider the environmental stressors and psychosocial factors resulting from living under military occupation in Palestine and its relationship to blood pressure. The model included looking at psychosocial factors and exposures as: 13-month exposure to settler colonial-related violence, refugee status, perceived stress over 13-months, perceived resilience, coping mechanisms, and mental wellbeing symptoms (Supplement I, Figure 8).

Data Collection and Variables

Anthropometrics were collected by research staff and measured three consecutive measurements of blood pressure (mmHg) that were averaged, heart rate (BPM), body fat (%), height (cm), and body weight (kg). Further, participants completed self-reported questionnaires (Supplement I) after anthropometric and blood pressure measurement collection.

Psychosocial factor variables

Survey items were derived from validated surveys (Supplement I) in Arabic utilized among adolescent Palestinian and Syrian refugee and community-dwelling populations.^{84–88} The following questionnaires were utilized: Sociodemographic, Individual and Collective Exposure to Israeli Military and Settler Violence and Trauma questionnaire (ETV) Questionnaire,⁸⁸ Child and Youth Resilience Questionnaire (CYRM),⁸⁷ Ways of Coping Questionnaire (WCQ),⁸⁵ Perceived Stress Scale,⁸⁴ and Hopkins Symptom Checklist-25 (HSCL-25).⁸⁶ Questionnaire items and descriptions of measures collected are shown in Supplement I.

Blood Pressure

Trained staff recorded three consecutive blood pressure readings with a 3-minute resting period in between using a validated blood pressure monitor.⁸⁹ Students were instructed to keep legs uncrossed and legs on the floor pre and during blood pressure measurement. Students were asked to refrain from caffeine intake for 4 hours prior to measurement. Blood pressure categories were defined as: normal blood pressure (i.e., <120/<80 mmHg), prehypertension (i.e., 121/<80 to 129/<80 mmHg) and hypertension (i.e., ≥130/≥80 mmHg).⁹⁰ The average of the 3 blood pressure measurements was used to represent the final blood pressure measurement.

Anthropometric measures

A body composition scale was employed to measure weight (kg), while a measuring tape was utilized to measure height (cm). An estimated body fat percentage was determined using a bioelectrical impedance sensor body fat scale. Staff entered the participant's height (cm) and age (years) into the scale and directed participants to stand barefoot on the scale.

Subsequently, the scale measured their weight (kg) and calculated the estimated body fat percentage.

Statistical Analysis

All analyses were conducted using version 3 of RStudio: Integrated Development for R statistical software.⁹¹ Tests of significance were two-sided and have a P-value of < 0.05 . Descriptive statistics included the mean and standard deviation for all continuous variables and percentages for categorical variables by refugee status. Bivariate analyses compared participant characteristics by refugee status using t-tests and χ^2 tests for continuous and categorical variables; respectively. Psychometric analyses to support use of summed scores for each factor using multidimensional item response theory (mIRT) tools⁹² and relationships among factors were explored with Exploratory Graph Analysis (EGA).⁹³ Differential Test Functioning (DTF) analysis in mIRT compared performance of scales across refugee and non-refugee groups prior to assessing group differences to examine validity and reliability of use of the scale across both groups. Pearson correlation coefficients were computed among all summed scales identified during mIRT and EGA analyses to evaluate collinearity (i.e., ≥ 0.7 is strong collinearity) among factors. Internal consistency of each scale was estimated using Cronbach's alpha to quantify reliability of scores. Ordinal regression models were used to assess bivariate relationships among each factor identified and blood pressure level (i.e., normal, prehypertension, hypertension) and multivariate relationships among all psychosocial factors identified during EGA analysis and blood pressure levels while adjusting for age and sex (Figure 7). Normal blood pressure served as the reference category.

Results

The participant sample characteristics are presented in Table 3. A total of 706 students had completed the study and 695 students had valid blood pressure data with 3 repeated readings (98.4%).

Sample Descriptives

In total, 10.5% of students resided in a city, 38.4% resided in villages, and 50.9% resided in refugee camps. Refugee adolescents reported lower annual family income i.e., less than \$300 a month (38%) compared to non-refugee adolescents (11.4%) (Table 3). Most students reported that they conduct physical activity at least 2 or more times a week (60% refugee adolescents and 56.4% non-refugee adolescents). The family history of hypertension was prevalent in 36% (refugees (32.1%) and non-refugees (32.8%)) of the adolescent sample. The overall prevalence of prehypertension was 26% and hypertension was 14% for the total sample (Table 3). Refugee adolescents in the sample had a lower prevalence of prehypertension [25.5% vs. 27.0%] and hypertension [12.7% vs. 16.0%] compared to non-refugee adolescents, although confidence intervals overlapped (Table 3).

Psychometric Analysis

MIRT and EGA analyses resulted in a total of 15 separable factors from (Figure 4) the original 5 scales (Supplement I). Differential Test Functioning scores suggested consistent measurement across both groups for most psychosocial factors (Table 5). Overall, most of the 15 factor measures generated internal consistency with Cronbach's Alpha Coefficients of 0.6 or higher (Table 4). The correlation matrix (Figure 2.2) displays the pairwise correlations between the 15 psychosocial factors identified in Table 4 and Figure 5.

Collinearity and Bivariate Analyses

There was weak evidence of collinearity among most factors, as the correlation coefficients were below the threshold of ± 0.8 (Figure 5).⁹⁴ Bivariate analyses demonstrated among refugees, per unit increase of each factor over a 13-month time span, five out of fifteen factors were associated with having lower odds of having high blood pressure (i.e. normal, pre-hypertension, hypertension) after adjusting for age and sex: Cultural resistance resilience [AOR (95%CI) = 0.76(0.63-0.90)], settler colonial violence on neighbors/friends [0.51(0.36-0.74)], settler colonial violence including tear gas and sounds of bombs [0.80(0.66-0.98)], adaptive coping [0.72(0.51-0.99)], and depression symptoms [0.74(0.57-0.94)] (Supplement Figures 9-

14). In contrast, per unit increase of each factor over a 13-month time span, 3 of the 15 factors were associated with higher blood pressure in non-refugees after adjusting for age and sex: settler colonial violence on neighbors/friends [1.94(1.36-2.78)], settler colonial violence including tear gas and sounds of bombs [1.24(1.02-1.52)], and depression symptoms [1.65(1.11-2.47)] (Figure 6, Supplement Figures 9-14).

Multivariate Analyses

Multivariate regression analysis demonstrated inverse relationships on high blood pressure associations among refugee groups per unit increase over a 13-month time span of psychosocial factors as settler colonial violence on neighbors/friends (refugees (AOR = 0.54(0.31-0.93) vs non-refugees (1.85(1.07-3.18)) and settler colonial violence to the individual (refugees (2.28(1.01-5.12) vs (0.44(0.20-0.99)). Moreover, depression symptoms [2.02(1.01-4.06)] were independently associated with higher blood pressure in non-refugees (Figure 7).

Discussion

This cross-sectional study among Palestinian adolescents -- both refugees and non-refugees -- living under Israeli military occupation explored the associations between psychosocial and environmental factors related to stress processing and blood pressure burden. Overall, high blood pressure was associated with various psychosocial factors differing by refugee status.

Differential item function scores assessed between refugees and non-refugees demonstrated consistent relationships among factors such as adaptive coping, negative coping, affective feeling stress, dealing with stress, anxiety symptoms, depression symptoms, faith and supportive relationships resilience, cultural resistance resilience, perseverance resilience, individual exposure to personal settler colonial violence. However, scores of factors identified among the ETV Questionnaire differed by refugee status including shelling, shootings, and explosions, household, and friends and neighbors. Refugee adolescents expressed higher scores across most factors of settler colonial violence including exposures to household and

among friends and neighbors. Such findings differed from the Giacaman et al. study focused on the relationship of Israeli settler colonial violence on Palestinian adolescent mental wellbeing in which suggested 5- factor model of 3 collective factors (i.e., settler colonial violence to strangers, friends and neighbors, tear gas and sounds of bombs, and shelling/shooting/explosions) and 2 personal factors (i.e., settler colonial violence household and settler colonial violence to self) to be utilized to measure settler colonial violence regardless of refugee status.⁹⁵ The results may have varied due to the higher exposure and extreme restrictions imposed by the Israeli military within the refugee camps and the daily exposure to military raids within confined camp space compared to non-refugees who live in neighboring villages. ⁹⁶ Refugees live in extreme crowded living conditions within camps compounded by factors as poverty and social, psychological and political pressures alongside pressures from inherited trauma due to the ongoing effects of Israeli settler colonial violence over last 75 years.⁹⁵ As a result, this study utilized the factors identified by both the mIRT analyses and 5 factors suggested by the Giacaman et al study.⁹⁵ Further research is needed to examine the validity of such factors among refugee and non-refugee groups independently when assessing factors of settler colonial violence between both groups.

Despite refugee status, most Palestinian adolescents in occupied West Bank have lived their entire lives under Israeli military occupation. Research has shown that those residing in refugee camps report more exposure to settler colonial violence (i.e., military raids, tear gas exposure, violence to friends and neighbors) compared to non-refugee counterparts.⁶⁷ The exposure to specific forms of settler colonial violence among Palestinian adolescents was significantly related to blood pressure levels but differed by refugee status. Interestingly, increased exposure to tear gas, hearing bombs, and witnessing settler colonial violence toward neighbors and loved ones over a 13-month timespan was related to high blood pressure in non-refugee adolescents; Conversely, refugee adolescents exhibited lower odds of high blood pressure in similar circumstances. Moreover, refugee adolescents displayed higher odds of

having high blood pressure if they suffered settler colonial violence to their homes, while their non-refugee counterparts were less likely to have increased blood pressure in analogous conditions. Such findings align with mental health research conducted among Palestinian populations which suggest that there are specific forms of settler colonial violence that are particularly detrimental to the population's health.⁹⁷ For example, Thabet et al. express that sources of settler colonial violence such as losing a child to military violence, surviving bombardment, experiencing home demolitions, collective violence to community (e.g., physically and psychologically harming the community), and being detained and tortured in Israeli prisons are among the specific exposures most harmful to Palestinian populations and heightened for refugee populations.⁸⁰ Moreover, El-Khodary et al.'s study that assessed traumatic events and post-traumatic stress disorder found that 83.7% of Palestinian children witness trauma in others, and 88.3% observe property demolition are more likely to be diagnosed with post-traumatic stress disorder compared to those who did not.⁹⁸ Similar to our findings, research focused on transitional refugee dynamics using inflammatory markers identified via collection of nail cortisol among Serbian and Kakuma refugees explained that a potential difference in inflammatory markers among refugee groups may be due to diverse psychosocial experiences and psychosocial stressors during varying periods of the refugee process.¹⁹ For example, both Serbian and Kakuma refugees experience chronic stress, however Kakuma refugees have a longer history of exposure to chronic stressors in the refugee process in which may influence stress-responsive neuroendocrine systems to adjust over time resulting in allostasis.¹⁹ Gettler et al., further explained that population differences in post-traumatic stress during and prior to becoming a refugee and the individual's physical health should be considered when assessing plausible reasons for such differences among refugee and non-refugee groups.²⁰ For example, Palestinian adolescents living in refugee camps in occupied West Bank are considered part of unrecognized populations continuously exposed to demolition, forced displacements and evictions from non-registered homes by the Israeli military.^{99,100} Palestinian refugees have been

forcibly displaced since 1948 (Nakba) to provide space for Israeli settlement growth, military bases, and newly declared nature reserves; this traumatic situation is continuously felt by third-generation adolescent refugees, especially those living in refugee camp.⁷⁰ The home is a significant symbol to Palestinian refugees and the dream to return to their original homes is passed through generations as a way to connect to the land, hence why many refugees still have a key to their original home;⁸³ this alone explains why settler colonial violence to the home was related to poorer blood pressure levels in the adolescent refugee population compared to non-refugee counterparts.

Depression symptoms were high among the entire sample and significantly related to blood pressure among both groups. Conversely, while an increase in depression symptoms posed as a risk factor for non-refugee adolescents in the sample, it functioned as a protective factor in the sample of Palestinian refugee adolescents in relation to high blood pressure. Such findings align with the El-Khodary et al study in which showed that Palestinian non-refugee adolescents who lived in poverty and experienced settler colonial violence in Gaza, Palestine were more likely to have mental health conditions than Palestinian refugee counterparts.¹⁰¹ This may be due to the intricate histories of traumatic stress and intergenerational effects of Palestinians residing under decades of brutal Israeli military occupation and the forms of intergenerational protective processes used to process traumatic experiences, particularly in those who have been forcibly displaced.¹⁰² The literature shows there is a strong relationship between exposure to settler colonial violence and Palestinian adolescent mental wellbeing,¹⁰³ however evidence in diverse politically-inflicted settings suggest that psychological consequences of adversity, particularly in those who experience forced displacement can vary based on type and accumulation of violence experienced, age, gender, accessibility of culturally relevant resources, post-crisis conditions, cross-generational processing and rituals, and the nature of community and family bonds.⁸⁰ Intergenerational protective processes in families and communities have shown to protect children from challenges associated within living among

systemic racist contexts over multiple generations. Protective processes in the Palestinian context include enduring social relationships, preserving family and community survival, and social support.¹⁰⁴ Early integration of such processes have shown to be protective against second-generation psychological distress.¹⁰⁵ For example, a study conducted in Palestinian children with mothers found that showing social support through cultural storytelling and activities lowered the probability for the child to develop psychological symptoms.¹⁰⁶

Cultural resistance resilience, known as Muqawama in Arabic, was a significant resilience protective factor against high blood pressure among Palestinian adolescent refugees in the sample. Cultural resistance resilience represents a multifaceted resilience factor used by Palestinian families to protect their physical survival, dignity, psychological wholeness and community integrity through collective and individual actions.⁸⁰ This resilience factor is centered around family and includes multigenerational storytelling, youth sharing and asking questions, voicing generational concerns, communal storytelling, cultivating direct skills (e.g., planting olive trees), cultural traditions (Palestinian art e.g., Dance (debka), cross-stitch (tatreez), traditional music, etc.), and critical knowledge across generations to support resistance against dehumanization and military occupation.⁸⁰ Similar findings were revealed in Atallah's study focused on resilience processes among Palestinian refugee families living under Israeli military occupation in occupied West Bank.¹⁰⁷ Despite the impact of structural discrimination experienced by Palestinian adolescents living under settler colonial rule, Palestinians demonstrate remarkable forms of cultural resilience which buffers against the stressors.⁸⁰

Adaptive coping was a significant protective factor in the sample of refugee adolescents; Our findings suggest that refugee adolescents who adopted adaptive coping mechanisms in daily practices were less likely to have higher blood pressure. The adaptive coping factor in our study revealed factors related to acceptance, social support, faith, and readiness to attend the challenge. Such findings align with a study conducted among Palestinian refugees in Gaza in which coping mechanisms as: 1) giving cultural and religious meaning to the exposure; 2)

moving from individualism to collectivism; 3)normalization and habituation; 4)belonging, acceptance, expectation, and readiness; and 5) social support and expression of distress were identified as most common coping mechanisms used.⁸³ The way Palestinians cope with military occupation and settler colonial violence is shaped by their social networks and the meanings they ascribe to within those networks, especially in refugee communities within Palestine.¹⁰⁸ Palestinians' ability to endure such traumatic daily exposures is understood through their resilience and perception of military occupation being a part of their daily life;¹⁰² Studies conducted in other countries as South Africa, Northern Ireland, and Palestine have shown similar findings in which strong ideological commitment to liberation from settler colonialism can increase resilience and enhance coping strategies⁸³. Further, the literature suggests that a good proportion of refugee children are able to function well despite negative exposures to adverse childhood experiences such as violence. Resilient children have shown to be less likely to express symptoms of poor mental well-being and poor health outcomes due to consequences of adversity experienced; Studies suggest that sources of resilience in refugee children stem from affirming faith and cultural traditions.^{109,110}

Implications

The data shows that there is an urgent need among mental health and public health professionals to understand the diverse psychosocial factors that may hinder or promote future behavioral and pharmacological interventions in Palestinian populations; This includes cultural registers of traumatic exposures, specifically by refugee experiences. Health professionals must recognize that the chronic stressful violent events and cumulative exposed trauma experienced by Palestinian populations cannot be assessed as individual cases in isolation.⁹⁵ Palestinian adolescents, regardless of refugee status, experience settler colonial violence individually and collectively however living in refugee camps introduces additional stressful contexts beyond settler colonial violence.^{95,111} Given this, the need for a community centered approach based on diverse contextual experiences must be considered for future health interventions in the region.

High blood pressure in this sample was related to different psychosocial factors based on refugee status. Palestinian adolescents have unique political and social determinants of cardiovascular health due to the military occupation, forced displacement, and encampment. Future longitudinal research must consider these differences to understand its impact on cardiovascular health.

Limitations

The large diverse sample size of participants from across the occupied West Bank region strengthens this study. However, there are limitations of this study that need to be considered. First, sampling participants in government schools by grade level limited our ability to balance the age groups among refugee and non-refugee students. UNRWA government schools, where most refugee students attend to obtain education, do not provide classes for grades 11 and 12; This causes refugee students to attend PMOE government schools for grades 11 and 12. There was no ethical approach in randomly sampling refugee students in both grade levels at PMOE governments schools resulting in the sampling of older non-refugee students compared to refugee students. Further, given the geopolitical circumstances in the region limiting access to census data, sample weighting techniques could not be completed to determine the population-based prevalence estimates. Additionally, the study's sampling technique sampled adolescents across the region, however regions such as Jenin, Tulkarem, East Jerusalem, and Gaza were not easily accessible. Such regions are home to the largest refugee camps in Palestine and experience extreme rates of military attack launches on civilian populations. Further, this study is cross-sectional and cannot address causal or temporal relationships. Future longitudinal research is required to address the directional assumptions using the Lazarus Framework related to stress and its impact on blood pressure levels.

Conclusion

This study demonstrated that exposure to different forms of settler colonial violence living under Israeli military occupation and depression symptoms are correlated with high blood

pressure and inversely related depending on the refugee status among Palestinian adolescents residing in occupied West Bank, Palestine. Further, factors as adaptive coping and cultural resistance resilience may serve as protective factors related to lowering blood pressure levels specifically for Palestinian adolescent refugee communities. These significant findings introduce measures to consider in future preventative and treatment interventions and should challenge the need for a policy change in funding Israeli military occupation.

Tables

Table 3- Participant Demographics and Characteristics by Refugee Status

Characteristic	Non-refugees	Refugees	P-value
Sample size (n)	329	377	
Age (mean (SD))	14.73 (1.34)	14.16 (1.28)	<0.001
Age (years (n (%)))			<0.001
-13	81 (24.7)	164 (43.6)	
-14	65 (19.8)	79 (21.0)	
-15	88 (26.8)	67 (17.8)	
-16	50 (15.2)	41 (10.9)	
-17	44 (13.4)	25 (6.6)	
Sex (n (%))			0.937
-Female	131 (39.9)	148 (39.4)	
-Male	198 (60.1)	229(60.6)	
Residence (n (%))			<0.001
-City	56 (17.1)	18 (4.8)	
-Village	256 (78.3)	15 (4.0)	
-Refugee Camp	15 (4.6)	343 (91.2)	
Monthly Family Income (n (%))			<0.001
-Less than \$300	35 (11.4)	106 (37.9)	
-\$301-650	62 (20.1)	88 (31.4)	
-\$651 or more	211 (68.5)	86 (30.7)	
Family History of High Blood Pressure (n (%))	124 (32.8)	132 (32.1)	0.923
Mean Body Fat (%(SD))	25 (9)	24 (10)	0.251
Weekly Physical Activity Status (n(%))			0.159
-0 to 1 Times	140 (43.6)	146 (40.0)	
-2-3 Times	113 (35.2)	154 (42.2)	
-4 or more times	68 (21.2)	65 (17.8)	
Heart rate (mean (SD))	86.12 (11.99)	87.28 (13.09)	0.222
Blood pressure category (n (%))			0.357
-Normal	186 (57.1)	228 (61.8)	
-Prehypertension	88 (27.0)	94 (25.5)	
-Hypertension	52 (16.0)	47 (12.7)	

Table 4 -Reliability Assessment: Cronbach's Alpha Coefficients for the Psychosocial Factors Identified During Psychometric Analyses and Factor Items.

Table 4 Reliability Assessment: Cronbach's Alpha Coefficients for the Psychosocial Factors Identified During Psychometric Analyses and Factor Items (Continued)			
Scale	Factor	Items	Cronbach's alpha
Perceived Stress Scale	Feeling Stress	"In the last month, how often have you dealt successfully with day to day problems and annoyances?" "In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?" "In the last month, how often have you felt confident about your ability to handle your personal problems?" "In the last month, how often you felt that things were going your way?" "In the last month, how often have you been thinking about things that you have to accomplish?" "In the last month, how often have you been able to control the way you spend your time?"	0.8
	Dealing with stress	"In the last month, how often have you been upset because of something that happened unexpectedly?" "In the last month, how often have you felt nervous and "stressed"?" "In the last month, how often have you felt nervous and "stressed"?" "In the last month, how often have you found that you could not cope with all the things that you had to do?" "In the last month, how often have you been angered because of things that happened that were outside of your control?" "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?"	0.86
Hopkins Symptom Checklist-25	Anxiety symptoms	"In the last year, how often have you felt faintness, dizziness, or weakness." "In the last year, how often have you felt your heart pounding or racing." "In the last year, how often have you felt trembling." "In the last year, how often have you felt tense or keyed up." "In the last year, how often have you felt headaches." "In the last year, how often have you felt a spell of terror or panic." "In the last year, how often have you felt restless or can't sit still." "In the last year, how often have you felt nervousness or shakiness inside."	0.9
	Depression symptoms	"In the last year, feeling low in energy, how often slowed down."	0.88

Table 4 Reliability Assessment: Cronbach's Alpha Coefficients for the Psychosocial Factors Identified During Psychometric Analyses and Factor Items (Continued)

Scale	Factor	Items	Cronbach's alpha
		"In the last year, how often Blaming yourself for things." "In the last year, how often you feel crying easily." "In the last year, how often have you had Poor appetite." "In the last year how often Difficulty falling asleep, staying asleep." "In the last year how often do you have a Feeling hopeless about future." "Feeling blue." "Feeling lonely." "Feeling of being trapped or caught" "Worry too much about things." "Feeling everything is an effort." "Feeling of worthlessness."	
Ways of Coping Questionnaire (WCQ)	Negative coping	"Tried to get the person responsible to change his or her mind." "Criticized or lectured myself." "Went along with fate; sometimes I just have bad luck." "Went on as if nothing had happened." "Slept more than usual."	0.74
	Affective expression/ other coping	"I expressed anger to the person(s) who caused the problem." "I got professional help." "I waited to see what would happen before doing anything." "I let my feelings out somehow."	0.6
	Adaptive coping	"Just concentrated on what I had to do next –the next step." "I tried to analyze the problem in order to understand it better." "I felt that time would make a difference –the only thing to do was to wait." "Bargained or compromised to get something positive from the situation." "I did something which I didn't think would work, but at least I was doing something." "Talked to someone to find out more about the situation." "Tried not to burn my bridges, but leave things open somewhat." "Accepted sympathy and understanding from someone." "I told myself things that helped me to feel better." "I was inspired to do something creative." "I planned of action and followed it"	0.84
	Individual exposure to	"Exposed to sound bombs." "Tear gas"	0.87

Table 4 Reliability Assessment: Cronbach's Alpha Coefficients for the Psychosocial Factors Identified During Psychometric Analyses and Factor Items (Continued)

Scale	Factor	Items	Cronbach's alpha
ETV Questionnaire	setter colonial violence: Tear gas/sound of bombs		
	Individual exposure to setter colonial violence: shelling/shooting/explosion	"Have you seen friends or neighbors being: Killed." "Have you witnessed neighborhood: Shelling." "Have you witnessed neighborhood: Shooting." "Have you witnessed neighborhood: Explosions/shelling"	0.62
	Individual exposure to setter colonial violence: household	"Personal- House related items" "Personal- House occupied while you were in it." "Personal- House occupied and you were thrown out." "Personal- Housed sealed or demolished." "Personally Beaten by settlers" "Personally used as human shield."	0.71
	Individual exposure to setter colonial violence: personal	"Personally Beaten by the army" "Personally, body searched." "Personally detained or arrested." "Personally humiliated" "Stripped in public" "Personally interrogated" "Personally tortured"	0.72
	Collective exposure to settler colonial violence: friends/neighbors	"Have you seen strangers being: Humiliated." "Have you seen strangers being: Arrested." "Have you seen strangers being injured." "Have you seen strangers being: Killed." "Have you seen friends or neighbors being: Humiliated." "Have you seen friends or neighbors being: Arrested." "Have you seen friends or neighbors being injured."	0.88
Child and Youth Resilience Questionnaire (CYRM)	Faith and supportive relationships	"People think I am fun to be with [people like to spend time with me]." "I talk to my parents/caregivers about how I feel [I talk to my family about my feelings]." "I feel supported by my friends." "I know where to go in my community to get help [I know where to go to ask for help]." "I participate in organized religious activities (I participate in communal religious activities [such as group prayer, attending religious groupings, religion lessons])"	0.88

Table 4 Reliability Assessment: Cronbach's Alpha Coefficients for the Psychosocial Factors Identified During Psychometric Analyses and Factor Items (Continued)

Scale	Factor	Items	Cronbach's alpha
	Cultural resistance	"I think it is important to serve my community. [I think that serving my community is important]." "I feel safe when I am with my family/caregiver. [I feel safe when I am with my family]." "I have opportunities to develop skills that will be useful later in life (like job skills and skills to care for others) [I have opportunities to develop and improve myself for the future]." "I enjoy my family's/caregiver's cultural and family traditions [I enjoy participating in the customs and traditions of my family]." "I enjoy my community's traditions [I enjoy participating in the customs and traditions of the community in which I am living now]." "I am proud to be a citizen of Palestine, I am proud to be Palestinian."	0.88
	Perseverance	"I cooperate with people around me." "Getting an education is important to me [education is important to me]." "I know how to behave in different social situations [words added to the sentence: such as weddings and feasts]." "My parents/caregivers watch me closely [my family/relatives really watch out for me]." "My parents/caregivers know a lot about me [my family/relatives know a lot about me]" "If I am hungry, there is enough to eat [when I am hungry, there is enough to eat]." "I try to finish what I start [I try to finish things I start]." "Spiritual beliefs are a source of strength for me [religion and faith are a source of strength for me]." "I am proud of my ethnic background [I am proud of my lineage]."	0.94

Table 5- Average Scale Scores and Differential Test Functioning of Psychosocial Factors by Refugee Status

Original Scale	Psychosocial factor	Refugee Mean and 95%CI	Non-refugee Mean and 95% CI	P-Value	sDTF score	95%CI	P-Value
Perceived Stress Scale	Feeling stress	3.13 (2.50, 3.81)	3.38 (2.75, 4.00)	0.003	0.15	-0.42 - 0.75	0.607
	Dealing with stress	2.67 (2.00, 3.50)	3.00 (2.33, 3.50)	0.054	-0.6	-1.36 - 0.12	0.11
Hopkins Symptom Checklist-25	Anxiety symptoms	3.14(2.48,3.79)	3.14(2.64,3.64)	0.6	0.9	-0.28 - 2.13	0.13
	Depression symptoms	3.25(2.38,3.75)	3.25(2.75, 3.63)	0.9	0.21	-0.26 - 0.67	0.35
Ways of Coping Questionnaire	Negative coping	2.75 (2.38, 3.19)	2.75 (2.38, 3.25)	0.8	0.32	-0.35 - 0.98	0.35
	Affective expression/other coping	2.50 (2.00, 3.00)	2.33 (2.00, 3.00)	0.009	-0.002	-0.28 - 0.26	0.98
	Adaptive coping	2.92 (2.50, 3.33)	2.92 (2.52, 3.33)	0.9	-0.255	-1.13 - 0.63	0.58
ETV Questionnaire	shelling/shooting/explosion	1.50 (1.00, 1.75)	1.25 (1.00, 1.75)	<0.001	-0.542	-0.86 - 0.23	0.002
	Individual exposure to settler colonial violence: household	1.00 (1.00, 1.29)	1.00 (1.00, 1.14)	<0.001	0.68	0.21 - 1.09	0.02
	Individual exposure to settler colonial violence: personal	1.00 (1.00, 1.33)	1.00 (1.00, 1.20)	<0.059	0.16	-0.2 - 0.50	0.36
	Collective exposure to settler colonial violence: friends/neighbors	1.71 (1.14, 2.57)	1.43 (1.14, 2.16)	0.024	0.68	0.20 - 1.10	0.02
Child and Youth Resilience Questionnaire	Faith and supportive relationships	3.71 (2.86, 4.43)	3.71 (2.71, 4.29)	0.2	0.38	-0.25 - 1.00	0.217
	Cultural resistance	4.29 (3.43, 4.71)	4.14 (3.43, 4.57)	0.2	0.01	-0.83 - 0.79	0.98
	Perseverance	4.21(3.50, 4.71)	4.25(3.71, 4.62)	0.9	1.162	-0.39 - 2.71	0.16
sDTF= signed Differential Test Function; CI= Confidence Interval; Reference group= non-refugees							

Table 6 - Odds Ratios for High Blood Pressure Adjusted for Age and Sex: Comparing the Bivariate and Multivariate Relationships of Psychosocial Factors on Palestinian Adolescent Blood Pressure by Refugee Status

Covariates adjusting for age + sex	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value
Bivariate Regression Analyses						
Refugee				Non-Refugee		
Resilience: Faith and Supportive Relationships	0.87	0.74-1.03	0.11	1.07	0.80-1.42	0.642
Resilience: Cultural Resistance	0.76	0.63-.90	0.002	1.06	0.81-1.40	0.667
Resilience: Perseverance	0.92	0.78-1.09	0.321	1.3	0.77-1.37	0.997
Settler colonial violence on friends/neighbors	0.51	0.36-0.74	<0.001	1.94	1.36-2.78	<0.001
Settler colonial violence: shelling/shooting/explosion	0.82	0.51-1.33	0.43	1.22	0.75-1.97	0.43
Settler colonial violence: Tear gas/sound of bombs	0.8	0.66-0.98	0.029	1.24	1.02-1.52	0.029
Settler colonial violence: Personal	0.82	0.44-1.53	0.53	1.22	0.65-2.29	0.53
Settler colonial violence to household	1.15	0.67-1.99	0.61	0.87	0.50-1.50	0.61
Adaptive coping	0.72	0.51-0.99	0.047	1.13	0.69-1.85	0.62
Negative coping	0.97	0.73-1.30	0.856	0.99	0.65-1.50	0.969
Affective expression/other coping	0.76	0.55-1.06	0.105	1	0.63-1.60	0.989
Depression symptoms	0.75	0.59-0.95	0.019	1.65	1.11-2.47	0.013
Anxiety symptoms	0.9	0.70-1.16	0.418	1.2	0.82-1.77	0.348
Dealing with stress	0.86	0.71-1.05	0.145	1.33	0.96-1.83	0.08
Feeling stress	0.92	0.76-1.11	0.363	1.2	0.89-1.63	0.239

Table 6 - Odds Ratios for High Blood Pressure Adjusted for Age and Sex: Comparing the Bivariate and Multivariate Relationships of Psychosocial Factors on Palestinian Adolescent Blood Pressure by Refugee Status (Continued)

Covariates adjusting for age + sex	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value
Multivariate Regression Analyses						
Refugee				Non-refugee		
Refugee x Age	0.82	0.62-1.09	0.165	1.22	0.12-0.56	0.165
Refugee x Sex [female]	3.89	1.79-8.45	0.001	0.26	0.12-0.56	0.001
Resilience: Faith and Supportive Relationships	1.02	0.64-1.63	0.929	1.21	0.61-2.41	0.582
Resilience: Cultural Resistance	0.77	0.54-1.11	0.159	1.2	0.66-2.17	0.548
Resilience: Perseverance	1.27	0.85-1.88	0.241	0.65	0.37-1.14	0.135
Settler colonial violence on friends/neighbors	0.54	0.31-0.93	0.026	1.85	1.07-3.18	0.026
Settler colonial violence: shelling/shooting/explosion	1.21	0.59-2.46	0.607	0.83	0.41-1.69	0.607
Settler colonial violence: Tear gas/sound of bombs	0.94	0.72-1.22	0.621	1.07	0.82-1.39	0.621
Settler colonial violence: Personal	0.76	0.31-1.85	0.547	1.32	0.54-3.21	0.547
Settler colonial violence to household	2.28	1.01-5.12	0.046	0.44	0.20-0.99	0.046
Adaptive coping	0.71	0.40-1.24	0.227	1.24	0.53 – 2.92	0.618
Negative coping	1.21	0.79-1.85	0.386	0.89	0.49 – 1.64	0.714
Affective expression/other coping	0.77	0.45-1.32	0.345	0.73	0.33 – 1.59	0.424
Depression Symptoms	0.72	0.49-1.05	0.085	2.02	1.01 – 4.06	0.048
Anxiety Symptoms	0.88	0.58-1.32	0.525	1.04	0.51 – 2.10	0.924
Dealing with Stress	1.13	0.82-1.55	0.085	1.02	0.62 – 1.67	0.95
Feeling stressed	1.04	0.76-1.41	0.804	1.4	0.85 – 2.31	0.182

Figures

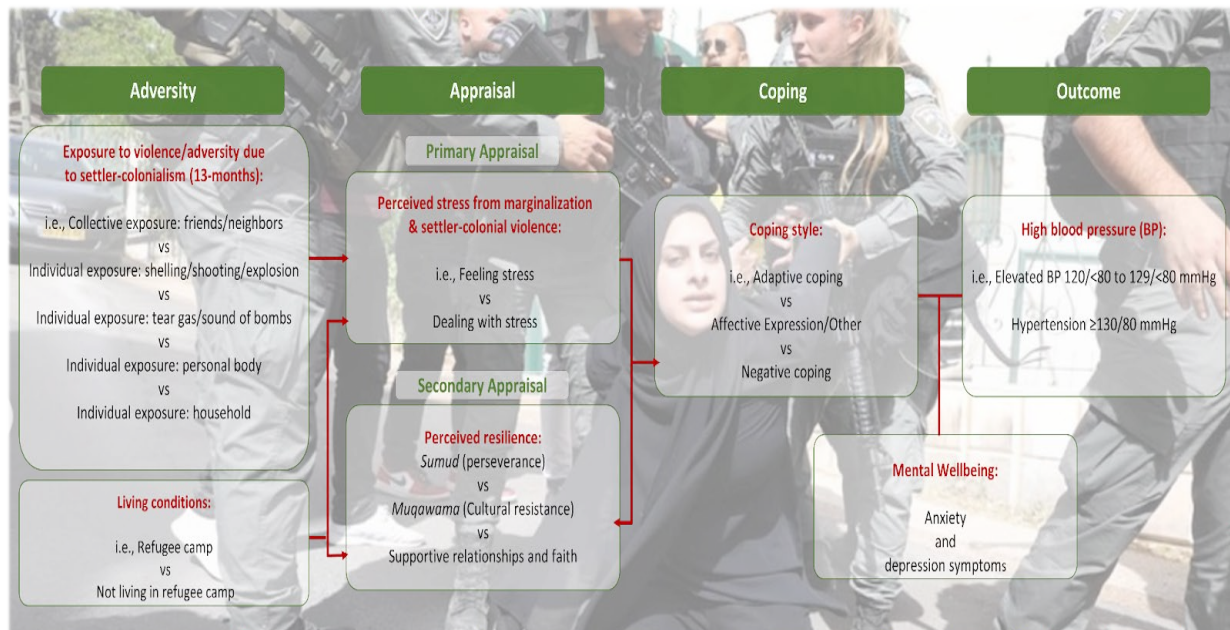


Figure 4-Stress, Coping, and Adaptation by Lazarus Adapted to Settler Colonial Violence Exposure Experienced by Palestinian Adolescents in Occupied West Bank, Palestine

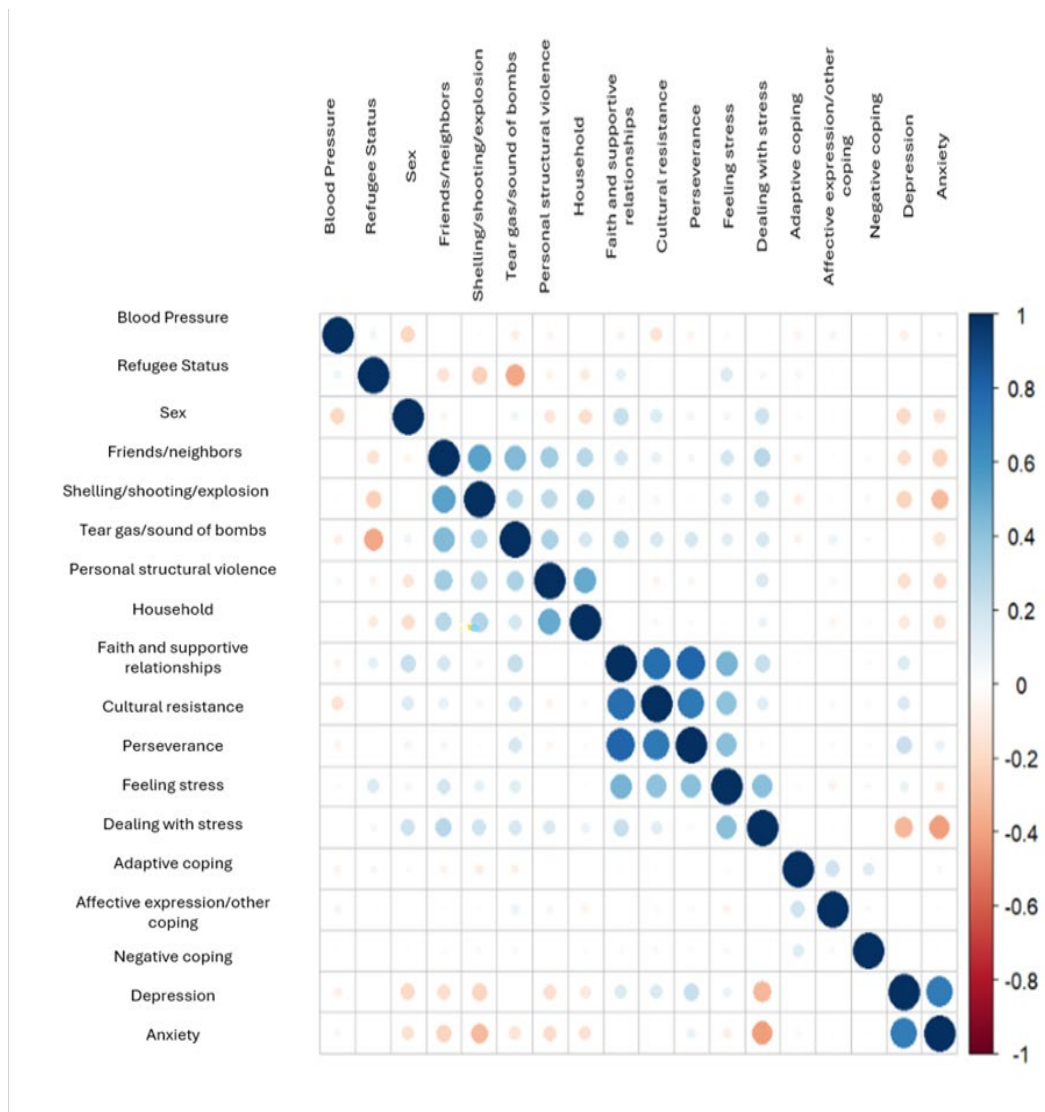


Figure 5- Correlations Between Psychosocial Factors and Blood Pressure

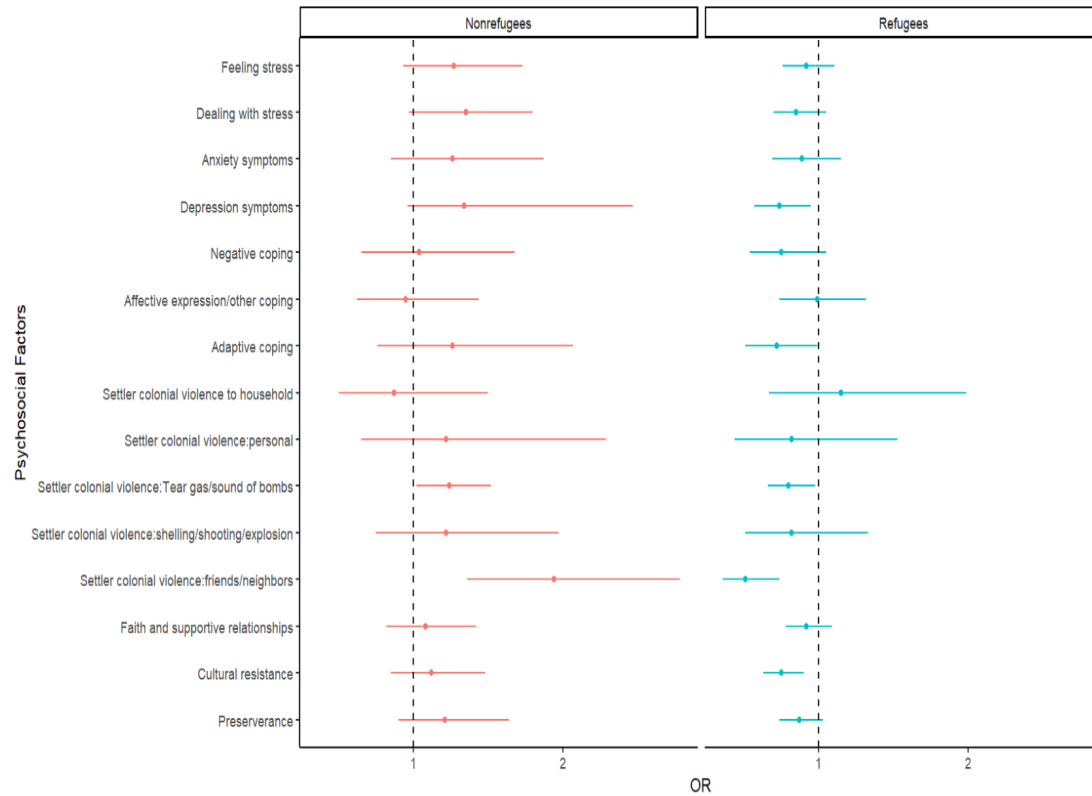


Figure 6-Forest Plot of Odds Ratios for High Blood Pressure Adjusted for Age and Sex: Comparing the Bivariate Relationship of Psychosocial Factors on Palestinian Adolescent Blood Pressure by Refugee Status

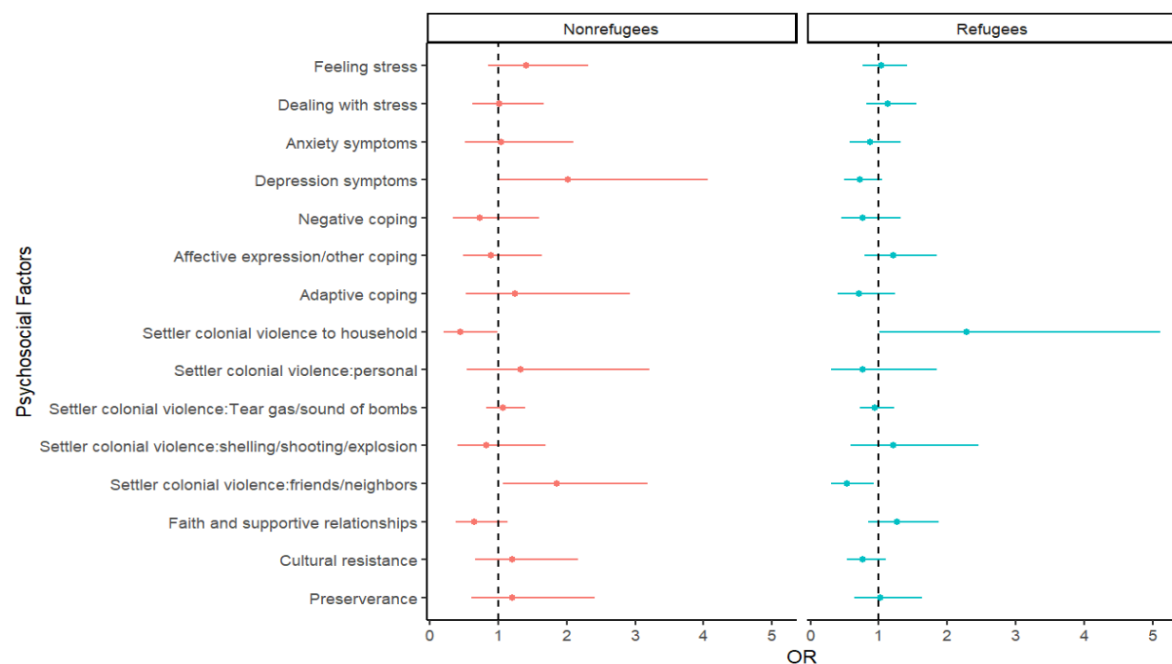


Figure 7-Forest Plot of Odds Ratios for High Blood Pressure Adjusted for all Psychosocial Factors, Age and Sex: Comparing the Multivariate Relationship of Psychosocial Factors on Palestinian Adolescent Blood Pressure by Refugee Status

Chapter 2- Supplement I

Methods

The sociodemographic questionnaire included the following items: Sex (Male or Female), age (13-17 years), school grade level (8-11), caregiver occupation (employed or unemployed), place of residence (refugee camp, city, village), family history of hypertension (yes vs no), physical activity level (0 to 1 time a week, 2-3 times a week, 4 or more times a week), refugee status (registered refugee or non-refugee), and school type (UNRWA school or PMOE government school).

The ETV questionnaire consisted of 26 items categorized into individual exposures (e.g., house searched, body searched, detained, used as human shield) and collective exposures (witnessed in neighborhoods, schools, and checkpoints) over a 13-month period.⁹⁵ Responses were recorded on a 5-point Likert Scale from 1 (Never) to 5 (More than 3 times), with total scores ranging from 26 (lowest exposure) to 130 (highest). ETV has been used in previous Palestinian youth studies to assess exposure to Israeli military and settler violence. Validated among Palestinian adolescents in Ramallah grades 10 and 11, it demonstrated a Cronbach alpha of .74.

CYRM included 28 items designed to assess overall resilience in geopolitical violence zones. Using a 5-point Likert Scale (1= not at all, 2= a little, 3= somewhat, 4= quite a bit, 5= a lot), CRYM contains three subscales reflecting the main categories of resilience.¹¹² The first subscale represents individual factors that are categorized as five items for personal skills, two items for peer support, and four items for social skills. The second subscale includes 2 caregiving items related to physical caregiving and five items related to psychological caregiving. The third subscale consists of contextual components that promote a sense of belonging, namely three items related to spirituality, five items related to culture, and two items

related to education. Reliability was high, with Cronbach's alpha of .87 in refugee youth and .94 in Palestinian adolescents from Gaza.

WCQ included 66 items and employed a 4-point Likert scale (0=not used, 1=used somewhat, 2=used quite a bit, 3=great deal) to evaluate coping strategies used over the last 13 months during periods of stress. It has been employed in studies involving Palestinian and Syrian refugees.¹¹³ The WCQ encompasses 8 subscales, including problem-solving, seeking support, distancing, and avoidance. In a previous study in Gaza focusing on coping with war trauma, the WCQ demonstrated strong reliability, with a Cronbach's alpha coefficient of 0.90.

HSCL-25 consisted of 25-items and was used to measure mental well-being symptoms i.e., symptoms of anxiety and depression over a 13-month timeframe.¹¹⁴ Respondents rated their experiences on a scale from "Not at all" to "Extremely". The HSCL-25 is a categorical variable, offering composite scores for overall mental well-being, anxiety, and depression symptoms. Additionally, it has been translated into Arabic and validated among Syrian refugee and Palestinian populations, showing good reliability with Cronbach's alphas of 0.95 for Palestinians in Gaza and 0.85 for Syrian refugees in Kurdistan.

Perceived Stress scale was used to measure perceived stress due to living under military and settler occupation over the past month.¹¹⁵ The 5-point Likert scale captured responses ranging from 0= Never to 4= very often and demonstrated high reliability (alpha=0.91) in Palestinian students residing in Gaza, Palestine.

Supplement Methods

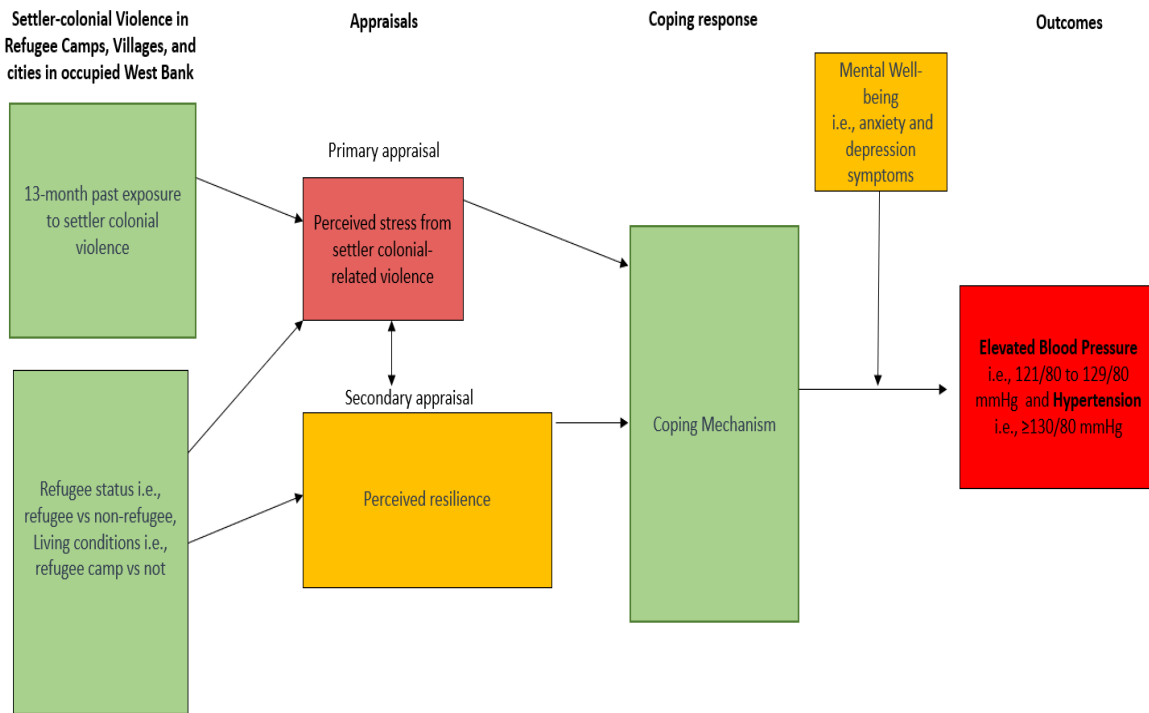


Figure 8-Stress, Coping, and Adaptation by Lazarus Adapted to Structural Violence Exposure Experienced by Palestinian Adolescents in Occupied West Bank, Palestine

Results

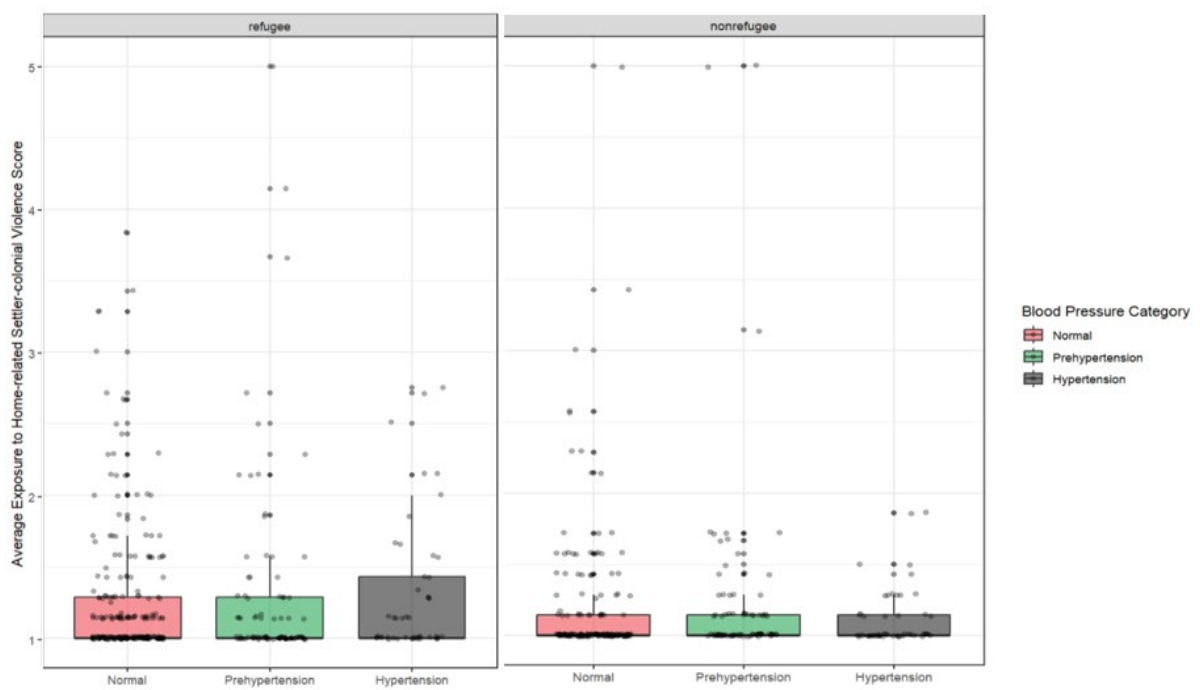


Figure 9-The Average Settler Colonial Violence to Household Score and its Relationship to Blood Pressure in Palestinian Adolescents Residing in Occupied West Bank, Palestine by Refugee Status

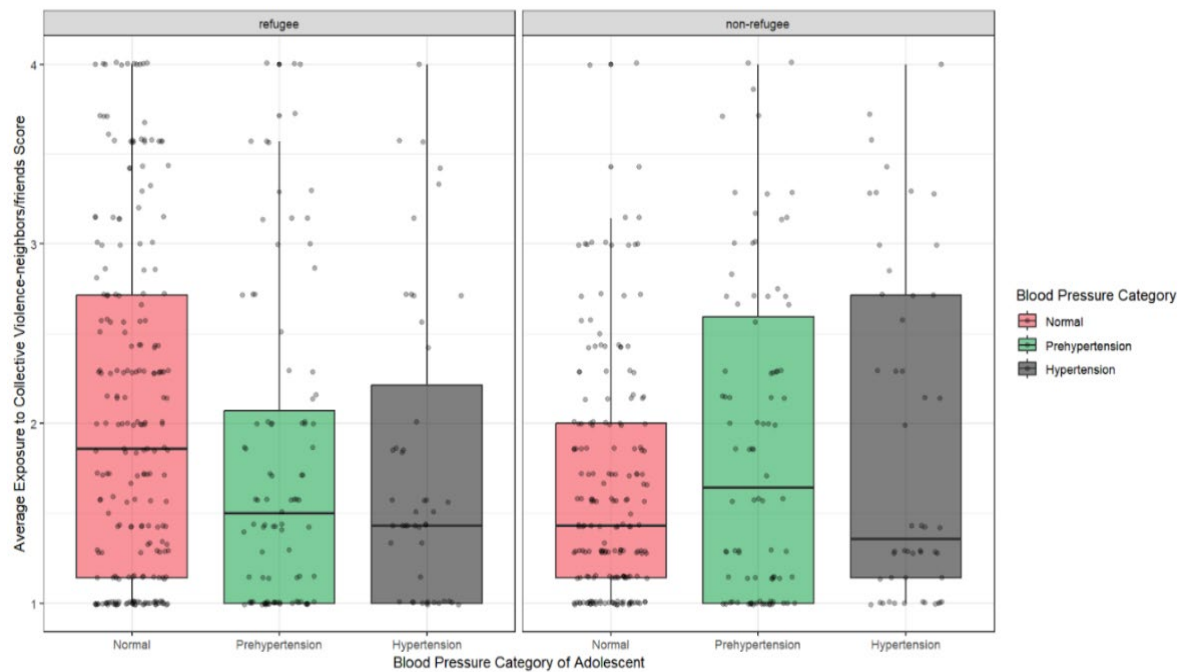


Figure 10-The Average Settler Colonial Violence to Neighbors and Friends Score and its Relationship to Blood Pressure in Palestinian Adolescents Residing in Occupied West Bank, Palestine by Refugee Status

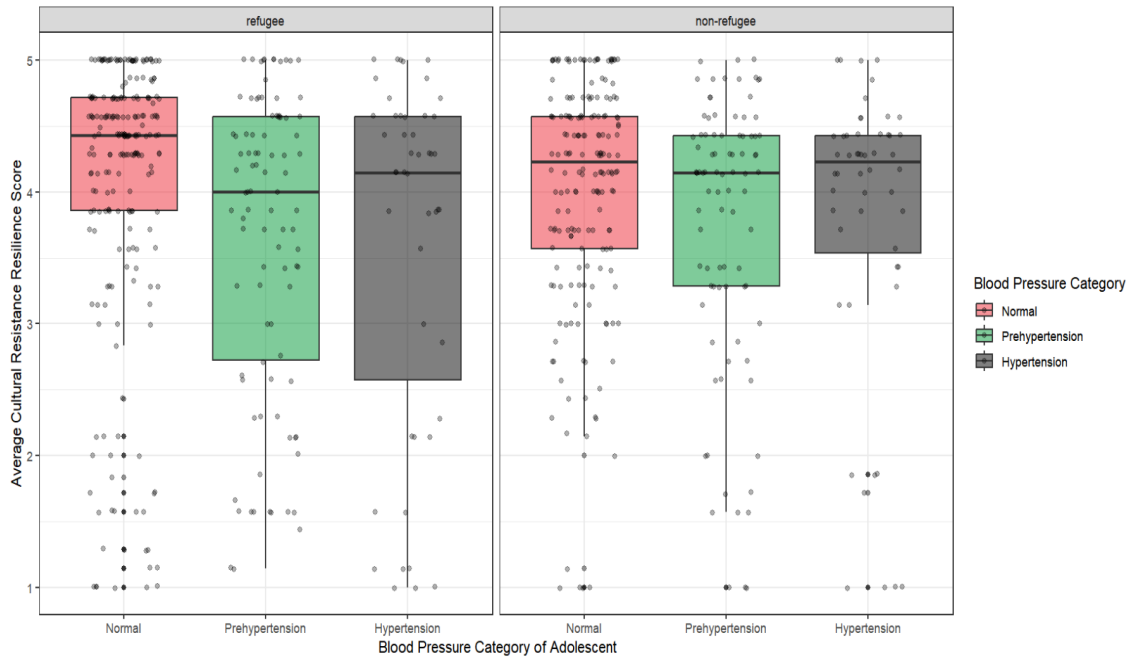


Figure 11- The Average Cultural Resistance Resilience Score and its Relationship to Blood Pressure in Palestinian Adolescents Residing in Occupied West Bank, Palestine by Refugee Status

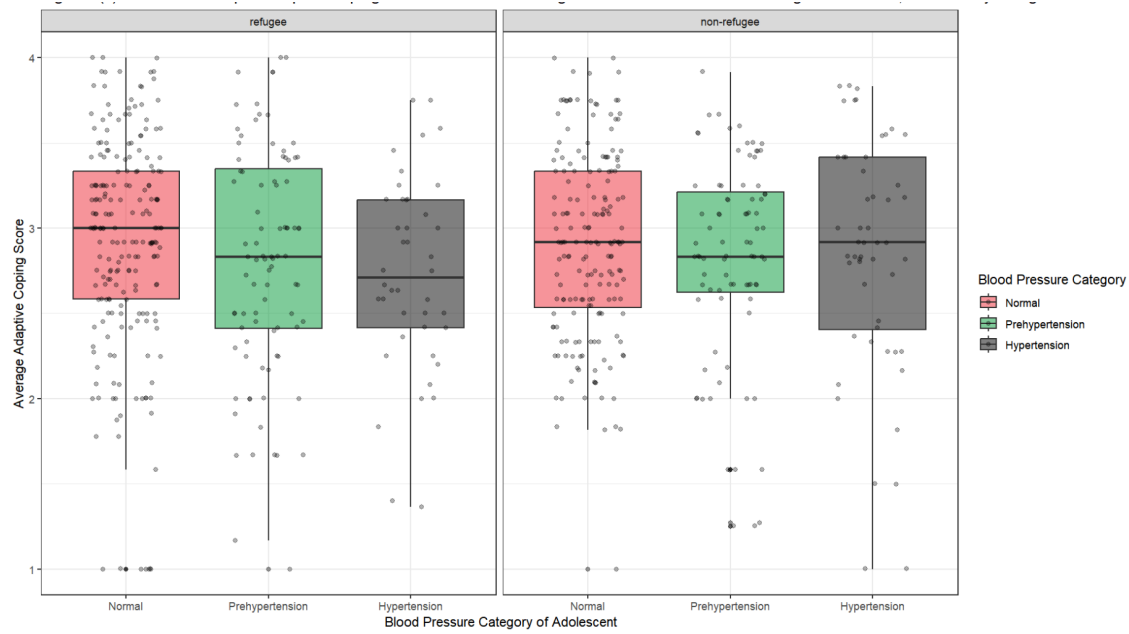


Figure 12-The Average Adaptive Coping Score and its Relationship to Blood Pressure in Palestinian Adolescents Residing in Occupied West Bank, Palestine by Refugee Status

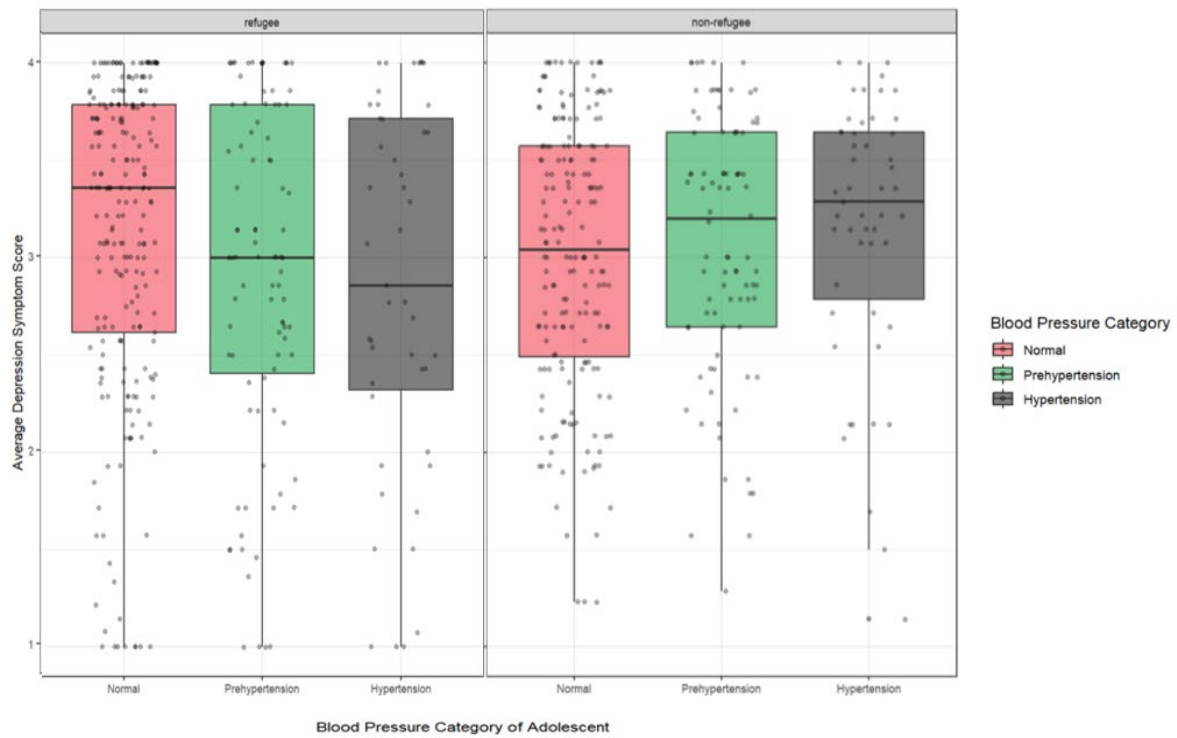


Figure 13-The Average Depression Symptom Score and its Relationship to Blood Pressure in Palestinian Adolescents Residing in Occupied West Bank, Palestine by Refugee Status

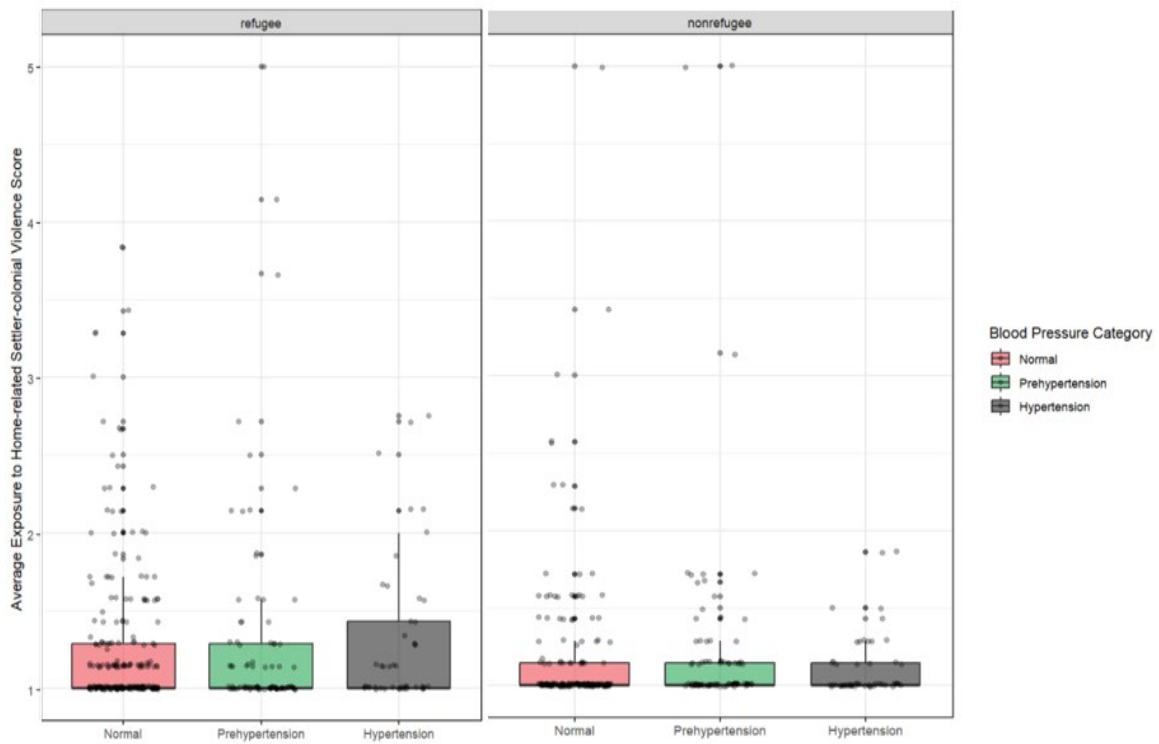


Figure 14-The Average Settler Colonial Violence to Household Score and its Relationship to Blood Pressure in Palestinian Adolescents Residing in Occupied West Bank, Palestine by Refugee Status

CHAPTER 2- ACKNOWLEDGMENT

I would like to acknowledge my committee for their unconditional support of this research proposal. Instead of questioning the feasibility of this project, we worked together to make it feasible. Thank you for believing me when others gave up.

I would also like to acknowledge Drs. Zeena Salman and Aymery Constant as external advisors who helped provide guidance throughout the dissertation and my lab members Lamees, Nargis, Mariam, Baseel, and Marcos who helped support my project.

Chapter 2, will be submitted for publication of its material. I, Dina Hamideh was the primary investigator and author of this material in this chapter. Strong, David; Al Zabadi, Hamzeh; Mahmood, Lamees; Bandoli, Gretchen; Crespo, Noe; Constant, Aymery; Hamideh, Baseel; Real, Marcos; Ahmadi, Nargis; Mansour, Mariam; Al Rousan, Tala are coauthors on this chapter.

CHAPTER 3- “Will It Be Used for Me or Against Me?”: A Qualitative Study on the Use of Mobile Health Interventions Among Adolescents and Parents Living in Palestine.

Authors- Dina Hamideh, Lamees Mahmoud, Lana Bridi, Hamzeh Al-Zabadi and Tala Al Rousan

Abstract

Background

The political determinants of health in the occupied Palestinian territory are pronounced, impacting care for chronic disease. Mobile health (mHealth) is increasingly used for self-management of chronic conditions as cardiovascular disease or diabetes among adolescents and adults in other populations, but perceived acceptability among Palestinians remains unknown.

Objective

To qualitatively assess the acceptability of potential mHealth interventions addressing pertinent health concerns among Palestinian adult and adolescent refugee and non-refugee populations residing in occupied Palestinian territories.

Methods

The Technology Acceptance Model was used to examine determinants that influence mHealth user acceptance. Twelve dyadic or focus group semi-structured interviews (n=32) were conducted among Palestinian adolescents and parents recruited through stratified cluster sampling from 4 refugee camps, villages, and cities in Palestine. Interviews were transcribed, translated, and analyzed using inductive thematic analysis.

Results

Participants included 13 families [(i.e., n=32) parents, grandparents, and children] from refugee camps (n=14), villages (n=10), and cities (n=8) across the region from diverse professional backgrounds. The following themes were identified: Benefits include: improved 1)

access to care living under Israeli military occupation, 2) real-time health monitoring during stressful encounters due to military occupation, 3) remote health monitoring of self and family members, and 4) health promotion and disease prevention. Barriers include: 1) mHealth weaponization by the Israeli government, 2) lack of resources needed to utilize mHealth, 3) concerns for mHealth validity, and 4) lack of adoption and parameterization by local health professionals. Considerations for a successful mHealth intervention include: 1) mHealth personalization by health outcome, 2) transdisciplinary collaboration and adoption, 3) affordability and validity of tools, and 4) user-education and friendliness.

Conclusions

Since adolescents and their parents believe in the potential benefits of mHealth for self-management, they are willing to engage in such interventions. However, cultural, historical, and geopolitical adaptation of interventions prior to implementation are crucial to account for contextual factors to avoid placing the population at risk of harm given living circumstances.

Keywords

mHealth; settler colonialism; Technology Acceptance Model; chronic disease; disease prevention; social determinants of health

Introduction

Palestine is a colonially fragmented region -- currently comprising occupied West Bank, East Jerusalem, and the Gaza Strip -- with challenging public health needs as a result of enduring Israeli settler colonialism, military occupation, medical apartheid, forced displacement, poverty, and other social determinants of health.¹ For decades, Israeli institutionalized oppression has created structural violence for Palestinians including political divisions, the blockade of the Gaza Strip, physical obstacles to movement, and the implementation of a permit regime.¹¹⁶ Specifically, occupied West Bank alone has 140 fixed military checkpoints, 2254 flying checkpoints, 500 road obstacles, and 712 kilometers of separation wall barrier while Gaza is under complete blockade from occupied West Bank and East Jerusalem.¹¹⁷ These injustices have created a system of medical apartheid through deprivation of funding for Palestinian health care, frequent attacks on already vulnerable healthcare infrastructure, and the policy of requiring Palestinians to apply for permits to access healthcare, then denying and delaying applications.¹¹⁸ As a result, the Palestinian healthcare sector -- which includes the Palestinian Ministry of Health, the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), non-governmental organizations, and for-profit providers -- is left unable to meet the complex needs of Palestinians and largely dependent on increasingly restrictive international aid.¹¹⁹

These healthcare barriers have created worsening public health burdens among Palestinian populations of all ages. Cardiovascular diseases, chronic respiratory diseases, diabetes, and cancer are prominent noncommunicable diseases among more than 75% of the Palestinians residing in the occupied West Bank.¹¹⁹ Despite advancements in NCD prevention, the burden has been increasing as the number of Palestinian refugee patients with diabetes, hypertension, or both, has tripled since the late 1990s.¹²⁰ The Palestinian population is also unique in that 40% of the population is under 18 years, and the population growth rate is extremely high at over 3%.¹²¹ The pediatric population faces increasing rates of food insecurity

and stunting (56% and 13.2%, respectively in Gaza) along with a mental health and trauma exposure epidemic (80% of Palestinian teenagers have witnessed shootings and 54% of boys had experienced body searches).¹²¹ While slow progress has recently declined communicable diseases, the continued escalation of the human crisis in Gaza alongside continued settler expansion in occupied West Bank has led to alarmingly increased rates of infections among Palestinian populations residing in Palestine attacking all sources of medical care and hindering access to healthcare.¹²²

To address these growing healthcare barriers and disparities, public health experts such as the Palestinian Health sector and the Ministry of Foreign Affairs of Japan have investigated the utility of mobile health (mHealth) interventions in Palestine.¹²³ For example, Palestinian refugees in the West Bank were provided wireless applications to allow access to online health care through UNRWA health centers during the Covid-19 pandemic.¹²⁴ These apps helped refugees receive medication and blood pressure monitoring reminders, health provider messaging, access to electronic health records, and health awareness materials.¹²⁴ As socio-political issues are on the rise, the Palestinian healthcare sector is working with diverse stakeholders, including phone and internet companies, to extend similar mHealth solutions to all Palestinians.¹²⁵

While healthcare decision makers are considering the adoption of alternative strategies as mHealth across health centers, research is needed to assess whether mobile health is a viable approach for health management in Palestinian populations of all ages given the geopolitical, topographical, and infrastructural challenges experienced in the region. Therefore, the aim of this study is to assess the acceptability of mHealth to manage noncommunicable diseases and overall daily health in Palestinian adult and adolescent populations in Palestine.

Methods

Design

This exploratory qualitative study investigated attitudes toward mHealth among Palestinian adolescents and their parent/legal guardian(s) based on data collected from a series of dyadic interviews and focus groups. This study took place among various regions in Palestine (i.e., Ramallah, Nablus, Hebron, Bethlehem, Jerusalem) to cover a large geographical area and enhance generalizability of collected data. Applied, inductive thematic analysis was selected to analyze the collected. This grounded technique was used to describe participants' narratives and opinions as comprehensively and accurately as possible.¹²⁶ This study followed the Standards for Reporting Qualitative Research.¹²⁷

Technology Acceptance Model (TAM)

TAM framework (Figure 16) developed by Davis is an overarching model used to assess the acceptability of a proposed mHealth strategy. This model considers two main beliefs: perceived usefulness and perceived ease of use as the main factors for an individual's acceptance of technology.¹²⁸ The TAM model assumes that there is a strong relationship between a person's intention to use and a person's actual use of technology.¹²⁹ This model also accounts for external variables (e.g., geopolitical, physical and social challenges or advantages) that may relate to the perceived usefulness, perceived use, and intention of adopting a mobile health tool to assist with remote stress and health management. This model has been utilized in many mHealth acceptability and feasibility studies, including a recent mHealth study focused on the Syrian Refugee population.¹³⁰ Through this work, we can learn about the acceptability and feasibility of mHealth application use for health in Palestinian adult and adolescent populations in Palestine.

Recruitment

A convenience sampling technique was used to recruit 13 families [i.e., 13 parent/legal guardians and 13 adolescent (ages 12 to 17)] residing in refugee camps, villages/towns, and

cities across Palestine. The adolescents are the children of the parent/legal guardians. A random sample of schools were selected across the region (Figure 1) using a list provided by the Palestinian Ministry of Education. Study recruitment fliers were sent home to parent/legal guardian(s) with adolescent students interested in study participation. Recruitment occurred during November 2022 through February 2023. Inclusion criteria were: 1) adolescents must be ages 12 to 17 and 2) at least one parent or legal guardian must participate in the interview. There were no exclusion criteria in this study.

Interested participants were screened, consented, and assigned a date for a semi-structured in-depth interview with a child-caretaker dyad. To accommodate a few participants' schedules, 5 dyadic interviews became focus groups with 3 to 4 participants. These focus groups also included adolescents and their caretakers together. A total of 32 participants completed this study. All participants provided their verbal consent prior and during their interviews.

Data Collection

Data was collected through hour-long dyadic interviews or focus groups using Palestinian Arabic dialect by authors DH and LH, both of whom are native Arabic-speaking investigators. DH is experienced in conducting focus groups and in-depth interviews, and she trained LH before data collection began. Each interview was conducted in a private space via a school or psychosocial center in the corresponding village/town, refugee camp, or city of adolescent school attendance. The interviewer guide was developed by DH through a comprehensive literature review and integration of the TAM model. The semi-structured interview guide (Appendix 1) contained questions regarding perspectives on using mhealth interventions, its advantages, challenges and their preference on the contents and how to use the tool in the region. The research staff asked a series of questions regarding the participant's interest in using mobile health (e.g., self-management app, smartphones, blue tooth connected wearable devices) as a potential tool for stress and health self-management. Additional

questions regarding the acceptability of using the mobile tool presented [CoraHealth mobile application used for cardiovascular health management], the participant concerns, and interest in engagement were asked. Lastly, the participants provided feedback regarding the use of mobile applications in Arabic and informed the research staff about what they like or dislike about the tool.

All data was audio recorded and transcribed in Arabic by authors DH and LH within a week of recording the interview. The transcripts were checked against the audio recordings to ensure accuracy of transcription. The transcripts were translated into English by DH. Transcripts were back translated and checked by LH for reliability and accuracy of all finalized transcripts. Transcripts were not shared with participants; however, authors DH and LH summarized the main information at the end of the interview to obtain participant validation. All data is stored in a password-protected file hosting service.

Statistical Analysis

Figure 16 was developed by Davis as an overarching model to guide the analysis to assess the acceptability and feasibility of the proposed mobile health strategy. This model considers two main beliefs: perceived usefulness and perceived ease of use as the main factors for an individual's acceptance of technology. Perceived usefulness is when users believe that using technology will enhance their job performance. Perceived ease of use is a user's belief that technology is free of effort, which is influenced by external factors. The TAM model assumes that there is a strong relationship between a person's intention to use and a person's actual use of technology.

Data was analyzed through inductive thematic analysis. To enhance analysis credibility, investigator triangulation was implemented. Author LB, who has experience conducting and publishing qualitative studies, trained authors DH and LM on the coding and analysis techniques. Authors DH, LM, and LB had access to all 12 transcripts and coded them using ATLAS.ti software.¹³¹ To begin the coding process, the authors met to review a randomly

selected transcript, discuss the content, and code the transcript as a group. Then, a set of transcripts (n=3) were randomly selected and were coded independently by each of the three coders. The coders then met to establish the codebook and resolve intercoder disagreements through the subjective assessment method.¹²⁶ The remaining set of transcripts were also coded independently by each of the three coders using the established codebook. The coding team met regularly to finalize the remaining transcripts by continued resolution of intercoder disagreements and review of emergent codes. This process helps ensure dependability and confirmability of this study's results. .

After all transcripts were coded, authors DH, LM, and LB held analysis meetings to identify recurrent themes through an iterative process following Crabtree and Miller's 5-step guide.¹³² Using the existing concepts from the TAM framework, the authors organized the themes that were identified from the interviews.

Sample Size Considerations

The sample size goal was determined based on previous exploratory qualitative research conducted in Palestine.¹⁰² Data collection continued until both data saturation and the requirements for sampling were met for diversity in age, gender, refugee status, and area of residence. Interviewers DH and LH determined data saturation based on informational redundancy.¹³³

Ethical Considerations

The study was deemed exempt from ethics approval according to the Common Rule (45 CFR 46) and adhered to the Declaration of Helsinki, 2013 amendment, by the University of California San Diego and An-Najah National University Institutional Review Boards. An extensive risk assessment was done to ensure there was no risk to the participants and population in the region.¹³⁴

Results

Participant Characteristics

Participants (n=32) included parents, grandparents, and children from refugee camps (n=14), villages (n=10), and cities (n=8) across the region (Figure 15). Adult participants (n=18) had a mean age of 47.5 (24-70 years of age) and adolescent participants (n=14) had a mean age of 14.5 years (12-17 years of age). Most adult participants were from diverse professional backgrounds and had diverse health outcomes (Table 8). Each household reported to have access to at least one internet-based device (e.g., smartphone, tablet, computer).

Participants' Perceptions of the Use of mHealth for Health Management in the Region in Relation to TAM Variables

The collected data yielded 12 themes regarding potential mHealth use in Palestine. These themes and subthemes were organized in relation to TAM variables [Figure 16]. This included 1) regional barriers to consider prior to implementation of mHealth, 2) facilitators and barriers that may contribute to the perceived usefulness and perceived ease of use of adopting mHealth, and 3) the participants' intent to adopt mHealth.

Regional barriers impact current healthcare in Palestine

All participants expressed that the geo-political conditions stemming from Israeli settler colonialism in Palestine contribute to healthcare barriers. Specifically, military roadblocks contributing to movement restrictions, fear of military aggression and settler colonial violence when leaving home for healthcare visits, and the fragmentation of healthcare and public health systems due to medical apartheid were cited as challenges to healthcare access [Figure 16].

"I have been experiencing some health issues and need to seek medical care at a clinic or local hospital. On the way to the clinic, I often find the road blocked because of the Israeli soldiers choosing to block the road, and we can't pass. Neither ambulance nor car will be allowed to pass just because the soldiers want to make it hard on us." Mother, Ramallah Village

Further, medical supply shortages were mentioned by many participants across the region as a significant problem.

“You saw the other day that we need an ambulance, and we don’t have an ambulance in our town.”- Mother, Ramallah Village

Moreover, refugee participants expressed lack of financial means and access to medication, specifically noting challenges through UNRWA services.

“There are challenges in accessing and paying for healthcare. We live under military occupation. I have a broken back. I must take certain medications and vitamins; however, medications are very costly, and we receive limited support from UNRWA.”- Mother, Bethlehem Refugee Camp

Both adults and their children expressed how these barriers to consistent, quality health care have led to poor health outcomes.

“It is hard to get quality care, pay for care, and access care with the medical system and being under occupation. For example, when someone is sick here, they go from hospital to clinic to find someone that can give them care they trust, access and afford. By the time the person gets to the medical professional they need, they are already in worse health.” -Father, Bethlehem Refugee Camp

Perceived Usefulness and Perceived Ease of Use of mHealth

Participants described the facilitators and barriers in adopting mHealth in the region.

Facilitators for Perceived Use of mHealth

I. Improved Healthcare Access While Living Under Military Occupation

Most adult participants expressed that the adoption of mHealth (particularly telehealth and sensors that track vitals) in the region will be perceived as potentially useful tools by decreasing reliance on in-person healthcare visits for ambulatory health outcomes. By providing a resource for virtual care appointments and self-monitoring, participants felt that mHealth would reduce physical access barriers including military checkpoints.

“These tools would be very beneficial for health management in Palestine, especially given people have a hard time with roadblocks and other occupation-related situations to get access to the doctor. This will help give remote access to healthcare. In such cases Palestinian populations would appreciate the mobile health tools.” – Nurse Practitioner, Jerusalem

Moreover, most adults expressed having mHealth tools as centralized electronic health records (EHR) would improve providers’ care.

"[EHR] would serve as good tools for physicians across the region to access medical records about a patient's health so doctors can know medication regimen and diagnostics conducted." -Boy, Hebron

Others focused specifically on the benefit of EHR for monitoring health statuses of pediatric patients.

"Having a complete EHR for a student on a mobile application communicating to local physicians and school staff would be helpful; Having a record for students can help teachers attend student health concerns during school hours." -Teacher, Ramallah Village

"EHR would be good for only students who have health outcomes to organize the medication prescribed and prognoses from different physicians. This can organize notes about students with certain allergies or health conditions and help teachers know how to monitor student's health while parents are not available." -Teacher, Ramallah Refugee Camp

II. Improved Health Promotion, Disease Prevention, and Caretaker management

Participants reported how mHealth can improve early disease detection through different methods including vital sign trackers (e.g, heart rate, heart rhythm, or blood pressure). Many participants reported living under high stress given geopolitical conditions which heightens the need for early disease detection. Parents commonly expressed that having remote real-time tools can alert the individual to seek ambulatory care before a poor health outcome result (e.g., heart attack, stroke).

"We need some kind of tools that can give us a physiological reading of pre-stroke or heart attack. There are so many occasions where people have strokes or heart attacks and drop dead. If we can find a tool to notify us of physiological signals or messages warning us, this would be something we would like so we can be pre-active with getting care." -Father, Bethlehem Refugee Camp

Parents and their children commonly expressed that mHealth tools like smartwatches and blood pressure monitors connected to mobile applications can promote increased awareness of daily health like physical activity and blood pressure self-management (e.g., medication adherence, blood pressure awareness, food intake).

"These tools can allow someone to make proactive decisions on their health. For example, if they see from their phone or watch that they have high heart rate or blood pressure then they know to go take medication or seek medical attention". - Father, Bethlehem Refugee Camp

Further, mHealth was perceived as useful for supporting self-management of care for loved ones (e.g., parents, guardians, children), allowing for daily health monitoring, medication management, and organizing health regimen. A mother who has a child with diabetes mentioned

“If there are kids that have chronic conditions, it would be helpful to parents to have these tools to remotely monitor their child’s health and provide us parents a peace of mind.”

Participant Perceptions on the Perceived Ease of Use of mHealth

Perceived ease of use of mHealth was impacted by the user-friendliness of the tools. Adult and adolescent populations expressed the need for the mHealth tool to be easy to navigate and not tedious to use. A public health scientist mentioned

“As long as the mHealth application or tool is accessible and easy for them to understand and doesn’t hide the needed features that make it hard to find the information they need, those who need it in the community will use it.”

Moreover, all participants requested that mHealth tools and interventions promoted in the region should be available in Arabic and English. A healthcare provider in Jerusalem mentioned

“This kind of tool [about Cora health Blood pressure app] would be very beneficial to the Palestinian populations here and loved. They drive us crazy about their blood pressure. It would have to be in Arabic though. The problem with many of these apps is that they are only partially translated. So, you need to make sure these apps are fully translated properly in Arabic.”

Personalization of mHealth programs to cater to the individual’s health outcome or health goals was commonly expressed across adult participants. For example, a mother from a refugee camp in Ramallah expressed:

“I see that there are many ways to use cell phones for our health in Palestine, not only for children. I mean, the situation in Palestine may affect people over the age of 25. As for children, I see that the focus is not only on blood pressure in such applications, but we are also supposed to focus on diabetes and the psychological pressure that many children suffer from, who do not have entertainment means or places to play.”

Barriers that May Interfere with mHealth Being Perceived Useful and Easy to Use in Palestine

I. Lack of Validity and Reliability of Measures Obtained By mHealth Tools

Reliability and validity of the health measures obtained by mHealth tools such as smartwatches and sensors were common mHealth concerns expressed across the region.

“These tools do not always provide valid results and instead of helping it can harm our health by providing inaccurate measures.”- Mother, Salfit

Moreover, many adolescent participants had concerns about false results which can promote unnecessary stress and anxiety

“Unnecessary anxiety can occur if a tool gives you the wrong prognosis. The person who is not sick will now think they are sick because of this.”- Grandmother, Ramallah Refugee Camp

II. Unstable Internet and Limited Technological Infrastructure for Implementation in Palestine

Additional concerns include the instability of the internet in the region and mHealth tools requiring blue-tooth internet connection, especially for patients with chronic conditions who may need reliable and consistent monitoring.

“If someone is relying on their phone for these measures, they need the internet all the time to work. They may be in a place where there is no internet or not good internet or what if the battery of their phone or watch dies? This can be a big problem. In Palestine we do not have good internet everywhere. It is very unstable in certain areas and if these tools are needed to depend on taking care of a person’s health, they can fail to be reliable offline when needed.” – Boy, Jerusalem

Alongside the concern of internet instability and offline measurements, many participants expressed concern about access to electronics for mHealth tools

“It is true that many people have mobile phones, but there are also many people who do not have them, especially in the refugee camp. There are times when we do not have the internet.” – Girl, Nablus Refugee Camp

III. Lack of Local Health Provider Acceptability of mHealth Adoption as Diagnostic Tools

Participants across the region expressed concern that local health providers may not adopt mHealth tools due to lack of trust and preference for in-person visits.

“The local health professionals may not approve these forms of tools due to lack of validity of tools, trust and personal reasons. Each health professional likes

their own diagnostics and doesn't trust each other's diagnostics to trust mobile tools. The doctors like to run their own diagnostics.” – Mother, Bethlehem Refugee Camp

“Most doctors here do not trust internet-based tools and rather see patients in person.”- Girl, Ramallah

IV. Health and mHealth Illiteracy Among the Palestinian Population

Limited health and or technology literacy, especially for older patients, were common barriers identified across interviews.

“I don't think many people from older generations would use such tools. These types of tools would be used by generations that are savvy with technology and generations to come.”- Boy, Hebron Village

Participants also referenced the knowledge gap Palestinians may have regarding less prevalent conditions

“Most Palestinians are suffering from chronic diseases and health causes like stroke and heart disease. The people are not going to understand concepts beyond the measures identified by these tools.”

Technology illiteracy was reported as a common theme among older adult and refugee populations reinforcing the need for user friendly tools. A middle-aged mother in Hebron explained

“You may face difficulties implementing these tools for individuals that do not know how to use the tools, but if this program is adopted by many in the population, seen as safe, trustworthy, and beneficial for the user then people will learn how to use it, they will accept it.”

V. Lack of Community Trust with mHealth among Palestinian Populations in Palestine

Across all interviews, participants highlighted the necessity of earning local community trust prior to mHealth implementation.

“It is so difficult to obtain a proper prognosis with a doctor. How can we expect this from a tool? Much work needs to be accomplished to obtain the trust of the population especially since we live under occupation.”- Boy, Jerusalem

“People in Palestine will accept these kinds of tools as long as they are implemented by trustful sources and tools are valid. As you know the circumstances, we live under occupation can make it difficult for trust. The implementers must build this trust.” - Nurse Practitioner, Jerusalem

VI. Tools measuring one's health all the time can make more sick

Several parents added that

"mHealth tools should only be for adults and children with health outcomes because then looking at their health all the time can make them be ill when they originally do not have an illness." – Mother, Ramallah Refugee Camp

VII. Fear of Weaponization of mHealth tools by Israeli Military

All participants expressed the fear of weaponization of mHealth tools by the Israeli military hindering acceptance of mHealth in Table 9. Sub-themes included concerns of 1) mHealth being used for Israeli government surveillance and Israeli military detention of family and community members without charge of a crime and 2) the Israeli military cyber-attacking the tool and providing false health advice to exacerbate disease.

Use Behavior

Current mHealth Awareness and Use in Palestine

All participants reported using internet health searches on how to manage current health via smartphone, tablets, and computers. Most parents expressed they use their phones for internet health searches.

"When I feel sick, I use my mobile phone to look at symptoms and what diseases are going around and their risks"- Mother Ramallah Refugee Camp
"I use social media and google for health advice and how to go about treatment"
Mother, Ramallah village"

Participants of all ages also expressed that they use their smartphone and mHealth trackers (e.g., Fitbit, blue-tooth connected blood pressure monitors, mobile applications) for health monitoring as step counting, managing dietary intake, blood pressure and heart rate management, and physical activity.

"I use my watch or phone to track steps and for reminders to move" Son, Nablus village

Most participants claimed their mobile phone and tablets are predominately used for communication and for school.

“I use my phone for studying for school and I like to follow education modules online” -Girl, refugee camp in Nablus.

Palestinian Population’s Intent to Use and Adopt mHealth

Table 10 describes the 9 key sub-themes and quotes expressed by participants regarding the population's intent mHealth adoption and efficiencies that need to be in place prior to accepting and adopting mHealth in the region.

Urgent Tools and Features Requested by Populations in the Region

MHealth tools requested by participants include: Centralized Electronic Health Records (EHR), emergency response tools, community health promotion tools, self/caretaker-monitoring real-time tools, telehealth, and mental health management resources.

“If we can find a tool to notify us of physiological signals or messages warning us, this would be something we would like so we can be pre-active to get care and discuss with a doctor or nurse instantly.”- Boy, Hebron

“If there are education tools that can educate us on the disease or virus for adults and children and advise treatment like medicine, track medicine, and provide the adult advice to help monitor their child remotely, this would help.”- Mother, Nablus Village

“It is possible for a person to go to work or school and see [Israeli] settlers or military on the road and encounter violence. They constantly kill family members and that constantly affects a Palestinian family’s mental health with all the stress and loss. Especially children face psychological pressure who don’t have entertainment means or a safe place to play. A tool to help us cope with this would be beneficial.” – Mother, Ramallah Refugee Camp

Many adult participants specifically asked for tools that provide real-time physiological readings for cardiovascular-related symptoms e.g., blood pressure, heart rate.

“We need some kind of tools that can give us physiological readings of pre-stroke or heart attack. There are so many occasions where people have a stroke or heart attack and drop dead.” – Father, Bethlehem Refugee camp

Many participants requested tools that included real-time communication with providers and health education messages. Further, tools that include message features should include an option that allows the user to select the frequency of messages received.

Discussion

This study aimed to assess whether mHealth is a viable and acceptable strategy for health management in Palestinian adults and adolescents residing in Palestine. It included participants from diverse socio-demographics (i.e., age, gender, health outcomes, professions, refugee status, and geography) who expressed similar themes regarding facilitators and barriers of mHealth adoption in the region. Overall feedback from this sample of participants was positive toward mHealth. Most participants shared interest in engaging in mHealth interventions for self-management alongside provider oversight as long as 1) reliability and validity of tools are established, 2) safeguards minimizing population harm is implemented, 3) there is cross-sector collaboration and adoption, 4) it allows for real-time communication with local healthcare providers, 5) healthcare provider and community trust is established, 7) tools are available and affordable, 8) tools are culturally-tailored and personalized to be user-centric, and 9) mHealth tools are user-friendly, provide offline measures, and provide user education.

Facilitators such as improving health care access in the region by 1) using remote tools as sensors to track physiological measures in real-time and 2) providing telehealth options to access health providers for non-ambulatory visits was commonly favored by adult participants. Similar findings have been demonstrated in an mHealth intervention among Syrian refugee populations displaced in Turkey in which the use of an app helped improve health provider access, symptom management, and provided health education during the 2019 coronavirus disease.¹³⁵ Additional facilitators as the ability to use mHealth for community disease prevention, health promotion, and caretaker management interested the parents of the adolescents. Participants commonly shared that such tools would be useful for individuals with disease or health conditions that require monitoring and should not be disseminated to children without health conditions.¹³⁶ This finding is in line with a mHealth intervention in low-income urban caregivers with children with asthma, in which daily feedback provided by the mHealth intervention decreased perceived stress in the caregiver.¹³⁷ Further, the need for user-centric and user-friendly tools that provide comprehensible health education presented in Arabic and

English was expressed by all participants to promote adoption of mHealth. Similar suggestions were presented in a pilot using a hypertension self-management app in patients with hypertension in Saudi Arabia; Participants expressed concern that not all the words in the features of the app were translated in Arabic challenging the use of the app for self-management.¹³⁸

The TAM framework and supporting evidence show Israeli settler colonialism as the key structural determinant¹³⁹ contributing to the acceptability of adoption of mHealth in Palestine. Weaponization of mHealth by the Israeli government was a common security and privacy concern. Concerns include Israeli government and military use of mHealth to 1) track civilian populations and 2) exacerbate disease in the region. Such concerns arise from the settler-and-military violence that Palestinians face as Israel integrates surveillance weaponry in internet-based technologies and has an ongoing history of arresting hundreds of Palestinians from West Bank and East Jerusalem based on online activity (e.g., social media, WhatsApp).^{140,141} Participants advised that researchers should avoid implementing features that 1) collect identifiable data and 2) allow geofencing to avoid population harm. The cultural context of Palestinians who live under such occupation practices, political oppression, structural violence, lack of security and lack of basic human rights needs to be considered at a community-level or it can generate increased risk to the population.¹⁴² Implementing mHealth tools and interventions in Palestine may compound the ongoing stress Palestinian populations face daily. Factors such as establishing community trust are essential prior to deploying such interventions and tools. Given this, participants expressed the critical need for collective cultural and geopolitical adaptation of mHealth tools and interventions including trusted local community partner collaborations prior to implementation in the region.

Additional barriers such as the lack of validity and reliability of measures provided by mHealth and the disinclined local health provider acceptability and adoption of mHealth were expressed as obstacles that may hinder population adoption of mHealth interventions. The

efficacy and regulation of mHealth applications is not thoroughly established in medical practices worldwide; this is an existing global concern of health providers contributing to hesitation of adopting such tools as primary diagnostics.^{143–145} However, electronic health records are among the more preferred tools by health professionals in Palestine. More research is needed on the collection techniques, skills, and processes that should be in place to support the adoption of EHR alongside other mHealth tools given the limited studies that have been carried out in low-/middle-income countries, particularly countries afflicted with geopolitical turmoil.^{145–151} Our study adds to the limited research by providing Palestinian health stakeholder perspective on the adoption of mHealth in the region. Cross-collaboration with local health providers and community stakeholders is crucial as conveyed by many adult participants particularly those who worked as health professionals. Health provider and community trust must be established prior to deploying such interventions for chronic disease management.

External barriers as the limited technological infrastructure in Palestine including unstable internet connectivity and accessibility to wearable sensor technologies is a legitimate concern needed to be considered. As of 2022 Palestine's internet penetration rate stood at 70.6 percent;¹⁵² Safeguards as features on mHealth that allow for reliable offline continuous monitoring of vitals must be enrooted in all tools deployed to the population to avoid exacerbating health outcomes.¹⁵³ Moreover, there is a need to provide accessible and affordable tools to avoid compounding health inequity in the region. Co-designing in partnership with stakeholders as 1) communities of end-users (individuals and groups with interest in affordable, acceptable, and accessible health services, 2) government, healthcare and non-government organizations, and 3) telecommunications agencies will allow for early and informed dialogue.¹⁵⁴ TEXTMATCH, a maternal and child health text message program delivered in New Zealand was co-designed with Maori, Pacific, Asian, and South Asian mothers and demonstrated high engagement by incorporating culturally-tailored content advised by community stakeholders. However, it is important to note co-design is not the sole factor that

needs to be considered for sustainability of mHealth; Factors as 1) focusing on design through design and evaluation, 2) building funding capacities allowing the capability and local ownership in the systems that will deliver the initiative post-piloting the intervention, and 3) the need of constant evaluation of tools and interventions to carefully consider to prioritize the impact on stakeholders (e.g., user, organization, and systems).¹⁵⁴ Achieving success in health prevention and treatment in low-and-middle income countries requires that tools and interventions can be scaled to the context in which it is implemented in each region and population.¹⁵⁵ It is essential to work with local stakeholders throughout designing, conducting and implementing the intervention to ensure intervention is acceptable and appropriate.

Participants were highly motivated and proactive to adopt mHealth for health management and disease prevention despite facing daily challenges living under occupation. Such findings align with the current literature identifying the concept of steadfastness driving the capacity for Palestinians to conduct their lives as normally as possible despite the challenges faced due to occupation. [] As such, our results promote promising consideration of community-based engagement for digital intervention implementation in Palestine regardless of their exposure to challenges due to Israeli settler colonialism. Palestinians are a collective community with a shared experience surrounded by networks of supportive relationships with their families and community;¹⁵⁶ All responses from participants were community-centered vs individual-centered. This suggests the need for a community-based collective health intervention incorporating multi-stakeholder input to promote community adoption and avoid hindering mHealth efforts in future programs and initiatives in Palestine. This finding is consistent with previous studies focused on strategic design and implementation of mHealth interventions in marginalized communities.¹⁵⁷

Strengths and Limitations

The study had many strengths, for example, this is the first study in Palestine assessing the Palestinian population's perception and potential acceptance of mHealth adoption. Further,

we used TAM which is a validated model in diverse global communities when assessing mHealth adoption. Moreover, our study participant sample represented different experiences of Palestinians in West Bank and East Jerusalem to improve generalizability.

Our study findings have some limitations to consider. First, we were not able to sample participants in Gaza and Jenin who experience constant bombardment by the Israeli military and or live under Israeli military siege. The level of military violence exposure in both areas differs than areas sampled and may contribute varying perspectives. Further, the effects of military siege compounds health inequity in Palestinian populations and may contribute to differing perspectives on mHealth adoption. Sampling in the refugee camps, Hebron and Nablus helped minimize this limitation given the prevalent exposure to military violence in these areas. Second, qualitative interviews originally scheduled with the parent/legal guardian and their child became group interviews given the intergenerational family involvement in the Palestinian social structure. The adults overpowered conversations during the interview, however the interviewers guided the conversation to ensure opportunities for children to provide input.

Recommendation for Further Studies

Future studies should assess Palestinian health sector input prior to mHealth implementation; This would include local public health practitioners, sociologists, psychologists, informaticians working in digital health, and public health academic institutions to ensure the recognition of social and technical factors of the environment and establish optimal conditions and tools to maximize productivity and well-being of the population.^{158,159} Other studies can also focus on the cybersecurity needs of the region and its correlation to mental health needs of the Palestinian populations. Researchers should also consider a pilot mHealth intervention focused on disease-specific Palestinian adult populations.

Conclusion

The use of mHealth as an additional tool to monitor noncommunicable diseases and health outcomes in adults and children was widely accepted in this participant sample.

However, cultural, historical, and geopolitical adaptation of interventions prior to implementation are crucial to account for contextual factors to avoid placing the population at risk of harm given living circumstances.

Tables

Table 7-Focus Group and Dyadic Interview Participant Demographics

Inter view	Location	Participants	Age(years)	Health status	Occupation
1	Bethlehem Refugee Camp	Mother	40-50	Healthy	Unemployed
		Father	40-50	Cardiac disease	Businessman
		Daughter	16	Healthy	Student
		Son	13	Healthy	Student
2	Bethlehem Refugee Camp	Mother	40-45	Neurological	Unemployed
		Daughter	17	disease Healthy	Student
3	Hebron Village	Mother	45	Healthy	Scientist
		Son	17	Cardiac disease	Student
4	Ramallah Village	Mother	45	Healthy	School Principal
		Daughter	14	Healthy	Student
		Aunt	35	Healthy	Physical Education Teacher
5	Ramallah Refugee Camp	Mother	36	Healthy	Unemployed
		Daughter	12	Diabetes	Student
6	Ramallah Refugee Camp	Mother	39	Healthy	Teacher
		Son	12	Diabetes	Student
		Grandfather	70+	Cancer	School Principal
		Grandmother	70+	Diabetes	School Board Director
7	Nablus Village	Mother	42	Anxiety	Unemployed
		Son	16	Healthy	Student
		Older Brother	25	Healthy	Medical technician
8	Hebron City	Mother	50-55	Healthy	Unemployed
		Daughter	16	Healthy	Student
9	Ramallah Village	Mother	33	Asthma and	Teacher
		Daughter	13	Anxiety Healthy	Student
10	Jerusalem	Mother	45	Healthy	Nurse Practitioner
		Son	13	Diabetes	Student
11	Nablus Refugee Camp	Mother	60+	Cardiac disease	Unemployed
		Daughter	17	Healthy	Student
12	Salfit City	Mother	-	Healthy	Unemployed
		Grandmother	70+	Cardiac disease	Retired
		Older daughter	24	and Diabetes	Public Health
		Younger daughter	15	Healthy	Professional
				Healthy	Student
		Total n=32			

Table 8-Participant Key Quotes on the potential Weaponization of mHealth if adopted in the Region

"Everyone is aware that if you have a smartphone, surveillance is happening by the Israeli government. I believe the population here in Palestine may not be as aware of how much more harmful it may be by using such mobile health tools that track geolocation and heat and sensitive data in general" - Nurse Practitioner, Jerusalem

"We need to be mindful of Israeli military surveillance of these tools. We cannot just have the tools adopted by the population without considering their ability to hack the tools and use for surveillance of our population and exacerbation of disease in the population falsely educating the population on health outcomes"- Mother, refugee camp Ramallah

"I don't want these tools to collect names or identifiable information. I would not put my name in any of these apps or anything about my health conditions with identifying information. I don't trust where this information is going. You never know who can get hold of this data."
Girl, refugee camp in Nablus

"It is common for homes in Palestine to get raided by the Israeli military and they take our children and community members. We need to be mindful of any tool we build in to not put our population at more risk."- Mother, Salfit

"In our community, we trust old phones like Nokia phones. If you have a smartphone, you are done with it. We are very afraid of military surveillance. Because of occupation, there are so many ways they tried to conduct surveillance on the guys here and the way the Israeli Offense Forces goes about tapping into the smartphones of these guys. This is a way that IOF can hack into phones and enter homes and take guys and children from their homes. This can be a challenge that puts the Palestinian population at risk." Boy, Hebron

Table 9-Key Sub-themes of Improving Efficiencies and Ease of use of mHealth that need to be in place to influence regional intent of mHealth acceptance and adoption

Table 9- Key Sub-themes of Improving Efficiencies and Ease of use of mHealth that need to be in place to influence regional intent of mHealth acceptance and adoption (Continued)	
Sub-themes	Participant Key Quotes
Culturally and contextually tailored tools that adapt to community's needs	<i>"I appreciate a mobile application for my daughter that would benefit my child and have no wrong teachings of stigmatized topics and sinful teachings. As long as as a parent can monitor what my child is looking at, what is entered and displayed, I will trust the application"</i> -Mother, Nablus Refugee Camp <i>"This [mHealth] is something that health professionals will have to go about from a community contextual perspective before implementing in this society given our living circumstances in Palestine e.g., roadblocks, fear of government surveillance, and access to lack of quality health services."</i> - Boy, Hebron
Ensure tools implemented minimize risk of harm to the community and avoid features that collect identifiable data and that allow for geofencing	<i>"People of Palestine, if all considerations benefitting the population and not putting population of risk of harm will definitely want something beneficial as mHealth instead of going to the doctor in person for matters that can be handled remotely"</i> -Boy, Hebron <i>"Since my son got sick with his heart condition, I want to tell you the challenges we face living in Palestine from the military occupation. You as a researcher need to understand the psychology of our community. Anything that is different that we try to implement tool or intervention-wise need to be thought out"</i> -Scientist, Hebron
Personalization of content on tool needs be user-centric	<i>"Make it kid friendly with colors and nice images that can help the kid understand what they are learning from the tool, and they will like it. Keep in mind every region in Palestine is different when you intervene with the population. You are going to need to have these tools personalized to the health condition and health need."</i> - Nurse, Jerusalem
Real-time communication with local health	<i>"We can use tools that help us organize all our</i>

Table 9- Key Sub-themes of Improving Efficiencies and Ease of use of mHealth that need to be in place to influence regional intent of mHealth acceptance and adoption (Continued)	
Sub-themes	Participant Key Quotes
care provider and centralized EHR	<i>health records and help us contact doctors when we need help with our health. There are a lot of times troubles in the roads blocking one from going to the place we need. If we have these tools, it can help us get in touch with doctors and have all our records in one place.” - Boy, Jerusalem</i>
Establish mHealth validity and reliability prior to implementation	<i>“If they are credible validated and reliable tools built by medical professionals, measuring physiological measures accurately in real time, organize medications in one list from physicians, provide guidance on how to monitor health, provided in Arabic dialect local population understands, is user friendly and personalized to the user’s needs, then yes it will be accepted by the population in Palestine.” - Public Health Professional, Salfit</i>
Establish healthcare provider and community trust of research and mHealth tool	<i>“Will need to work with health professions in the region to build interventions and use validated tools, build trust between the programs, tools, and backed by evidence to gain health professional support. You will also need to build trust with communities and educate across all sectors on use”- Teacher, Ramallah</i> <i>“There is no objection if this program was created by a conscious trustworthy credible professional and directed to other credible health professionals that want to help the Palestinian people. I would trust it if the tool was made and validated by the right health professionals and professionals that recognize our harsh conditions, we live in and want us to benefit from the front heh tool and not have the tool harm us.” -Boy, Hebron</i>
Cross-sector collaboration and adoption	<i>“This is a concept that has not been introduced here yet in Palestine. I am sure it is used by outside nations, but it has not been used here. This is such a great concept that can benefit the people if designed right. This could be a good concept if the medical professionals agree with</i>

Table 9- Key Sub-themes of Improving Efficiencies and Ease of use of mHealth that need to be in place to influence regional intent of mHealth acceptance and adoption (Continued)	
Sub-themes	Participant Key Quotes
	<i>this approach. As you are aware, not all medical professionals would be welcoming of these tools. They will need to be involved with this decision”</i> -Father, refugee camp in Bethlehem
Provide affordable and accessible tools	<i>“You need to be mindful of the cost of these tools as well. Especially if this will be used to monitor children. Not everyone can afford high-cost tools. We need to make sure that we don't contribute to health inequity by making these tools only available to those who can afford them. Make sure they are affordable. We need to also be mindful that not everyone has the internet all the time. If someone is relaying their health on these tools we need to be mindful of there not being a stable internet of the tools. - Mother, Salfit</i>
Provide user education and ensure tools are user friendly	<i>“If it is safe to use and we educate the population how to use it, they will use it, but it will take some time for health providers to educate the population. It is possible.”</i> -Girl, Hebron city

Figures



Figure 15- Geographical location of Qualitative Interviews by Refugee Status

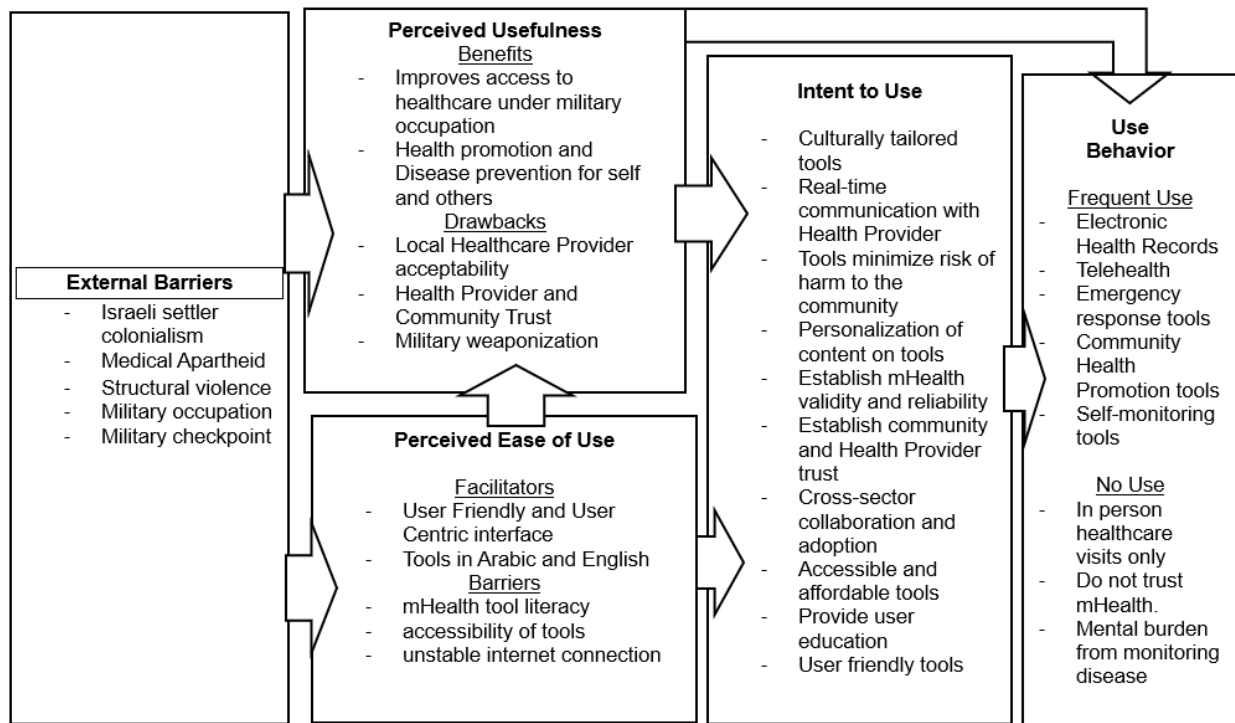


Figure 16-Themes and Subthemes Identified Per Construct in the Technology Acceptance Model

Appendix I- Supplemental Table and Figure

Table 1- Parent/legal Guardian and Adolescent Dyadic Interview Guide

1. Could you please share your experience of using a mobile phone? Probe: How, when, for what purpose etc.
2. What do you know about the use of mobile health for health management? Stress management?
3. What are the most urgent health tools needed to help with your health management and or stress management while living under occupation?
 - a. and managing your child's health needs? (Parent question only)
4. Could you please share your opinion on using mobile phones for stress management and or health management? Probe: what, how
5. Have you heard, or have you been told that you can get health messages through and manage your health through your mobile phone? (show example of the CoraHealth¹⁶⁰ health self-management app and its features (Figure 17)).
6. What is your opinion about it? What is your perspective on the potential of mobile health service in management of health in Palestine? Probe: what, how, example
7. What could be the potential advantages of using mobile health app in Palestine?
8. What could be the challenges in using mobile health app in Palestine for the management of health and or stress?
9. What can be done to overcome the challenges for a successful outcome?
10. What kinds of mobile health services would you like to get/use?
11. What should be the contents, timing, and frequency of such mobile health services?
12. Let us summarize some of the key points from our discussion. Is there anything else?

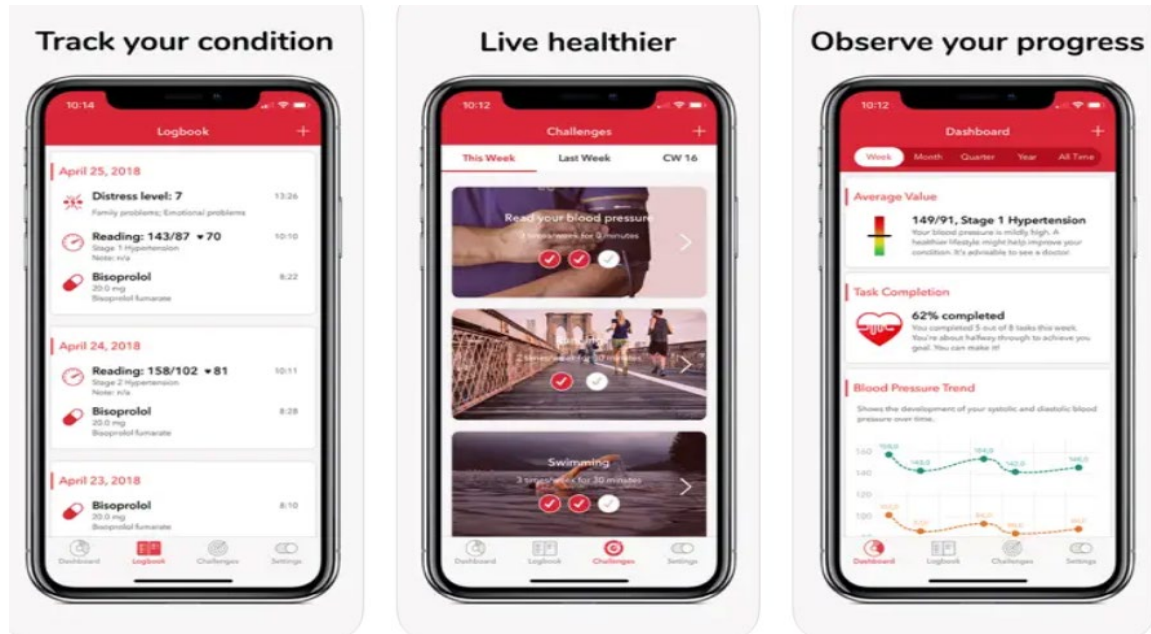


Figure 17-Example of Health management and Stress Management App

CHAPTER 3- ACKNOWLEDGEMENT

I would like to acknowledge my committee for their unconditional support of this research proposal. Instead of questioning the feasibility of this project, we worked together to make it feasible. Thank you for believing me when others gave up.

Chapter 3, will be submitted for publication of its material. I, Dina Hamideh was the primary investigator and author of this material. Bridi, Lana; Mahmoud, Lamees; Al Zabadi, Hamzeh; and Al Rousan, Tala are coauthors on this chapter.

CHAPTER 4- OVERALL SUMMARY

The adolescence period is a crucial period of physiological, psychological, and cognitive growth.⁹⁵ Throughout this period, adolescents explore their societal roles while incorporating social norms and values.¹⁶¹ Living under Israeli military occupation and an apartheid regime with ongoing structural violence on Palestinian civilians can interfere with Palestinian adolescent identity development alongside drastically influence their psychosocial health and overall health; Further, living under such harsh conditions can influence the Palestinian population's adoption of future mobile health interventions in the region. To start, Chapter 1 showed that 26% and 14% of the participant sample had prehypertension and hypertension; such findings indicate there may be a high prevalence of high blood pressure in the Palestinian adolescent population in the region. Early intervention to prevent the high risk of adult hypertension and cardiovascular disease should be considered in the Palestinian adolescent population. Moreover, Chapter 1 elucidated a relationship between gender and refugee status on adolescent blood pressure; such findings indicated that there is a need to assess the exposure of diverse psychosocial and other factors related to encampment experience among boys versus girls to account for the differences in relationship to blood pressure prior to deploying behavioral interventions.

Further, Chapter 2 demonstrated that high blood pressure was associated with diverse psychosocial factors differing by refugee status. Varying exposures to settler colonial violence, particularly among a 13-month time frame, has shown to be associated with refugee and non-refugee populations inversely, however the concept of resilience in the form of cultural resistance (Muqawama) was seen as a protective factor among Palestinian adolescent refugee population blood pressure living under Israeli military occupation. The concept of resilience has a multi-faceted definition, particularly in the Palestinian context, which includes both personal and collective characteristics in response to the exposure to Israeli settler colonialism and violence.¹⁵⁶ The literature translates Palestinian resilience in concepts as sumud (steadfastness/sticking to land), Jalad (ability to withstand), thabat (pliability), muqawama

(cultural resistance), and awda (right to return).^{102,156} Understanding the concept of resilience, particularly among diverse Palestinian communities, must be conceptualized as a fluid concept that cannot be defined the same across Palestinian populations with varying exposures living under Israeli military occupation.¹⁵⁶ Giacaman et al., found that resilience is a dynamic process in the Palestinian setting in which is embedded in agency, daily practices, and related to context.¹¹¹ The literature found that Palestinian youth who contribute to active nonviolent political participation (cultural resistance) addressing daily aggression by Israeli military occupation allowed for the restoration of dignity through resistance and agency; Such findings showed to serve as a protective factor positively influencing youth overall well-being (e.g., physical, psychological and social).^{156,162} Measuring the concept of resilience using tools adopted by Western countries must be used in caution,¹⁶³ particularly when measuring concepts of resilience in Palestinian populations; most tools ignore the key factor of community support, collective exposure to violation and the collective healing process in Palestinian communities.¹⁵⁶ Chapter 2 of our study demonstrates how resilience, particularly in the form of cultural resistance form, serves as a potential protective factor, particularly Palestinian refugee populations, when dealing with adversity and it may protect overall well-being (e.g., blood pressure). Longitudinal studies are necessary to bear this out. Future researchers need to consider concepts such as resilience alongside culture, society, and politics prior to considering the design of any intervention. Our findings show that context matters regardless of the shared experience of the exposure of settler colonial violence across Palestinian adolescents. It is important that future researchers do not ignore the root cause contributing to Palestinian population injustice (i.e., Israeli settler colonialism) and consider diverse psychosocial exposures prior to considering interventions.

Lastly, Chapter 3 displayed that mobile health interventions would be accepted by Palestinian adults and adolescent populations in Palestine to administer health under conditional circumstances. Adult and adolescent populations expressed that is crucial for

researchers to involve local health professionals, the local community, and consider the harsh realities living under Israeli military occupation when considering the design of interventions. Factors as weaponization of mobile health tools were repeated theme across the study by all interviewees. However, Palestinian adults and adolescents are willing to engage in such interventions if cultural, historical, and geopolitical adaptation of interventions are considered prior to implementation; These contextual factors are crucial to account for avoid placing the population at risk of harm given their harsh living circumstances.

Overall, this dissertation provided evidence that experiences living under military occupation can impact 1) Palestinian adolescent health differently based on refugee status and 2) require public health professionals to work with the local stakeholders and consider the geopolitical circumstances prior to designing and implementing future interventions. Most importantly, as Giacaman mentioned, providing humanitarian aid, building health interventions focusing on factors as resilience and coping to alleviate daily suffering to adapt to living under harsh conditions under Israeli military occupation is unacceptable without calling for justice for Palestinian populations.¹⁵⁶ The acknowledgment of injustice and working towards dismantling the racist system is crucial for advocating for Palestinian health.

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