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COVID-19 PUBLIC HEALTH MEASURES AND THEIR IMPACT ON MENTAL HEALTH AMONG OLDER SYRIAN REFUGEES IN LEBANON: A CROSS-SECTIONAL STUDY

by
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May this work be an apparatus to the path of helping all those in need and in assuming my responsibility toward my fellow brothers and sisters in humanity.

ABSTRACT
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Fatima Haidar Bazzoun for Master of Science
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Title: COVID-19 Public health Measures and Their Impact on Mental Health Among Older Syrian Refugees in Lebanon: A Cross-Sectional Study

Background The COVID-19 epidemic has impacted every aspect of life and increased the incidence of domestic violence globally, making already vulnerable populations, namely older Syrian refugees, more susceptible to negative mental health outcomes. The main objectives were to assess how the variation in adherence to COVID-19 preventive measures is associated with mental health outcomes and to explore the potential effect of domestic violence and whether this modifies or mediates the association between adherence to preventive measures and mental health in older Syrian refugees in Lebanon. ***Methods*** This was a cross-sectional study based on secondary data from AUB-NRC-ELRHA study which investigated changing vulnerabilities of older Syrian refugees across Lebanon based on data from waves 1 and 2 spanning from September 2020 to January 2021. The sampling frame included a probability sample of Syrian households with at least one adult aged 50 years or older. The data was collected via telephone interviews. ***Participants*** A total of 3,322 Syrian refugees older than 50, currently residing in Lebanon, and who participated in the initial study were selected using a beneficiary list from a humanitarian organization and constituted the sample size. ***Analysis*** Using a directed acyclic graph (DAG), a theoretical framework was composed to highlight associations between various risk factors and the association between the main exposure, adherence to COVID-19 preventive measures, the effect modifier domestic violence, with mental health. Descriptive and univariate analyses, along with ten multiple variable logistic regression models stratified by domestic violence were conducted. Due to multiple testing, an adjusted p-value of 0.01 was used to assess significance. Five separate interaction terms between each adherence measure with domestic violence were assessed. Five path diagrams were modeled based on logistic regression and evaluated the direct, indirect, and total effects of each adherence measure with domestic violence on mental health. ***Results*** nearly 70% of the participants reported poor mental health outcomes and 10.5% reported experiencing verbal or physical violence. Adhering to COVID-19 preventive measures was not associated with poor mental health. Domestic violence did not modify the association between each adherence measure with mental health; it did account for 7.14% of the indirect effect of receiving visitors at home on mental health and was significantly associated with receiving visitors at home (OR 1.42, p-value= 0.003). ***Conclusions*** Further studies are needed to highlight the role of COVID-19 measures on mental health, define the prevalence of mental disorders and domestic violence, and provide needs and services for older Syrian refugees in Lebanon.

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CHAPTER 1

BACKGROUND

The COVID-19 pandemic has drastically altered every facet of life, especially its implemented preventive measures like lockdowns, social distancing, and facemasks, which disrupted social, economic, and political functions, aggravated pre-existing physical and psychological morbidities, and consequently increased incidences of domestic violence globally [1, 2, 3]. The pandemic disproportionately impacted vulnerable and marginalized populations, specifically older Syrian refugees in Lebanon who were a major concern even before this pandemic and who are already at a disadvantage given their age-specific vulnerabilities [4, 5, 6, 7, 8]. Lebanon, a country undergoing political and economic turmoil, hosts nearly 1.5 million Syrian refugees as of 2021 and continues to host the largest number of Syrian refugees per capita worldwide [9]. Approximately 839,086 registered refugees reside across Lebanon but are heavily concentrated in the northern, southern, Beirut, and Beqaa districts, with nearly 2.7% of the Syrian refugee population in Lebanon being over-60 years of age [10]. Ten percent of Syrian refugee households in Lebanon include an elderly member who is older than sixty, of which 3% are unable to care for themselves [11]. The United Nations High Commissioner for Refugees (UNHCR) estimated that older individuals account for 8.5% of the total people of concern; a number much higher than anticipated [8]. When compared to host populations, studies showed older Syrian refugees had a higher prevalence of emotional and mental disorders most commonly depression, anxiety, and post-traumatic stress disorder [12, 13, 14]. Poor mental health experiences have been linked to prior war experiences and displacement stressors [12]. War

experiences include demolition of homes, exposure to bombings, loss of loved ones, torture, and violence. Post-displacement stressors include poverty, unemployment, poor living conditions, discrimination, lack of access to care, assistance, and basic needs, loss of social support, and psychosocial factors such as shifting family dynamics, safety, worry, and domestic violence [12]. The paralleled global increase in domestic violence during the pandemic with the increased physical and psychological domestic violence towards elderly Syrian refugees have become more concerning considering the additional range of mental health challenges they face [15]. The compounded effects of the COVID-19 pandemic with various pre-existing mental health conditions and the fragile political, economic, and social factors in Lebanon, have placed elderly Syrian refugees at a conceivably higher risk for poor psychological outcomes [16, 17]. Thus, considering the COVID-19 pandemics unequivocally multifaceted effects on older Syrian refugees in Lebanon, it is implausible to consider the effect of various factors linked to poor mental health without accounting for the role of the pandemic and the impact of domestic violence on mental health.

1.1. Prevalence of mental disorders in older Syrian refugees in Lebanon

Since the Syrian conflict in 2011, many Syrian civilians fled to Lebanon and settled under impoverished conditions to escape the war. Although resettlement stopped their exposure to war, it came with a unique set of stressors that have placed older Syrian refugees at increased odds of mental health disorders [18]. It is imperative to note the difference in post-migration stressors particular to the resettlement host country that older Syrian refugee populations face that may exacerbate or precipitate a mental illness. While depression, PTSD, and generalized anxiety disorders are more commonly

prevalent in the refugee population than in the general host population, there is a difference in the prevalence of these disorders between resettlement high-income countries (HICs) and low-middle income neighboring countries (LMICs), mainly since living conditions in high-income countries are often far better and refugees are provided opportunities to improve their lives otherwise not provided to them in LMICs. A recent systematic review that aimed to report on the prevalence rates of common mental disorders in adult Syrian refugees resettled in HICs found the total pooled prevalence rate estimate for having anxiety, depression, or PTSD was 33%, 40% for anxiety, 31% for depression, and 31% for PTSD, with little variation by gender [19]. Considering the unstable economic and political state of Lebanon with its limited opportunities and poor living conditions, displaced refugees often face added dimensions of stressors that lead to a higher prevalence of psychological disorders. For example, a systematic review assessing the burden of mental disorders among older Syrian refugees in neighboring Arab countries found PTSD, depression and generalized anxiety disorder to be highly prevalent, with a lifetime prevalence of 35%, 49% and 49%, respectively [14]. Other studies on older Syrian refugees in Arab countries found different prevalence rates of PTSD (43%), depression (40.9%), and anxiety (26.6%) [20]. Various other sociodemographic factors have been found to affect mental health disorders in Syrian refugee populations.

1.2. The role of existing vulnerabilities and COVID-19 on mental health

1.2.1. Sociodemographic factors

An underlying component that remains a stagnant predictor of poor mental health is the duration of displacement. A systematic review that identified the various risk

factors for mental health disorders among refugees found higher rates of mental disorders (particularly anxiety and depression disorders) in long-term resettled refugees (at least 5 years) compared to those first resettled [21]. In addition, increased duration of displacement was associated with an increased likelihood of experiencing mental disorders especially when refugees continued to live under dire situations in their host countries that create affiliative feelings towards their home countries [21]. This review was conducted on refugees resettled in HICs, thus considering the dire situation in Lebanon it is suggested that refugees mental health may be further aggravated. Within Lebanon, factors associated with common mental disorders like PTSD, anxiety, and depression include war-related trauma and violence, pre-and post-displacement stressors, forced migration, comorbidities, lack of access to care, poor living conditions, and loss of a loved one [12, 17]. Depression was more common among females, elders, and the well-educated [22]. Compared to other vulnerable populations, older Syrian refugees with higher education and socioeconomic backgrounds suffered worse poor mental health, possibly due to loss of status and identity [20, 23]. The high prevalence of poor mental health is attributable to various stressors older Syrian refugees encounter during post-migration, especially during the COVID-19 pandemic.

1.2.2. Post-migration

Having escaped from war, older Syrian refugees continually face daily stressors in their host countries such as poverty, poor living conditions, unemployment, lack of access to care and needs, and dependency on external forms of assistance for survival, all of which contribute to poor mental health outcomes. The COVID-19 pandemic emerged amid Lebanon's economic and financial crisis, and with the damage that

ensued from the Beirut blast in August 2020, socio-economic vulnerabilities in Lebanese and refugee populations were further exacerbated [11]. Poverty and unemployment negatively impact mental health in indirect ways. Evidence suggests that unemployed individuals often lead to financial problems and loss of self-esteem, social networks, and social participation [24]. Poverty-stricken refugee communities lack adequate housing, access to clean water, food, and various other necessities. Limited job opportunities and low wages create added barriers for refugees to improve their living conditions, bounding them to severe poverty and accentuating pre-existing physical and mental health conditions.

The environment of older Syrian refugees can worsen or prolong poor mental health symptoms. Most Syrian refugees in Lebanon reside in informal settlements under poor conditions, situated in already impoverished communities, with nearly 60% of Syrian refugees living in dangerous, substandard, or overcrowded shelters [10, 17]. Often Syrian refugees are dissatisfied with their poor living accommodations resulting in social isolation and helplessness, both of which endanger mental health [22]. The UNCHR reports that a third of Syrian financial beneficiaries in Lebanon rely on assistance as a sole income [25]. Even with various organizations providing financial and other types of assistance, 88% of Syrian refugees live below the extreme poverty line [9]. Considering the noticeable economic constraints, many older Syrian refugees have become heavily dependent on financial assistance from various organizations due to the loss of secured benefits or family support. Moreover, Lebanon's health system is predominantly privatized, underfunded, and overburdened by the influx of Syrian refugees and their increased demand for health services [17]. It is not enough that refugees face the consequences of poorly structured economic and social systems, but

their psychological and social distress often manifests in a wide range of emotional, behavioral, and social problems which jeopardize their psychosocial wellbeing.

1.2.3. Psychosocial factors

1.2.3.1 Worry

Worries tend to evolve as life circumstances change, and during the COVID-19 pandemic older Syrian refugees who typically worry about their families, financial situations, obtaining basic needs, and other factors, had the added worry of obtaining protective measures such as masks, gloves, and disinfectants to protect themselves and their families from infections. The overcrowded living accommodations of Syrian refugees are a key factor in the likelihood of a COVID-19 outbreak since it is difficult for refugees to employ social distancing measures that increase the risk of transmission [26]. The implementation of hygiene practices to limit the spread of the pandemic proved difficult in Syrian refugee settlements given that the majority do not have access to sanitary water [26, 27]. The synergistic effect of the COVID-19 pandemic with various non-communicable diseases prevalent among older Syrian refugees, namely hypertension and diabetes, can lead to severe health consequences mainly due to the inherent vulnerability of older individuals but also because it can exacerbate negative mental health states due to excess worry and concern for unmet healthcare needs [26, 28]. Excess worry may impact the elder's sense of safety and lead to added psychological distress.

1.2.3.2 Safety

Concerns for safety in Syrian refugees usually revolve around safety and security measures from experiencing war and all forms of violence, a sense of security

within their homes, and safety from deportation and other life stressors. Ongoing concerns about safety during difficult life circumstances can lead to hopelessness and are reported to be a significant source of stress [29]. Older Syrian refugees in Lebanon typically lack support from power structures and rely on their family and friends as a main source of safety. Displacement may disrupt these social support systems due to the loss of family ties and social networks [29]. The socially preventive measures implemented during the pandemic further secluded elderly Syrian refugees from their communities. Moreover, the increased domestic violence witnessed during the course of the pandemic placed older Syrian refugees who experienced violence in their homes at an increased risk of poor mental health [30].

1.2.3.3 Shifting familial dynamics

During post-migration, older Syrian refugees face additional social challenges particularly shifting familial dynamics due to the shared responsibility that redefines social and gender roles and impacts the internal cohesion of family units. Traditional Middle Eastern values rooted in religious and cultural ideological domains often define the roles of individuals in society. Social and gender roles are conducted within the patriarchal scheme where men (especially older) are deemed as the head of the household and final decision-makers. The youth, in times of peace and conflict, are expected to care for their elders. The elderly function as a backbone in the foundation of Syrian family structures by providing guidance, cohesion to family units, and strengthening social networks, especially during times of conflict which require them to engage in leadership roles [8]. These roles enrich the elderly's lives with a sense of agency and responsibility within their families and communities. However,

displacement shattered the structural integrity of these traditional values and social roles to accommodate for the shared responsibility of men and women to meet their family's basic needs, and in turn, created a site that cultivates and nurtures poor mental health conditions.

Syrian refugee men and women have limited opportunities for work in Lebanon and often must take on new responsibilities inconsistent with their traditional social roles wherein males are the sole head of household and decision-makers [31]. Few studies evaluating the impact of changing gender roles among Syrian refugees in Lebanon found that the new roles women take on outside of their traditional roles lead to feelings of discomfort and loss of gender identity and self-worth and make them increasingly vulnerable to domestic violence [29, 31]. Traditionally, males were responsible for household finances and retained overall decision-making power over how money was spent even when women organized expenses and were responsible for obtaining household needs [31]. During post-displacement, males maintained their control over household incomes and decision making, since assistance from humanitarian agencies is often paid directly to heads of households and they decide how it is spent [31]. Even with older Syrian refugee women taking on added responsibility and providing equal or greater economic contributions to the household’s maintenance, only 17% of Syrian refugee households are headed by an older female in Lebanon [11, 31]. On one hand, this added responsibility caused great stress for women, mainly since it delineates from the prescribed roles of women in Syrian households and did not provide decision-making power, however other women felt a sense of empowerment by this new opportunity [11, 29]. Older Syrian men suffering from material and identity loss, and who are unable to find stable employment in Lebanon suffer from low self-

esteem and self-worth, and psychological distress, considering their inability to maintain their leadership roles as family providers and protectors [11]. In addition, older Syrian men appeared to have poor mental health because they were often victims of discrimination and physical violence, and thus constantly worried about recurring events and had deep-seated anger. Men exposed to various life stressors often become withdrawn, socially isolated, and in extreme cases, manifest emotional and psychosocial distress as violent responses and behaviors towards their family members [12, 17].

Domestic violence in Syrian refugee households is related to changes or breakdowns of family structures. Shifting family dynamics that threaten the cohesion of family units often lead to domestic violence and create mental distress in all family members. Particularly for the elderly, as it is often difficult for elderly Syrian refugees to find their place in shifting family dynamics since the structure of the family unit no longer aligns with the roles elderly Syrian refugees are familiar with. Elderly Syrian refugees must continue with their roles, especially during times of conflict, however, the changing circumstances hinder their ability to contribute to their families. A study assessing the health status and needs of older (60 years and above) Syrian refugees in Lebanon found that elders who were unable to assist either financially or with household chores or were disabled, or incapable of performing daily activities felt that they were no help to their families and an added burden [23]. This reveals that although traditionally, the youth are expected to care for their elders, elderly Syrian refugees expressed their crucial need to partake and assume their responsibility towards younger family members [23].

Older Syrian refugees suffer from poor mental health due to the loss of social ties and support systems. Many older Syrian refugees had faced the loss of a loved one

or various family members and have been uprooted from their homes and isolated from their social networks and continue to face challenges associated with their social integration and acculturation [18]. The collapse of traditional support networks coupled with economic decline has eroded community values and left the elderly no longer enjoying the same respect, care, and integral role that they had had in the past [12]. The negative effects of social isolation and infrequent contact and interaction with relatives or friends on mental health have been a common theme in the literature on older Syrian refugees', highlighting the drastic role the loss of social networks and roles plays in poor mental health outcomes [22]. The restrictive COVID-19 preventive measures serve as an added barrier to social networks as they increase the risk of loneliness and social isolation [32]. Restrictions also pose serious threats to increased domestic violence as they strain families economically, emotionally, and socially, and provoke lurking family tensions.

1.3 The potential role of domestic violence on the relationship between COVID-19 preventive measures and mental health

The COVID-19 preventive measures have exacerbated many determinants of poor mental health. Reports of domestic violence doubled within the first month of the lockdown in Lebanon [33]. It is expected that the true incidence is underestimated due to underreporting especially in vulnerable populations [33]. The shadow pandemic, a term used to describe the increased global reports of domestic violence during the COVID-19 pandemic, has emerged secondary to the strict public health measures [34]. The interactive nature of preventive measures with domestic violence and various risk factors added another challenge to the well-being of older Syrian refugees. Preventive measures and lockdowns have restricted individuals to their crowded homes with their

abusers, exposing them to an increased risk of domestic violence [35]. The long duration of restrictive measures provokes feelings of underlying family tensions and deepens pre-existing conditions of abuse and violence, especially for refugees who are afflicted with economical stressors and negative emotions [6]. The increased domestic violence secondary to the COVID-19 preventive measures may indirectly modify the association of preventive measures with mental health. Evidence suggests that increased domestic violence is an outcome of the long duration of restrictive measures and simultaneously impact mental health [36]. Moreover, the effects of prolonged exposure to domestic violence increase the risk of experiencing PTSD, depression, and anxiety disorders which are commonly prevalent in older Syrian refugees [36]. Unfortunately, little is known about the prevalence of domestic violence in older Syrian refugee populations in Lebanon during the pandemic and its potential impact on their mental health.

1.4 The literature gaps

The empirical understanding of the COVID-19 preventive measures impact on older Syrian refugees in Lebanon remains elusive, despite the growing body of literature. The risk factors are numerous and differ across studies and settings. Most studies covering Syrian refugees do not focus on the elderly Syrian refugee population, particularly in Lebanon. Moreover, only a few studies have evaluated how adherence to COVID-19 preventive measures is associated with mental health outcomes in older Syrian refugees [15, 27, 37, 38, 39]. Although there is a concern for the increased domestic violence incidence in older refugee populations, there is little effort in evaluating the prevalence of domestic violence and its impact on the mental health of

older Syrian refugees in Lebanon during the COVID-19 pandemic. Current findings fall short of elucidating the interactive nature of domestic violence with the COVID-19 pandemic, and their cumulative effect on the risk of older Syrian refugees' mental wellbeing. Previous research has examined direct relationships between various risk factors, preventive measures, or domestic violence on mental health; however, risk factors might interact via complex pathways. Therefore, shifting the focus from direct relationships to more complex pathways could enrich our understanding of how adherence to preventive measures interacts with domestic violence and influence poor mental health.

1.5 The Current Study

Based on the literature, this study proposed a conceptual framework of how various risk factors impact adherence to COVID-19 preventive measures and mental health and how domestic violence may modify or mediate the effect of that relationship (Figure 1). The directed acyclic graph (DAG) represents the association of the exposures, adherence to the COVID-19 pandemic's preventive measures, presumably socially distancing measures like attending social events, leaving the home, traveling to another governorate, or receiving visitors at home, and protective measures such as wearing a mask on refugees' mental health [2, 3]. The increased domestic violence incidents second to the restrictive measures also had a drastic impact on refugees' mental health [5, 34, 36]. Thus, domestic violence is expected to modify or mediate the effect of preventive measures on mental health. Both the exposure and the effect modifier are associated with various sociodemographic and post-migration risk factors including age, sex, education, years since migrating from Syria to Lebanon, cash or

food assistance, and psychosocial factors including being the head of household and decision-making [7, 18, 21, 29]. These risk factors are considered confounding variables in this study. Two independent variables included in the diagram worry and safety, have been linked to poor mental health outcomes in elderly Syrian refugee populations, and are impacted by adherence to preventive measures. The implemented preventive measures have led to an increased sense of worry given the difficulty refugees face regarding obtaining protective measures such as masks, gloves, and disinfectants and the threat of COVID-19 on their health, which in turn impacts their mental health by increasing psychological distress [27, 28]. Excess worry is often a result of unstable and insecure living environments that impact refugees' sense of safety [21]. Safety is impacted by preventive measures by restricting social contact in hopes of protecting the elders from infections. Nonetheless, confining them with their abusers inside the home potentially aggravates mental health. To arrive at a comprehensive understanding of the potential role of domestic violence on the relationship between adherence to preventive measures and mental health, there is a need to evaluate how these factors, directly and indirectly, impact each other.

1.6 Objectives

This study aimed to examine the impact of COVID-19 adherence measures on mental health among older Syrian refugees in Lebanon. The main objectives are to assess how the variation in adherence to COVID-19 preventive measures is associated with mental health outcomes. Secondly, this study aimed to explore the potential effect of domestic violence and whether this modifies or mediates the association between

adherence to preventive measures and mental health in older Syrian refugees in Lebanon.

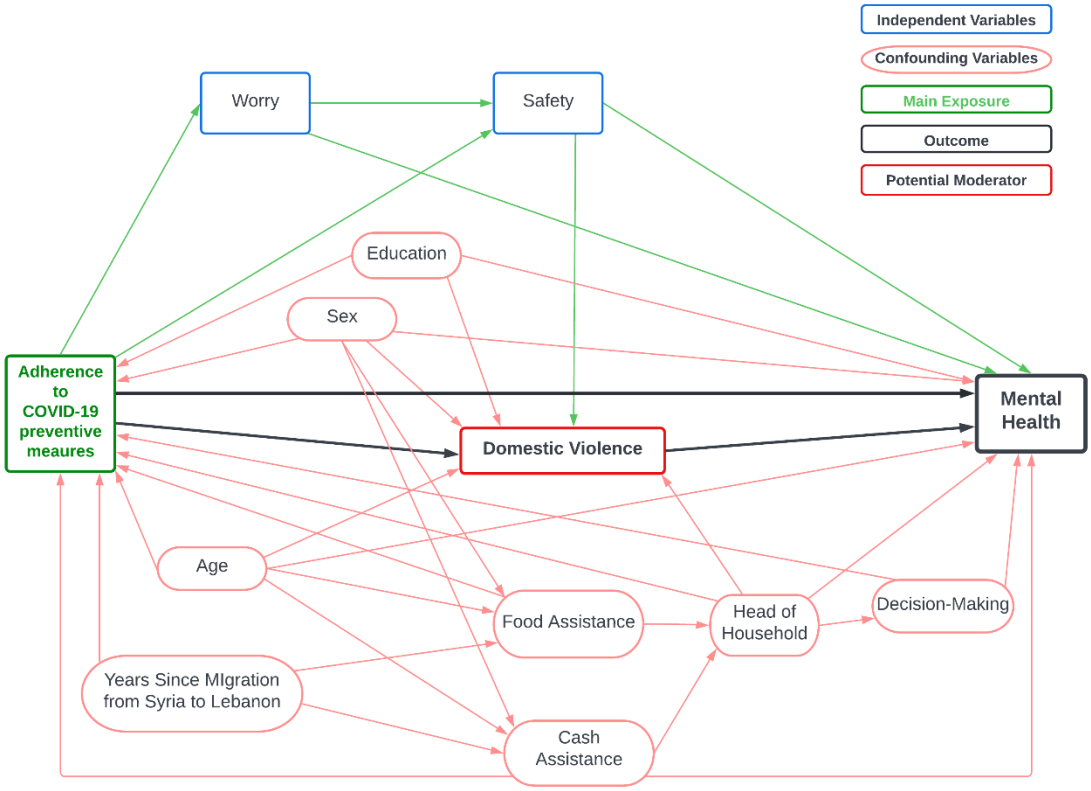

Figure 1. Directed Acyclic Graph (DAG). This DAG represents pathways from adherence measures[1] to domestic violence and mental health. The diagram highlights domestic violence as a potential effect modifier on the relationship between, exposure, adherence, and the outcome, mental health. Worry and safety were included as independent variables. All other variables are considered confounding variables**.**

[1] This study included 5 COVID-19 preventive measures: attending social events, mainly staying at home, traveling to another governorate, receiving visitors at home, and worn a mask.

CHAPTER 2

METHODS

2.1. Study Design and Participants

This was a cross-sectional study of older Syrian refugees based on secondary data from AUB-NRC-ELRHA study, which is a 5-wave longitudinal study aiming to track older Syrian refugee's vulnerabilities to COVID-19 in Lebanon. The primary study collected data through telephone surveys to evaluate refugees' sociodemographic characteristics, knowledge of perceived risk, self-efficacy, preventive behaviors, and quarantine in response to COVID-19, physical and mental health outcomes, health risk behaviors, social support, shelter, safety and security, violence and trauma, assistance, decision-making and more. The sampling frame was selected using a beneficiary list from a humanitarian organization and included a probability sample of Syrian households with at least one adult aged 50 years or older. This study investigated changing vulnerabilities of older Syrian refugees across Lebanon based on data from waves 1 and 2 spanning from September 2020 to January 2021. Data collected from wave 1 included information on basic sociodemographic characteristics such as age, gender, education, years since migration from Syria to Lebanon, food or cash assistance, psychosocial factors like being the head of household, decision-making, worry, violence, and self-reported mental health outcomes. Data regarding adherence to COVID-19 preventive measures came from wave 2. The sample consisted of 3,322 Syrian refugees 50 years or older living in Lebanon. All 3,322 respondents were selected and included in the study since they were Syrian refugees older than 50, lived in a district in Lebanon before and during the COVID-19 pandemic, and had

participated in the initial study. This study was approved by the Social and Behavioral Sciences Institutional Review Board (Reference: SBS-2020-0329). Data that will be used for the analyses was extracted from de-identified data.

2.2. Measurements

2.2.1 Outcome

Mental Health was the main outcome and was measured using the Mental health Inventory-5 (MHI-5) questionnaire, which is a reliable and valid instrument used for assessing mental health in adults [40]. MHI-5 was administered as part of the health module in the survey and contains the following questions: During the past 6 months/ the past month, how much of the time have you, (i) been a very nervous person; (ii) felt downhearted and blue; (iii) felt so down in the dumps that nothing could cheer you up; (iv) felt calm and peaceful; (v) and been a happy person? Each question had 6 responses ranging from ‘all of the time’ to ‘none of the time’. The score for MHI-5 was computed by summing the scores of each question item and then transforming the raw scores into a 0-to-100-point scale. Furthermore, the score was categorized into two groups: (poor) a score of 52 or less indicated poor mental health, and (good) a score of 53 and greater indicated good mental health.

2.2.2 Main exposures

This study included five COVID-19 preventive measures as the main exposures, namely restrictive preventive behaviors such as attending social events, mainly staying at home, traveling to another governorate, receiving visitors at home, and wearing a mask as a protective measure. Adherence to COVID-19 preventive measures was constructed from 5 questions under the COVID-19 module in the survey. The following

questions were: (i) have you attended social events; (ii) mainly stayed at home except for essential purchasing's; (iii) traveled to another governorate in the country; (iv) received visitors at home; (v) and/or worn a mask? The response to each question was dichotomized (no = 0/yes= 1). Each adherence measure was assessed separately.

2.2.3. Effect Modifier

The American Psychological Association (APA) Task Force on Violence and the Family define domestic violence as a pattern of abusive behaviors including physical, sexual, psychological, and emotional maltreatment, that can take many forms of physical or verbal abuse of one family by another, resulting in injury, psychological harm, or even death [41]. The current study measured 2 types of domestic violence: physical and verbal violence. The effect modifier, domestic violence, was constructed using 2 questions under violence in the survey which assessed whether participants had experienced violence from members of their households besides their spouse. The following questions were: since the COVID-19 pandemic (March 1, 2020), has anyone other than your spouse inside your household (i) yelled at you or said things to you that made you feel bad about yourself, embarrassed you in front of others, or frightened you; and (ii) done things like push, grab, hit, slap, kick, or throw things at you during an argument or because they were angry with you? The first question relates to experiencing verbal violence and the second question relates to experiencing physical violence, strictly by someone in the household besides the spouse. In this study, the total score was used as a binary exposure measure (0) as no exposure to verbal or physical domestic violence, and (1) as exposure to verbal or physical violence.

2.2.4. Sociodemographic characteristics and other covariates

Sociodemographic information of the refugees includes age, sex, years since migration, ever attended school, level of education, being the head of the household, receiving a food voucher, and/or cash assistance. Age (less than 65 years, and greater than 65 years); years since migration was categorized into 3 categories (1965-2000, 2001-2010, and 2011-2020) to describe and capture a difference in mental health outcomes among those who migrated before and after 2011 which is the onset of the Syrian war. Education (elementary, preparatory, and secondary); variable decision-making intends to evaluate who in the household had the last word in the decision about adhering to preventive COVID-19 behaviors. Responses were grouped into four categories namely (1) me, (2) my spouse or another family member, (3) me and my spouse, and (4) it is a family decision. All other variables were dichotomized (no/yes).

2.2.4.1. Safety

The variable safety intends to measure how safe subjects felt in their homes since the Covid-19 pandemic (March 1st, 2020) and was assessed by the question: since the COVID-19 pandemic, do you feel safe inside your home? The responses ranged from not safe at all, somewhat safe, and very safe.

2.2.4.2. Worry

Worry was related to Covid-19 factors and was measured by the following 3 questions: how much do you worry about (i) being unable to secure masks, gloves, soaps, or disinfectants; (ii) unable to access Covid-19 testing; and/or (iii) unable to access isolation centers? A total summative score ranging from 0 to 6 was categorized

into 3 groups (0 to 2). A score of (0) indicated not worrying at all, (1) indicated worry, and (2) indicated worrying all the time.

2.2.5. Sample Size

Since this study is based on secondary data, the number of respondents who participated in the initial study determined the sample size which included 3,322 participants.

2.2.6 Missing data

Missing data was due to subjects selecting “don’t know” or “refuse to answer” on some questions. Food assistance had an exceptionally low response rate of 20% (666 responses). Because of the colinear relationship of educational level with ever-attending school (since only respondents who answered yes to ever-attending school reported their level of education) and the low response rate to food assistance, both educational level and food assistance were excluded from any multiple variable logistic regression models and path analyses since they reduced the number of observations.

2.3. Statistical Analysis

2.3.1. Descriptive Analyses

Data were analyzed using STATA software version 17.0 [42]. A baseline descriptive analysis was conducted for all sample characteristics and covariates, along with the effect modifier (domestic violence), against the main outcome, mental health. An alpha level of 95% was used to indicate statistical significance. Each categorical variable was summarized using frequencies and percentages among respondents and the total sample population to account for missing values **(Table 1).**

2.3.2. Bivariate Analyses

Bivariate analyses using Chi-squared tests were conducted to assess for a statistically significant association between mental health, with all other variables. The analyses demonstrated percent distributions among poor and good mental health outcomes. Separate Cochrane-Armitage trend tests followed by a Somers' Delta measure of association were conducted on the outcome against safety and worry to account for the ordered groups **(Table 2).**

2.3.3. Univariate analysis, interaction, and multiple logistic regression

Simple and multiple logistic regression analyses were employed to address the research questions of this study. First, univariate logistic regression analyses were conducted to measure the association between covariates and assess adherence measures with mental health. Unadjusted odds ratios (OR) and 95% confidence intervals (CI), standard errors, and p-values were reported **(Table 3).** Second, to assess the relationship between each adherence measure and mental health accounting for the effect of the potential effect modifier, domestic violence, an interaction term was included in five separate models. Third, ten separate multiple logistic regression models were conducted to evaluate the main association between each adherence measure and mental health stratifying by domestic violence **(**Table 4**).** The first five models each included a single adherence measure and were stratified by no domestic violence. The last five models again included a single adherence measure but were stratified by verbal-or-physical domestic violence, while controlling for age, sex, years since migration, ever-attending school, cash assistance, head of household, decision-making, safety, and worry. All sociodemographic and psychosocial variables were included in

the multiple logistic regression models irrespective of their statistical significance (i.e., p-values < 0.05). Considering the multiplicity of analyses, the alpha level was adjusted[2] for and considered at 0.01* $\left\{\alpha = \frac{0.05}{5} = 0.01\right\}$ using the Bonferroni adjustment method [43]. Adjustments for multiple testing are required whenever results from multiple tests have been combined in one conclusion and to control appropriate error rates to protect against wrong conclusions [43].

2.3.4. Path Analysis Diagrams

Five exploratory path analysis diagrams based on the proposed theoretical framework were built and modeled using Stata's SEM builder. The observed estimated beta coefficients on each pathway in the diagrams were directly computed in Stata from logistic regression models. While adjusting for all confounding variables, the total, direct and indirect effects, and the mediation percentage were computed using the KHB-method developed by Karlson, Holm, and Breen for logistic regression models and are presented as odds ratios with their CI's and p-values in **(Table 5)** [44]. Since the path analysis diagrams are preliminary and intend to determine which of the risk factors are worthy of following up, adjustment for multiplicity was unwarranted in effort of not losing power to find a real effect [45].

[2] P-values presented with an asterisk have been adjusted for using the Bonferroni method and denote statistical significance at p-value = 0.01

CHAPTER 3

RESULTS

3.1. Descriptive Analysis

Table 1 presents the frequency of the sample's characteristics. The total sample consisted of 3,322 participants. Approximately 2,659 (80%) of the population were between 50 to 65 years of age, and the remaining 663 (20%) were over 65 years. The sample was almost equally distributed among both sexes; 1,584 (47.7%) females. Nearly 3,131 (95%) participants reported migrating from Syria to Lebanon during the years 2011-2020. An estimated 1,599 (51.5%) subjects reported ever attending a school, of which 857 (53.6%) reported attaining elementary level education, 557 (34.7%) preparatory, and 185 (11.6%) attained secondary level education. Only 666 (20%) of the 3,322 participants responded to whether they received food assistance, of which only 101 (15.2%) did. Around 2,314 (70%) of the sample reported receiving cash assistance, and 2,656 (80%) of subjects reported being the head of the household. About 1,037 (32%) participants reported being the final decision-makers about adhering to preventive measures, and 1,026 (32%) reported it is a family decision. Other participants reported final decisions about adherence to preventive measures were made by them and their spouses (n = 482, 15%) or by a spouse or other family member (n = 664, 20.7%). Most participants (n= 2,413, 73.23%) reported feeling safe in their homes since the COVID-19 pandemic (March 1st, 2020), 550 (17%) reported feeling somewhat safe, and 332 (10%) reported not feeling safe at all. In addition, 89% of the population reported worrying (n = 1,467, 45.7%) or worrying all the time (n= 1,390, 43.3%) about not being able to secure masks, gloves, soaps, or disinfectants, accessing COVID-19 tests, and/or accessing isolation centers during the pandemic, with only 352 (11%)

Table 1: Descriptive analysis of sociodemographic and psychosocial factors, adherence measures and the potential effect modifier along with bivariate analysis of the outcome (poor mental health) and these covariates.

Covariates		n	% Among Respondents	% In total Sample	P-Value[1]
Sociodemographic Characteristics					
Age	*< 65*	2,659	80	80	0.468
	≥65	663	20	20	
Sex	*Male*	1,738	52.32	52.32	0.037*
	Female	1,584	47.68	47.68	
Years since migration	*1965 – 2000*	26	0.8	0.8	0.933
	2001 – 2010	138	4.2	4.2	
	2011 – 2020	3,131	95	95	
Ever attended school	*No*	1,611	48.5	48.5	0.622
	Yes	1,599	51.5	51.4	
Education Level	*Elementary*	857	53.6	25.8	0.906
	Preparatory	557	34.8	16.77	
	Secondary	185	11.6	5.57	
Food Assistance	*No*	565	84.8	17.01	0.433
	Yes	101	15.2	3.04	
Cash Assistance	*No*	1,003	30.24	30.19	0.477
	Yes	2,314	69.76	69.66	
Psychosocial Factors					
Head of Household	*No*	666	20	20	0.141
	Yes	2,656	80	80	
Decision Making	*Me*	1,037	32.3	31.2	0.947
	Me and My spouse	482	15.0	14.5	
	Spouse or other family member	664	20.7	20	
	It is a family decision	1,026	32.0	30.9	
Safety	*Not Safe at all*	332	10.08	10.0	0.001*
	Somewhat Safe	550	16.69	16.56	
	Very Safe	2,413	73.23	72.6	
Worry	*Do not worry at all*	352	11.0	10.6	0.001*
	Worry	1,467	45.7	44.16	
	Worry all the time	1,390	43.3	41.84	
Adherence Measures					
Attended social events	*No*	3,136	94.5	94.4	0.032*
	Yes	183	5.50	5.51	
Mainly stayed at home	*No*	769	23.15	23.15	0.227
	Yes	2,553	76.85	76.85	
Traveled to another governorate	*No*	3,174	95.5	95.5	0.636
	Yes	148	4.50	4.50	
Received visitors at home	*No*	2.238	67.4	67.37	0.038*
	Yes	1,083	32.0	32.6	
Worn a mask	*No*	326	9.82	9.81	0.485
	Yes	2,995	90.18	90.16	
Potential Effect Modifier					
Domestic Violence	*None*	2,959	89.5	89.1	0.001*
	Verbal or physical violence	346	10.5	10.4	
	Verbal and Physical Violence Among Males and Females				
	Males	218	63	63	0.001*
	Females	128	37	37	0.001*

*Indicates significant association between covariate and outcome at p<0.05.

[1] *P-values by Chi-squared tests (χ^2).*

participants not worrying at all. Nearly 70% of respondents reported poor mental health outcomes.

A considerable number of elderly Syrian refugees had adhered to preventive measures within the study period. Approximately 3,136 (94.5 %) reported not attending social events such as weddings and funerals, 2,553 (76.9%) mainly stayed at home except for essential purchasing (for example, buying food), 3,174 (95.5) did not travel to another governorate within Lebanon, 2,238 (67.4%) did not receive visitors at home, and 2,995 (90%) of respondents reporting wearing a mask. Males were more likely to attend social events and stay at home, but there was no difference in traveling to another governorate, receiving visitors at home, and wearing a mask between both genders (results not shown). Finally, 346 (10.5%) of the 3305 subjects reported experiencing verbal or physical violence by someone other than their spouse inside their household. Of that 10.5%, males (63%) were more likely to report experiencing verbal or physical domestic violence compared to females.

3.2. Main Results

3.2.1 Bivariate Analysis

The results of the bivariate analyses of the outcome and other covariates are presented in **Table 2**. Overall, nearly 70% of participants reported poor health outcomes, except for 193 individuals who did not worry at all about securing protective equipment and accessing testing and isolating centers during COVID-19, were more likely to report good mental health (59%). Poor mental health was highest in individuals who did not feel safe at all (81.5%), worried all the time (78.6%), attended social events (78%), and experienced verbal or physical violence (80%). Sex, safety, worry, attending

social events, receiving visitors at home, and domestic violence were all statistically significantly associated with poor mental health. Sex was statistically significantly associated with having poor mental health (P-value = 0.037). Females were more likely to suffer from poor mental health (n= 1,057; 73%) compared to males (69%). The results of the Cochrane Armitage test convey a significant weak negative trend between safety and mental health (Somers Delta measure of association = -0.1; p-value = 0.001; CI (-0.12, -0.053)). Worrying was also significantly associated with poor mental health (Somers Delta measure of association = 0.23; p-value=0.001; CI (0.2, 0.27)), indicating a weak positive trend. Age, years since migration, ever-attending school, level of education, receiving food or cash assistance, being the head of household, being the final decision-maker about adhering to preventive measures, mainly staying at home, not traveling to another governorate, and wearing a mask were not found to be statistically significant predictors of poor mental health.

3.2.1.1. Adherence to preventive measures with poor mental health

Only attending social events (78%, p-value = 0.032) and receiving visitors at home (73%, p-value = 0.038) were statistically significantly associated with poor mental health. Of the 173 participants who reported attending social events, 135 (80%) had poor mental health. Of the 996 participants who received visitors at home, 730 (73%) reported poor mental health. Although adherence to other preventive measures was not found to be statistically significantly, 1,650 (70%) participants mainly stayed at home, 2,072 (71%) who did not travel to another governorate, and 1,943 (71%) who wore a mask had poor mental health.

Table 2: Bivariate analysis of outcome mental health and other covariates.-Percentages represent valid column percent (percent distribution among poor or good mental health outcomes).

Covariates		Mental Health				P-value
		Poor *n* (%)		Good *n* (%)		
Sociodemographic characteristics						
Age	*< 65*	1,741	(71)	706	(29)	0.468
	≥ 65	427	(70)	186	(30)	
Sex	*Male*	1,111	(69)	494	(31)	0.037*
	Female	1,057	(73)	398	(27)	
Years Since Migration	*1965 – 2000*	16	(69)	7	(31)	0.860
	2001 – 2010	91	(72)	35	(28)	
	2011 – 2020	2,043	(71)	843	(29)	
Ever Attended School	*No*	1,044	(71)	421	(29)	0.622
	Yes	1,123	(70.5)	471	(29.5)	
Education Level	*Elementary*	567	(71)	233	(29)	0.906
	Preparatory	369	(71.5)	147	(28.5)	
	Secondary	120	(70)	52	(30)	
Food Assistance	*No*	354	(67.2)	173	(32.8)	0.433
	Yes	67	(71)	27	(29)	
Cash Assistance	*No*	668	(72)	263	(28)	0.477
	Yes	1,497	(70.5)	627	(29.5)	
Psychosocial Factors						
Head of Household	*No*	457	(73)	167	(27)	0.141
	Yes	1,711	(70)	725	(30)	
Decision Making	*Me*	683	(71)	277	(29)	0.947
	Me and my spouse	313	(70)	136	(30)	
	Spouse or other family member	433	(71)	175	(29)	
	It is a family decision	667	(71)	276	(29)	
Safety [a]	*Not Safe at All*	247	(81.5)	56	(18.5)	0.001*
	Somewhat Safe	377	(74.2)	131	(25.8)	
	Very Safe	1,525	(68.5)	701	(31.5)	
Worry [a]	*Do not Worry at All*	133	(41)	193	(59)	0.001*
	Worry	959	(71.2)	388	(28.8)	
	Worry All the Time	1,017	(78.6)	277	(21.4)	
Adherence Measures						
Attended social events	*No*	2,031	(70.4)	854	(29.6)	0.032*
	Yes	135	(78)	38	(22)	
Mainly stayed at home	*No*	518	(73)	195	(27)	0.227
	Yes	1,650	(70)	697	(30)	
Traveled to another governorate	*No*	2,072	(71)	849	(29)	0.636
	Yes	96	(69)	43	(31)	
Received visitors at home	*No*	1,437	(70)	626	(30)	0.038*
	Yes	730	(73)	266	(27)	
Worn a mask	*No*	225	(73)	85	(27)	0.485
	Yes	1,943	(71)	806	(29)	
Potential Effect Modifier						
Domestic Violence	*None*	1,897	(70)	820	(30)	0.001*
	Verbal or physical violence	262	(80)	65	(20)	
Verbal and Physical Violence Among Males and Females						
	Males	159	(78)	46	(22)	0.005*
	Females	103	(84)	19	(18)	0.003*

* Indicates significant association between covariate and outcome at $p<0.05$

[a] P-values by Cochrane-Armitage trend test to account for the order of groups after conducting Chi-squared tests ($\mathcal{X}^2$). All other p-values from Chi-squared tests ($\mathcal{X}^2$).

3.2.1.2. Domestic Violence with poor mental health

The potential effect modifier, domestic violence, was statistically significantly associated with poor mental health (p-value 0.001), with 262 (80%) subjects who were verbally or physical abused reporting poor mental health outcomes. Domestic violence was a significant predictor of poor mental health among both males (p-value = 0.005) and females (p-value = 0.003). Males where more likely to experience verbal and physical violence compared to females. However, females were more likely to report poor mental health (84%) compared to males (78%).

3.2.2. Logistic Regression

3.2.2.1. Univariate Analysis

The results from the univariate logistic regression models along with the unadjusted odds ratio (OR), 95% confidence intervals (CIs), and p-values are presented in **Table 3**. Females had 1.2 greater odds of having poor mental health compared to males (OR 1.2, 95% CI:1.01, 1.38). When compared to elderly subjects who did on feel safe at all, subjects who reported feeling somewhat safe inside their homes had 0.65 lower odds of having a poor mental health (OR 0.65, CI: 0.46, 0.93). Elderly subjects who felt very safe inside their homes had 0.5 lower odds of having poor mental health compared to elders who reported not feeling safe at all inside their homes (OR 0.5, 95% CI: 0.36, 0.67). Individuals who worried about being unable to secure masks, gloves, soaps, or disinfectants, unable to access COVID-19 testing, and/or unable to access isolation centers had almost 3.6 higher odds of poor mental health (OR 3.59, CI:2.79 – 4.61) compared to individuals who did not worry at all. Elders who worried all the time

Table 3. Univariate logistic regression analysis of the outcome (poor mental health) and other covariates with unadjusted ORs. (n) % represents the frequency among respondents with poor mental health and % is the valid percentages (accounting for missing values).

Covariates		*n* (%)	Unadjusted OR	CI for unadjusted OR [95%]	Std. Err	P-value
Sociodemographic Factors						
Age	*< 65*	1,741 (80.3)	*Ref*	--		
	≥ 65	427(19.7)	0.93	[0.77 – 1.13]	0.092	0.468
Sex	*Male*	1,111 (51.25)	--	--		
	Female	1,057 (48.75)	1.2	[1.01 – 1.38]	0.094	0.037*
Years Since Migration	*1965 – 2000*	16 (0.74)	*Ref*	--		
	2001 – 2010	91 (4.23)	1.14	[0.43 – 3.00]	0.563	0.790
	2011 – 2020	2,043 (95.02)	1.06	[0.43 – 2.59]	0.482	0.890
Ever Attended School	*No*	1,044 (48.2)	*Ref*	--		
	Yes	1,123 (51.8)	0.96	[0.82 – 1.12]	0.077	0.622
Education Level	*Elementary*	567 (53.7)	*Ref*	--		
	Preparatory	369 (34.9)	1.03	[0.81 – 1.32]	0.129	0.804
	Secondary	120 (11.4)	0.95	[0.66 – 1.36]	0.174	0.772
Food Assistance	*No*	354 (84.1)	*Ref*	--		
	Yes	67 (15.9)	1.21	[0.75 – 1.96]	0.298	0.433
Cash Assistance	*No*	668 (30.85)	*Ref*	--		
	Yes	1,497 (69.15)	0.94	[0.79 –1.11]	0.082	0.477
Psychosocial factors						
Head of Household	*No*	457 (21.08)	*Ref*	--		
	Yes	1,711 (78.92)	0.86	[0.71 – 1.05]	0.087	0.142
Decision Making	*Me*	683 (32.6)				
	Me and my spouse	313(14.9)	0.93	[0.73 – 1.19]	0.116	0.976
	Spouse or other family member	433(20.7)	1.00	[0.80 – 1.26]	0.115	0.581
	It is a family decision	667 (31.8)	0.98	[0.80 – 1.19]	0.099	0.842
Safety	*Not Safe at all*	247 (11.5)	*Ref*	--		
	Somewhat Safe	377 (17.5)	0.65	[0.46 – 0.93]	0.117	0.017*
	Very Safe	1,525 (71.0)	0.49	[0.36 – 0.67]	0.076	0.001*
Worry	*Do not Worry at All*	133 (6.30)	*Ref*	--		
	Worry	959 (45.5)	3.59	[2.79 – 4.61]	0.468	0.001*
	Worry All the Time	1,017 (48.2)	5.33	[4.12 – 6.89]	0.701	0.001*
Adherence Measures						
Attended social events	*No*	2,031 (93.8)	*Ref*			
	Yes	135 (6.20)	1.49	[1.03 – 2.16]	0.281	0.033*
Manly stayed at home	*No*	518 (23.9)	*Ref*			
	Yes	1,650 (76.1)	0.89	[0.74 – 1.07]	0.085	0.227
Traveled to another governorate	*No*	2,072 (95.6)	*Ref*			
	Yes	96 (4.4)	0.91	[0.63 – 1.32]	0.172	0.636
Received visitors at home	*No*	1,437 (66.3)	*Ref*			
	Yes	730 (33.7)	1.20	[1.01 – 1.42]	0.103	0.038*
Worn a mask	*No*	225 (10.4)	*Ref*			
	Yes	1,943 (89.6)	0.91	[0.70 – 1.18]	0.122	0.485
Potential Effect Modifier						
Domestic Violence	*None*	1,897 (87.9)	*Ref*			
	Verbal or physical violence	262 (12.1)	1.74	[1.31 – 2.31]	0.252	0.001*

*Indicates significant association between covariate and outcome at $p < 0.05$ level.

were at even higher odds of having poor mental health compared to those who did not worry (OR 5.33, CI: 4.12, 6.89).

3.2.2.1.1. Adherence to preventive measures with poor mental health

Subjects who attended social events had 1.5 times the odds of having poor mental health compared to individuals who did not attend social events (OR 1.49, CI:1.03, 2.16). Females who attended social events had 2.1 greater odds of poor mental health compared to males (p-value = 0.035). Those who received visitors at home during the time of the study had 1.2 higher odds of poor mental health compared to individuals who reported not receiving visitors at home (OR 1.20, CI 1.01, 1.42). Females who received visitors at home also had 1.34 greater odds of poor mental health compared to males (p-value = 0.024).

3.2.2.1.2. Domestic Violence with poor mental health

Subjects who experienced verbal or physical domestic violence had nearly double the odds of having poor mental health compared to those who did not report verbal or physical violence (OR 1.74, CI: 1.31, 2.31). Although both males (OR 1.63, CI: 1.2 – 2.3) and females (OR 2.13, CI: 1.3 – 3.5) had higher odds of having poor mental health had they experienced verbal or physical domestic violence, females had greater odds of poor mental health compared to males (results are not presented).

3.2.3. Effect Modification

Five interaction terms were evaluated in five separate logistic regression models to account for the effect modification of domestic violence on the relationships between adherence to each preventive measure and mental health. Stratum-specific OR's and the

overall OR from each interaction model were reported, along with their CIs and p-values (alpha adjusted at $\alpha = 0.01$*). There was no statistically significant interaction between attending social events (OR 0.73, CI: [0.25, 2.2], mainly staying at home (OR 1.50, CI: [0.73, 3.1]), traveling to another governorate (OR 1.46, CI [0.40, 5.5]), receiving visitors at home (OR 0.91, CI [0.51, 1.6]), wearing a mask (OR 1.10, CI [0.42, 2.6]) and poor mental health among those who did not experience domestic violence and those who experienced verbal or physical violence. The results can be found in **Supplementary Table 1** of the appendix**.**

3.2.4. Multivariable Logistic Regression

The results of adherence measures from each of the ten stratified models along with the adjusted ORs, 95% CIs, and p-values* are reported in **Table 4.** Each model adjusted for potential confounders and did not include food assistance or level of education (elementary, preparatory, secondary). In the models that were stratified among those with no domestic violence, only those who attended social events (p-value = 0.018, 95% CI (1.9- 2.6) and receiving visitors at home (p-value = 0.040, CI (1.01 – 1.5) yielded statistical evidence of a significant association with poor mental health at p-value = 0.05. However, they were not statistically significant at p-value = 0.01. Among respondents stratified by no domestic violence, participants who attended social events (n = 106) and received visitors at home (n = 567) had greater odds of poor mental health compared to those who did not. Respondents who mainly stayed at home (n = 1,321), traveled to another governorate (n= 73), and wore a mask (n = 1,555) had lower odds of poor mental health, however none of the associations were statistically significant. All models showed no evidence of a statistically significant association between attending

social events, staying at home, traveling to another governorate, and wearing a mask with poor mental health, irrespective of participants experiencing or not experiencing verbal or physical violence.

Table 4: 10 Multivariable logistic regression models assessing the association between poor mental health outcome with each adherence measure while stratifying by domestic violence (none/verbal or physical violence), adjusting for all other variables ‡.

		Domestic Violence							
		No violence				Verbal and physical violence			
		n	Adjusted OR‡	(95% CI) [a]	P-value†	*n*	Adjusted OR	95% CI [a]	P-value†
Adherence Measure									
		Model 1				**Model 6**			
Attended social events (such as weddings and funerals)	*No*	1,637	*Ref*	-	-	233	*Ref*	-	-
	Yes	106	1.67 (n=2,496)	1.9 – 2.6	0.018	20	0.68 (n=314)	0.2 – 2.0	0.495
		Model 2				**Model 7**			
Mainly stayed at home except for essential purchasing	*No*	432	*Ref*	-	-	40	*Ref*	-	-
	Yes	1,312	0.81 (n=2,497)	0.7 – 1.0	0.062	213	1.30 (n=314)	0.6 – 2.8	0.539
		Model 3				**Model 8**			
Travelled to Another governorate in the country	*No*	1,671	*Ref*	-	-	238	*Ref*	-	-
	Yes	73	0.78 (n=2,497)	0.5 – 1.2	0.255	15	0.56 (n=314)	0.1 – 2.2	0.405
		Model 4				**Model 9**			
Received visitors at home	*No*	1,176	*Ref*	-	-	150	*Ref*	-	-
	Yes	567	1.23 (n=2,496)	1.01 – 1.5	0.040	130	0.86 (n=314)	0.5 – 1.6	0.640
		Model 5				**Model 10**			
Worn a mask	*No*	189	*Ref*	-	-	29	*Ref*	-	-
	Yes	1,555	0.90 (n=2,496)	0.7 – 1.2	0.423	224	0.80 (n=314)	0.3 – 8.4	0.641

† *Adjusted alpha level for multiplicity considering $\alpha = 0.01$*

n = number of poor mental health observations in elderly who adhered to each preventive measure in each model.

OR = Odds Ratio, CI = confidence Intervals

[a]95% CI of the odds ratio

(n =) indicate the total number of observations in each model. Adjusted OR, with their corresponding CI and p-value are reported from 10 separate multivariate logistic regression models.

‡ Adjusting for age group, sex, years since migration, head of household, ever attending school, cash assistance, safety, worry, and decision making.

3.2.5. Path Analysis

The path diagrams aimed to explore the potential total, direct and indirect effect of domestic violence on the association between adherence measures and mental health while estimating the magnitude and significance of statistical associations between the variables. First, an explanation of the visual representation of the path analysis is merited. Each exposure is placed in a green box, independent variables in blue, the effect modifier in red, confounders in orange, and the outcome in black. Orange paths originate from a confounding variable, green paths originate from the exposure to the independent variables and from the independent variables to endogenous variables. The bold black paths (arrows) represent the pathway between the exposure, the effect modifier, and the outcome. The beta coefficients are tangent on each path in the diagrams; the corresponding results of each path diagram can be found in **Supplementary tables 2-6** from the appendix. The coefficients of the total, direct, and indirect effects of each adherence measure, domestic violence, and the outcome adjusting for confounders are presented as ORs in **Table 5** along with the 95% CIs and p-values

The results from all path diagrams showed that mental health was only associated with attending social events, domestic violence, safety, and worry. The only adherence measure domestic violence was associated with was receiving visitors at home. Domestic violence was also associated with being both sexes, individuals older than 65 years of age, ever-attending school, and an individual's sense of safety. Safety was associated with worrying, receiving visitors (OR 0.84, CI: [-0.34, -0.01]), and mainly staying at home (OR 0.69, CI: [-0.6, -0.2]). All adherence measures except for having worn a mask were associated with decision-making. Decision-making about

adhering to COVID-19 preventive measures was associated with being the head of the household. Attending social events was associated with cash assistance and staying at home was associated with being female (OR 0.72, CI: [-0.5, -0.13]), older than 65 years of age (OR 0.72, CI: [-0.5, -0.1]), and ever-attending school (OR 1.28, CI: [0.06, 0.44]).

Table 5. Total, indirect, and direct effects of the effect modifier (domestic violence) on the association between attending social events and mental health while controlling for all other variables‡.

Path Analysis Diagram		**Direct effect on Domestic Violence**		**Direct Effect on Mental health**		**Indirect effect on Mental health**		**Total Effect**	
		OR (95% CI)	P-value	**OR (95% CI)**	P-value	**OR (95% CI)**	P-value	**OR (95% CI)**	P-value
1	Attended Social Events	1.36 (0.9 – 2.1)	0.154	1.49 (1.01 – 2.2)	0.044*	1.01 (0.98 – 1.03)	0.330	1.51 (1.02 – 2.2)	0.039*
	Domestic Violence	-	-	1.46 (1.1 – 2.0)	0.014*	-			
	Mediation %[a] = 2.64								
2	Mainly Stayed at home	1.20 (0.9 – 1.6)	0.239	0.84 (0.70 –1.03)	0.099	1.01 (0.99 – 1.02)	0.302	0.85 (0.7 – 1.04)	0.110
	Domestic Violence			1.47 (1.08 – 2.0)	0.013*				
	Mediation %[a] = -3.36								
3	Traveled to Another Governorate	1.14 (0.7 – 1.9)	0.619	0.82 (0.56 – 1.21)	0.314	1.01 (0.98 – 1.03)	0.587	0.82 (0.56 – 1.2)	0.329
	Domestic Violence			1.46 (1.08 – 2.0)	0.014*				
	Mediation %[a] = -3.23								
4	Received Visitors at Home	1.42 (1.13 – 1.80)	0.003*	1.20 (1.00 – 1.43)	0.056	1.01 (1.0 – 1.03)	0.068	1.21 (1.01-1.5)	0.040*
	Domestic Violence			1.45 (1.1 – 2.0)	0.018*				
	Mediation %[a] = 7.14								
5	Worn a mask	0.91 (0.63 – 1.32)	0.614	0.88 (0.67 – 1.16)	0.370	1.00 (0.98 – 1.01)	0.636	0.88 (0.67 – 1.16	0.357
	Domestic Violence			1.46 (1.07 – 2.0)	0.015*				
	Mediation %[a] = 2.71								

Abbreviations: CI, confidence interval; OR odds ratio

[a] The mediation percentage (%) can be interpreted as the percentage that the indirect effect account for of the total effect in the logistic model.

*P-values significant at p>0.05.

The decomposition of the total, direct, and indirect effects was derived from separate logistic models using the KBH method [44]. The direct effects are identical to the beta coefficients presented in each corresponding path diagram; except they are tabulated as ORs for convenience.

‡ Age, sex, years since migration, ever attending school, cash assistance. Head of household, decision-making, safety, and worry.

3.2.5.1. Attending social events

The total (OR 1.51, CI: [1.02, 2.2]) and direct (OR 1.49, CI: [1.01, 2.2]) effects of attending social events were close and significantly associated with poor mental health. The indirect effect of attending social events from domestic violence on mental health was statistically insignificant (OR 1.01, CI: [0.98, 1.0]), given the unobserved significant association with domestic violence. The indirect effects accounted for only 2.64% (mediation percent) of the total effect in the model. In **Figure 2**, attending social events was not statistically significantly associated with domestic violence (OR 1.36, CI: [0.9, 2.1]).

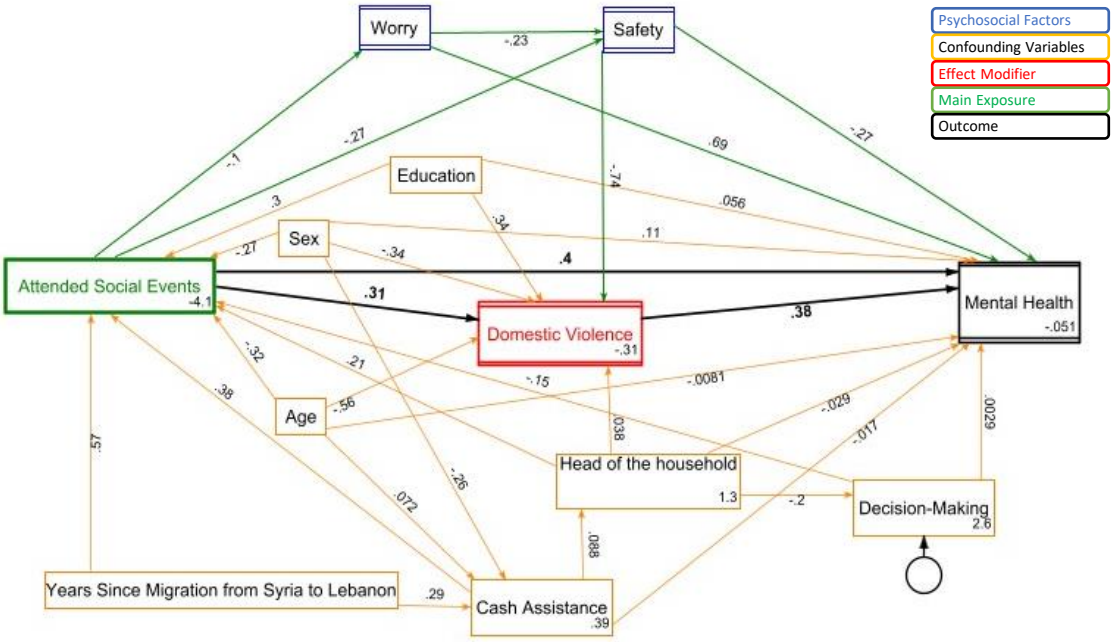

Figure 2 PATH DIAGRAM 1 represents the main exposure (attended social events), with the effect modifier domestic violence, the outcome (mental health), safety and worry, and all other confounding variables. The exposure is in a green box, independent variables in blue, confounders in orange, the effect modifier in red, and the main outcome in black boxes. The orange paths (arrows) indicate a path originating from a confounding variable. The green paths (arrows) indicate a path from the exposure or an independent variable to another endogenous variable in the model. The bold black paths (arrows) represent the pathway between the exposure, the effect modifier, and the outcome. The paths are presented with their corresponding beta coefficients.

3.2.5.2. Mainly Stayed at Home

The direct effects of mainly staying at home on mental health (OR 0.85, CI: [0.70, 1.04]), and indirect effects of mainly staying at home to domestic violence on mental health were not statistically significant (OR 1.01, CI: [0.99, 1.02]). The magnitude of the indirect effect of mainly staying at home on mental health mediated by domestic violence was -3.36%. Since the total effect (OR 0.85 CI: [0.7, 1.04]) was close to the direct effect, mainly staying at home accounted for most of the effect on poor mental health. The results from **Figure 3** showed no statistically significant association between mainly staying at home (OR 1.20, CI: [0.9, 1.6]) and domestic violence.

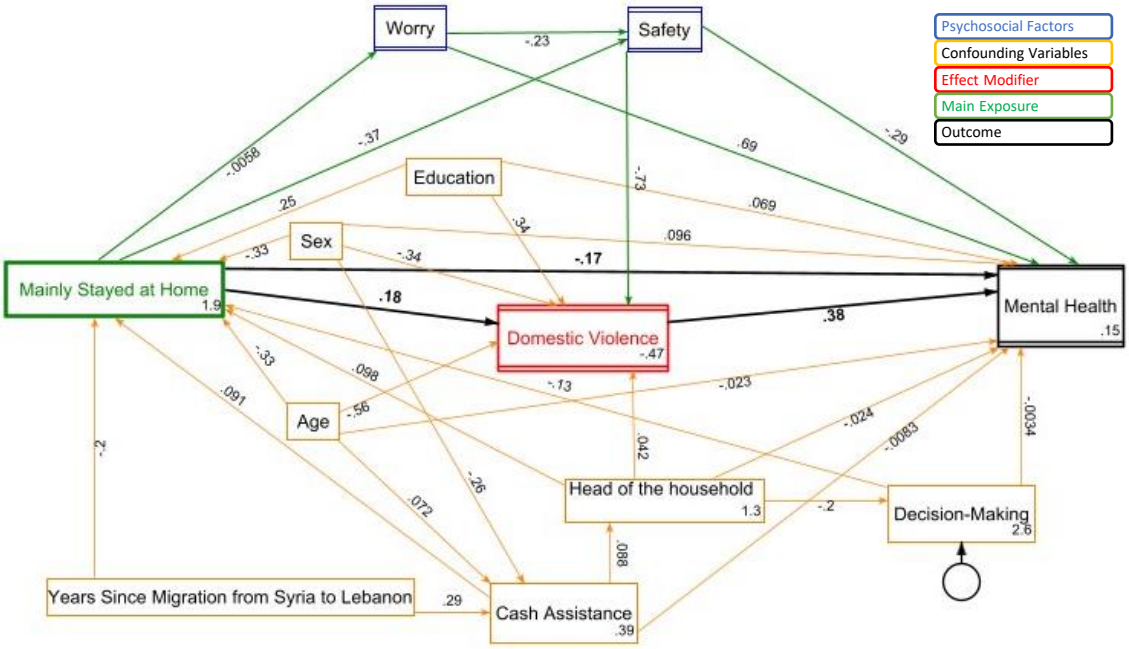

Figure 3 PATH DIAGRAM 2 represents the main exposure (mainly stayed at home), with the effect modifier domestic violence, the outcome (mental health), safety and worry, and all other confounding variables. The exposure is in a green box, independent variables in blue, confounders in orange, the effect modifier in red, and the main outcome in black boxes. The orange paths (arrows) indicate a path originating from a confounding variable. The green paths (arrows) indicate a path from the exposure or an independent variable to another endogenous variable in the model. The bold black paths (arrows) represent the pathway between the exposure, the effect modifier, and the outcome. The paths are presented with their corresponding beta coefficients.

3.2.5.3. Traveled to Another Governorate

The total, direct and indirect effects of traveling to another governorate were not statically significantly associated with mental health. The total effect (OR 0.82, CI: [0.56, 1.21]) was close to the direct effect (OR 0.82, CI: [0.56, 1.21]) of traveling to another governorate on mental health. The magnitude of the indirect effect of traveling to another governorate on mental health mediated by domestic violence accounted for only -3.23% (OR 1.01, CI: [0.98, 1.03]). As presented in **Figure 4**, the direct effect of traveling to another governorate was not associated with domestic violence (OR 1.14, CI: [0.7, 1.9]).

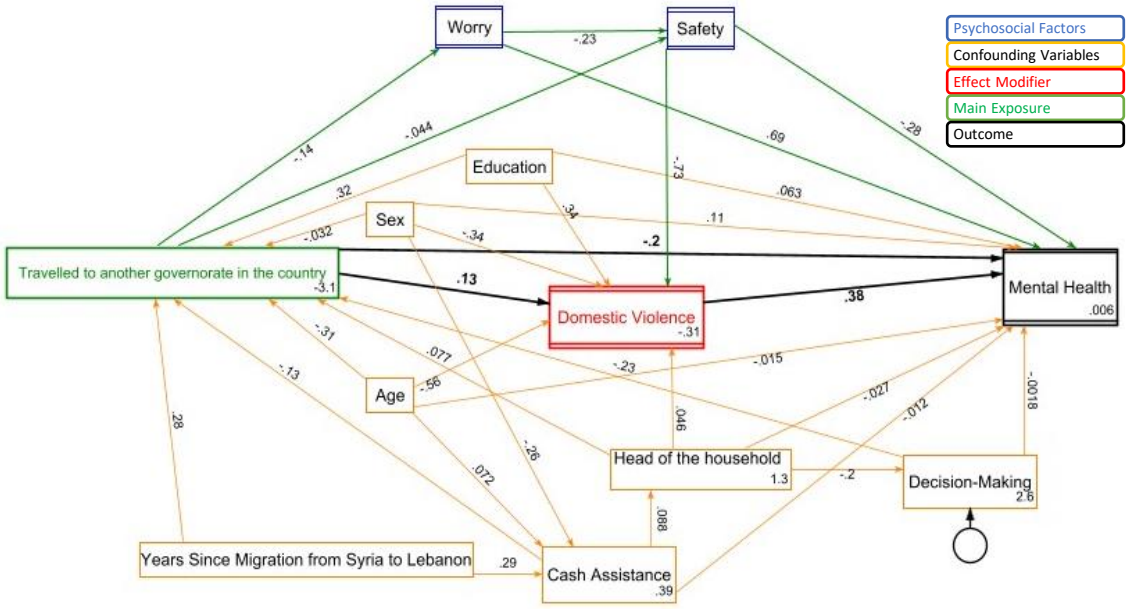

Figure 4 PATH DIAGRAM 3 represents the main exposure (traveled to another governorate), with the effect modifier domestic violence, the outcome (mental health), safety and worry, and all other confounding variables. The exposure is in a green box, independent variables in blue, confounders in orange, the effect modifier in red, and the main outcome in black boxes. The orange paths (arrows) indicate a path originating from a confounding variable. The green paths (arrows) indicate a path from the exposure or an independent variable to another endogenous variable in the model. The bold black paths (arrows) represent the pathway between the exposure, the effect modifier, and the outcome. The paths are presented with their corresponding beta coefficients.

3.2.5.4. Received visitors at home

The total effect of receiving visitors at home was statistically significant (OR 1.21, CI: 1.01, 1.5), and was close to the direct effect of receiving visitors at home on mental health, however, the direct effect was not statistically significant (OR 1.20, CI: [1.00, 1.43]). The indirect effect was not statistically significant (OR 1.01; 1.0, 1.03), yet the magnitude of the effect of receiving visitors at home on mental health mediated by domestic violence was 7.14%. In **Figure 5**, receiving visitors at home was associated with domestic violence, (OR 1.42, CI: [1.13, 1.80]). This association could account for the relatively high mediation percentage among those who received visitors at home compared to all other adherence measures.

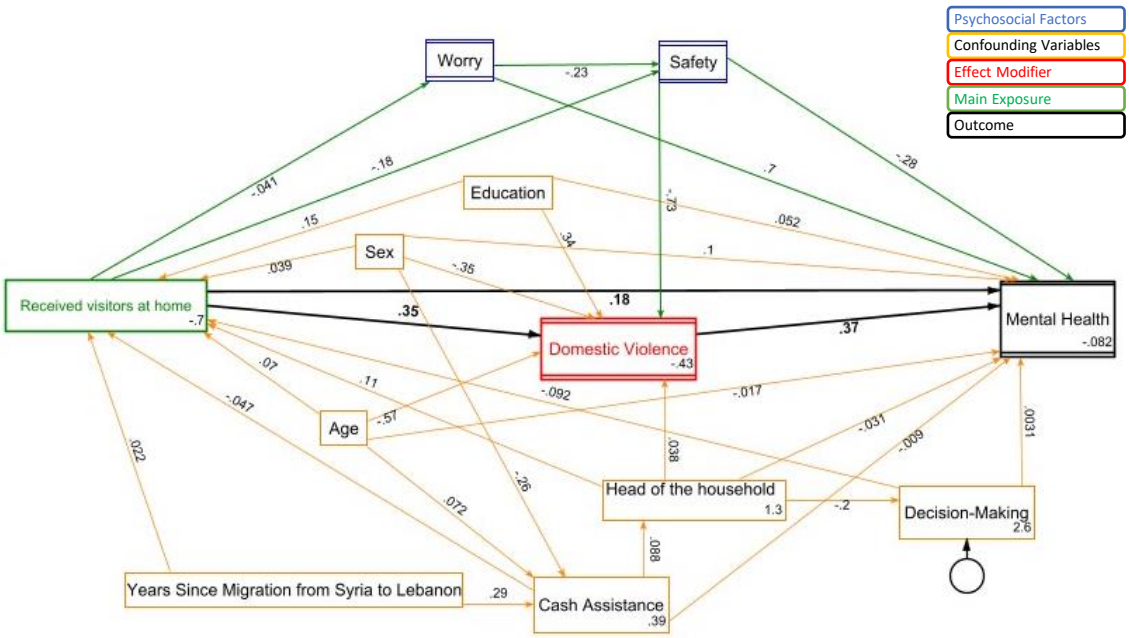

Figure 5 PATH DIAGRAM 4 represents the main exposure (received visitors at home), with the effect modifier domestic violence, the outcome (mental health), safety and worry, and all other confounding variables. The exposure is in a green box, independent variables in blue, confounders in orange, the effect modifier in red, and the main outcome in black boxes. The orange paths (arrows) indicate a path originating from a confounding variable. The green paths (arrows) indicate a path from the exposure or an independent variable to another endogenous variable in the model. The bold black paths

(arrows) represent the pathway between the exposure, the effect modifier, and the outcome. The paths are presented with their corresponding beta coefficients.

3.2.5.5. Worn a Mask

The direct, indirect, and total effects of wearing a mask on mental health was not statistically significantly associated with poor mental health, (OR 0.88, CI: [0.67, 1.16]), (OR 1.00, 0.98, 1.01]), and (OR 0.88, CI: [0.67, 1.16]), respectively. The total and direct effects are similar, and thus the magnitude of the indirect effect of wearing a mask on mental health mediated by domestic violence is 2.71%. Wearing a mask had the lowest mediation percentage among all other exposures. As presented in **Figure 6**, domestic violence was not statistically significantly associated with wearing a mask (OR 0.88, CI: [-0.47, 0.27]).

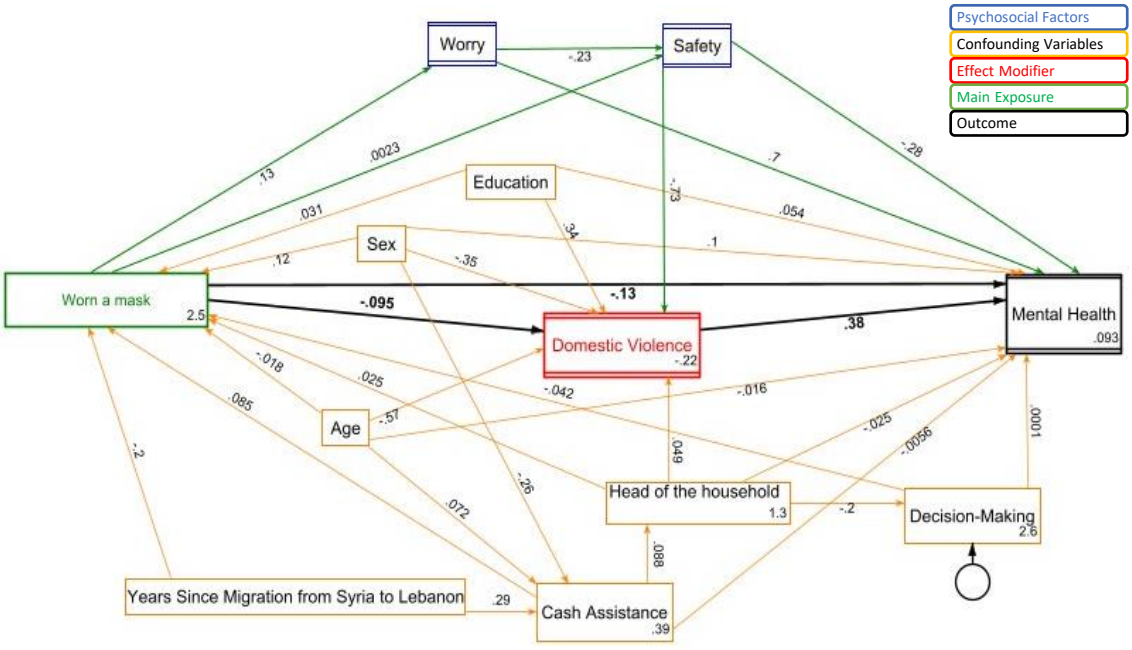

Figure 6 PATH DIAGRAM 5 represents the main exposure (wearing a mask), with the effect modifier domestic violence, the outcome (mental health), safety and worry, and all other confounding variables. The exposure is in a green box, independent variables in blue, confounders in orange, the effect modifier in red, and the main outcome in black boxes. The orange paths (arrows) indicate a path originating from a confounding variable. The green paths (arrows) indicate a path from the exposure or an independent

variable to another endogenous variable in the model. The bold black paths (arrows) represent the pathway between the exposure, the effect modifier, and the outcome. The paths are presented with their corresponding beta coefficients.

CHAPTER 4

DISCUSSION

4.1. Key results

This study aimed to examine the impact of COVID-19 adherence measures on older Syrian refugees' mental health in Lebanon and to evaluate whether domestic violence modified or mediated the association between adherence to preventive measures and mental health. Nearly 70% of respondents reported poor mental health. Feelings of safety and worry were significant predictors of poor mental health outcomes. Additionally, a considerable number of older Syrian refugees adhered to COVID-19 preventive measures, however adherence to any preventive measures was not statistically associated with poor mental health. The effect of domestic violence did not modify or mediate the association between adherence to any preventive measure and mental health. Domestic violence was a significant predictor of poor mental health, with nearly 10.5% of the sample reporting verbal or physical violence, and more prevalent in males. Domestic violence was associated with individuals older than 65, both sexes, educated individuals, and feelings of safety inside the home, and was statistically associated with receiving visitors at home, accounting for nearly 7.14% of the total effect on poor mental health.

4.2. Interpretation

The high prevalence rate of poor mental health among elderly Syrian refugees in Lebanon was expected. Although earlier findings have found a high prevalence of mental disorders among Syrian refugees in Lebanon, none have reflected a prevalence as high as 70%. Studies conducted either in Lebanon or in neighboring countries have

found various rates of mental health disorders from as low as 16% to 84% [14, 18, 46]. Therefore, although the prevalence was shockingly high among this sample population, a high prevalence of poor mental health outcomes has been previously reported in Syrian refugee populations in different settings. The dire social, political, and economic conditions in Lebanon at the time of the COVID-19 pandemic have exacerbated poor mental health outcomes in elderly Syrian refugees. Considering that older refugees face various pre-and post-displacement stressors, it is bound that difficult life circumstances take a toll on their mental well-being. Earlier findings have suggested that sociodemographic factors such as being female, age, years since displacement, receiving cash or other forms of assistance, higher educational level, and psychosocial factors including being the head of household and final decision-maker were all major risk factors for poor mental health outcomes or mental disorders [20, 22, 23]. However, this study did not find any statistically significant association between these risk factors and poor mental health. These findings align best with studies conducted in HICs that found age and educational levels insignificant predictors of common mental disorders [19]. This could reflect the difference in the risk factors that contribute to poor mental health outcomes in various settings and situations among older Syrian refugees or the limited data on the elderly Syrian refugee population in Lebanon. It is imperative to note that other studies investigated the risk factors associated with commonly prevalent mental disorders namely PTSD, depression, and anxiety, whereas this study was limited to assessing the prevalence of poor or good mental health outcomes.

Two important psychosocial factors, safety, and worry have been repeatedly found to contribute to poor mental health outcomes particularly in refugee populations in this study and earlier studies [12, 21, 27-30]. Fortunately, most elders felt safe inside

their homes during the pandemic and this sense of safety was protective against poor mental health. The magnitude and direction of safety and worry remained relatively similar before and after adjusting for confounders. The decreasing trend found in the study suggested as elderly Syrian refugees' sense of safety increased, their probability of poor mental health decreased. This finding aligns with previous studies that found when refugees' sense of safety deteriorated due to daily stressors and exposure to difficult life circumstances, so did their mental health [29, 47]. Individuals' sense of safety was also associated with domestic violence, which is expected since older Syrian refugees who face domestic violence and experience tense family dynamics are at an increased odd of not feeling safe inside their homes and have a diminished sense of safety [30]. Sadly, most elders reported worrying about not being able to secure masks, gloves, soaps, or disinfectants, accessing COVID-19 tests, and/or accessing isolation centers during the pandemic. The positive trend found in the study suggests that as elders' sense of worry increased so did their probability of having poor mental health. Heightened feelings of worry about accessing testing and isolation centers and securing personal protective equipment negatively impacted elderly Syrian refugees' mental health considering the severity of the infection on pre-existing comorbidities [27].

Contrary to earlier findings, which have found strong associations between the increased prevalence of poor mental health outcomes and COVID-19 preventive measures, this study did not find any associations between the five preventive measures and poor mental health. The variation in adherence to COVID-19 preventive measures impacts mental health differently. The protective measure of wearing a mask was not associated with poor mental health mainly because its application differs from socially restrictive preventive measures. Wearing a mask during the pandemic, was a form of

safeguarding against infections that required personal effort, which could positively impact elders by giving them a sense of responsibility towards their families and community. Wearing a mask was not as severe as personally restrictive measures that secluded or isolated an individual and may have not limited social contact compared to other restrictive measures [48]. Thus, allowing elders to maintain their social ties even during dire times [49]. Restrictive measures such as lockdowns and social distancing differ from protective measures in that they limit social contact and lead to isolation and loneliness which endanger mental health [32]. Due to the loss of social networks caused by displacement, older Syrian refugees are at an increased odds of being socially isolated and losing their social roles and identities [12, 22]. Individuals who attended social events and received visitors at home had some form of social contact and perhaps maintained social ties during the pandemic, but the crude OR suggests that the odds of poor mental health were higher in these two groups. The initial crude OR for attending social events and receiving visitors at home were statistically significantly associated with poor mental health at $\alpha = 0.05$ but not $\alpha = 0.01$. The adjusted ORs from the models among those with no domestic violence were relatively unchanged. However, when we stratified by verbal or physical violence, the ORs shifted in magnitude and direction and conveyed a protective effect against mental health. After adjusting for multiple testing there was no statistically significant association between any socially restrictive adherence measure and mental health. This was an unexpected finding and contradicted most of the published rhetoric stating such restrictive measures drastically impacted mental health [2]. It may be plausible to assume that attending social events and receiving visitors may have exposed individuals to other stressors that may have impacted their mental health. Thus, the different results found in Syrian refugees may

reflect a social or contextual difference among older Syrian refugees in Lebanon that may be linked to other factors not considered in this study. Syrian refugees face social inequalities like poverty, trauma, and war (among many) that worsen mental health. Reducing these problems, which are the main root of mental disorders among displaced Syrian refugees and other vulnerable and marginalized populations, may prevent mental health problems [50]. The lack of significant associations in this study could be due to the relatively small number of observations and might require more statistical power to capture any real or significant associations between preventive measures and mental health.

Domestic violence was a significant predictor of poor mental health. Although the association of domestic violence with poor mental health might have been partially confounded, the direction and the magnitude of the association remained significant. The effect of domestic violence did not modify or mediate the association between adherence to any preventive measure and mental health. This finding may not be accurate considering there is no published evidence to suggest whether domestic violence has mediated the effect of adherence measures during the pandemic, aside from the high incidence rate. Moreover, the observations from the stratified analysis of the effect of domestic violence on the relationship between adherence measures and mental health were extremely small. Seeing how the incidence of domestic violence increased during the COVID-19 restrictive measures, it is logical to deduce that domestic violence may impact mental health in direct or indirect ways, particularly under the implemented preventive measures. Domestic violence in Syrian refugee households is related to changes or breakdowns of family structures. Familial conflicts over gender roles compounded with external life stressors and the disruption of family

cohesion often cause great tension that can lead to domestic violence, all of which may have been further intensified during the pandemic [29] [31]. Contrary to earlier findings relating to the high prevalence of domestic violence among female Syrian refugees by various family members, this study found that males were more likely to experience physical or domestic violence from someone besides the spouse in the household. Recent studies have reported that males often disproportionately face various forms of sexual, physical, and/or psychological abuse from other family members and are more likely to be targeted by authorities or host community members. These incidences often go unreported mainly due to internal barriers within the humanitarian community that lacks to acknowledge that men may face various forms of violence and are often overlooked in policy and planning [51]. In addition, there is often little available help, outreach programs, or services for men who live in a culture of silence. This finding may begin to illuminate important differences that have not been uncovered before and hopefully lead to additional research that can investigate risk predictors among both female and male Syrian refugees associated with mental health but also the various challenges refugees may have faced.

The path analysis diagrams highlight important associations among various risk factors and may provide us with keener insight into how factors work together. In this study, receiving visitors at home had a significant direct effect on domestic violence. The reasons behind this association remain elusive although it is possible to infer that it may be related to elders experiencing or being exposed to verbal or physical domestic violence from members outside of their household. Additional findings from the path analysis indicate that individuals who experienced verbal or physical violence received visitors and mainly stayed at home likely had a diminished sense of safety. Adherence

to both of these preventive measures confines individuals to their homes. Although further studies are needed to investigate these associations, individuals confined to their homes might have reported lower odds of feeling safe at home due to exposure to various familial tensions and psychological stressors, which may lead to domestic violence and poor mental health. This is in line with other studies which have found that domestic violence often threatened family members' sense of safety and their physical and mental well-being [52]. In addition, domestic violence was also associated with both genders, individuals older than 65, and having attended school. This parallels earlier findings which showed that elderly Syrian refugee women who are less educated are often the victims of domestic violence and recent findings that uncovered that Syrian refugee men may be exposed to various forms of violence not previously acknowledged [17]. Refugees older than 65 years of age are more likely to face elder abuse amid the pandemic, notable physical and psychological abuse by their family members [15].

Although receiving cash assistance was not a predictor of poor mental health in this study, with the high inflation rates and the Lebanese currency losing most of its value, it was expected to find that over 70% of respondents received cash assistance. Refugees who had longer durations of displacement are more likely to be bound to poverty, particularly in LMIC countries [21]. This finding further highlights the detrimental effects of poverty which threaten older Syrian refugees' access to essential services and needs, particularly during the pandemic, leaving them highly dependent on external forms of assistance [11]. Poverty may directly or indirectly impact mental health, and although cash assistance was not a significant predictor of poor mental health, heightened feelings of worry were a significant predictor. During the COVID-19

pandemic, worrying transcends the typical concerns associated with refugees' life circumstances and reflects the poor living conditions which refugees worry to protect themselves from that may increase their risk of infections and negatively impact their physical and psychological wellbeing [26, 28]. Cash assistance is also associated with sex and years since migration. This parallels earlier findings which suggested that cash assistance was more often provided to the head of the household who was often male [31]. Being the head of the household was associated with decision-making about adhering to COVID-19 preventive measures. This may point to the underlying social structures that are maintained in Syrian refugee populations which may impact adherence to socially preventive measures. Cash assistance was also associated with attending social events. It is possible to hypothesize that individuals who received cash assistance were able to capitalize on social relations and participation and therefore capable of partaking in social events. The UNCHR reports that above all the benefits of providing Syrian refugees with cash assistance, it served best to facilitate social interactions and participation and to improve intra-household relationships due to reduced stress [53]. This may support the notion that the pandemic exposed and strained many economic and social disparities already present in vulnerable populations. Also, there are other factors like cash assistance that lead to social isolation and loneliness in Syrian refugee populations beyond the preventive measure's secondary to the pandemic. Decisions about adhering to the strict preventive measures play a role in socially restrictive measures such as attending social events, staying at home, traveling, and receiving visitors at home. This may reflect the role the elderly play to mitigate infections and ensure that they maintain a sense of safety within the home. Providing a sense of safety is essential for older Syrian refugees to adapt and adjust to new

circumstances and may serve as a protective factor that may curtail mental disorders [47]. Psychosocial factors like safety and worry have a drastic impact on refugees' mental health and are associated with each other and various other factors like domestic violence and other adherence measures. The path analyses served their purpose in displaying underlying associations among various factors. This exploratory study simply provides a glimpse of the many factors and conditions of refugees, and not just older Syrian refugees residing in Lebanon. Although other studies can build on preliminary studies, multiple factors must be analyzed to provide a near-wholistic view of the struggles of refugees to expedite and increase the reach of mental health interventions in refugee and displaced populations everywhere.

4.4. Strengths

To the best of our knowledge, this study provided the first estimates of the prevalence of adherence to preventive measures in elderly Syrian refugees in Lebanon and evaluated their impact on mental health. It also provided estimates of verbal or physical violence from family members besides the spouse among older Syrian refugees in Lebanon, which is often less studied than intimate partner violence. Findings from this study can shape our understanding of the prevalence and burden of poor mental health outcomes and domestic violence during the COVID-19 pandemic among older Syrian refugees in Lebanon and aid in allocating and planning health resources for this understudied yet highly vulnerable population. This study also assessed whether domestic violence modified or mediated the association between adherence and mental health, further elucidating the interactive nature of adhering to strict preventive measures and domestic violence secondary to the pandemic and their overall impact on

mental health. This study provided a theoretical framework based on literary evidence of the various risk factors associated with mental health and conducted exploratory path analyses to further evaluate associations of risk factors and the COVID-19 preventive measures to shed light on how risk factors directly or indirectly impact mental health.

4.3 Limitations

There are several limitations to this study. The sample population, though is believed to be a representative sample of the older Syrian refugee population in Lebanon, was drawn from a beneficiary list provided by a humanitarian organization which suggests refugees were recipients of aid. The prevalence of poor mental health may be higher among unregistered refugees since there may be important differences between those who may be provided with numerous types of support compared to those who are not. Unregistered refugees may face additional barriers to their well-being particularly in distressing times like pandemics, but often go unnoticed. A disadvantage of the MHI-5 questionnaire used to assess mental health is that it does not have an internationally established cut-off point which may lead to misclassification bias. The high prevalence of poor mental health in this study may reflect the inability of the questionnaire to properly classify the outcome. Questions in the survey relied upon participants' self-reports and perhaps respondents were unfamiliar with or hesitant to answer some questions possibly resulting in self-reporting bias. Self-reporting bias may have skewed the data and resulted in inaccurate conclusions. The number of observations in the stratified analysis of domestic violence, mental health, and each exposure was low possibly due to missing values in covariates, thus decreasing the power to detect any significant effect size. The low number of observations also

indicates a class imbalance, which drastically impacts our ability to gain a representative sample of those who adhered to each preventive measure, experienced domestic violence, and reported a poor mental health score. Future studies should implore statistical techniques to overcome class imbalances. Considering the many studies which have found a high prevalence of PTSD, depression, and anxiety disorders, a study evaluating the prevalence of common mental disorders found in older Syrian refugees in Lebanon is merited to explore the effects of adherence to preventive measures on commonly prevalent disorders and to better provide mental health services [13, 14, 19, 20, 54]. Since this study did not evaluate the prevalence of common disorders it failed to display important risk factors that may have impacted the mental health of older Syrian refugees during the pandemic. Data on prevalent mental disorders may also capture differences between the prevalence of mental disorders pre- and post-COVID-19. Since there are no pre-COVID-19 studies that evaluated the prevalence of domestic violence in older Syrian refugee populations in Lebanon, it is not assured that the prevalence of domestic violence observed in this study reflects an increased prevalence of domestic violence in older Syrian refugees during the COVID-19 pandemic. This study did not include subgroup analysis and thus did not capture important differences among subgroups in the sample. Moreover, since this was a secondary data analysis other factors that may have had impacted older Syrian refugees' mental health may have not been considered.

4.5. Implications of the research

Considering the high prevalence of poor mental health in elderly Syrian refugees in Lebanon, further studies are needed to evaluate the prevalence of common mental

disorders and various risk factors associated with poor mental health. The burden of poor mental health is unequally falling among vulnerable populations. The psychological damage that ensued from the pandemic is likely to have long-lasting effects. Prevention of mental health requires effort from multiple sectors and cannot fall on the public health sector alone. Given the overburdened health system in Lebanon that often neglects Syrian refugees and fails to provide the proper assistance and care, international efforts are required to provide financial assistance to refugees who suffer from extreme poverty and who live in dire situations. Aid can help in reducing poverty among vulnerable populations and directly or indirectly improve their overall well-being. Future research should focus on highlighting the range of social, economic, and environmental factors that may hinder refugees' wellbeing, and their access to care and necessities, particularly in Lebanon since evidence has repeatedly shown that many risk factors contribute to poor mental health due to the country's political and economic turmoil. There is a need for organizations or policymakers to provide resources or facilitate community engagement among Syrian refugees to help refugees build social networks and to regain their sense of agency and their place in their host country communities. Psychosocial factors are major contributors to poor mental health, and bridging communities my unify and strengthen social support systems for refugees. Research efforts can increase data collection, especially among unregistered Syrian refugees in Lebanon, and help these populations to regain their voice. Only a small percentage of Syrian refugees receive mental health services in Lebanon. Thus, a comprehensive plan coordinated by international and regional members is needed to subsidize humanitarian efforts to provide mental health services to those in need. Evidence from this study can be of significance to humanitarian interventions that

address and manage mental health in refugee populations. Additionally, it can aid in understanding the plausible significance of worsening mental health in other refugee populations across different geographical areas, and better implement and manage future restrictions and lockdowns.

4.6. Conclusion

The COVID-19 pandemic drastically impacted life globally. Its implemented preventive and protective measures disrupted daily functions and aggravated pre-existing physical and psychological morbidities, especially in vulnerable populations. Multiple risk factors are associated with older Syrian refugees' mental health and impact their well-being and their ability to adapt to life's pressing circumstances. The pandemic further exacerbated those vulnerabilities due to the added strain on economic, political, and social functions, and increased the incidence of domestic violence. Although this study did not find a statistically significant association between adhering to preventive measures and mental health, it did find a high prevalence of poor mental health and domestic violence among older Syrian refugees. Older refugees play an integral role in their communities and provide specific assets and strengths to emergency settings, although they are often less recognized for these. Further studies can explore other risk factors associated with mental health outcomes among the Syrian refugee population and how preventive measures may have aggravated or precipitated commonly prevalent mental disorders among older Syrian refugees. Further studies are necessary to assess the needs of marginalized Syrian populations and to provide strong evidence-based interventions that can provide effective care and improve individuals' lives.

APPENDIX

Supplementary Table 1. The results of the interaction terms between domestic violence and each adherence measure with the outcome mental health. The table includes the stratified odds ratios from each stratum of each exposure and domestic violence by mental health status and odds ratios of each interaction term along with the CIs and p-values while controlling for all other variables.

		Main exposure				
		No	Yes	Stratified OR (95% CI); P-value	OR[1] (95% CI)	P-value[†]
		Attending social events				
Mental Health	**Domestic violence**					
Good	No	787	33			
	Yes	60	5	1.99 (0.6 – 5.4); 0.160		
Poor	No	1,782	113		**0.44 (0.15 – 1.4)**	**0.161**
	Yes	240	22	1.45 (.85 – 2.3); 0.120		
		Mainly Staying at home				
Good	No	180	640			
	Yes	13	52	1.13 (0.58 – 2.3); 0.714		
Poor	No	472	1425		**1.66 (0.79 – 3.5)**	**0.183**
	Yes	43	219	1.69 (1.20 – 2.4); 0.003*		
		Traveled to another governorate				
Good	No	780	40			
	Yes	62	3	0.94 (0.18 – 3.1); 0.925		
Poor	No	1,817	80		**1.43 (0.40 – 5.5)**	**0.602**
	Yes	247	15	1.38 (0.72 – 2.5); 0.265		
		Received visitors at home				
Good	No	580	240			
	Yes	39	26	1.61 (0.92 – 2.8); 0.070		
Poor	No	1280	616		**0.81 (0.44 – 1.5)**	**0.499**
	Yes	153	109	1.48 (1.13 - 1.9); 0.003*		
		Worn a Mask				
Good	No	78	741			
	Yes	7	233	0.87 (0.38 – 2.3); 0.743		
Poor	No	196	1701		**1.00 (0.39 – 2.6)**	**0.994**
	Yes	29	233	0.93 (0.61 – 1.4); 0.714		

[1] OR (95% CI) for interaction between exposure and domestic violence within strata of mental health; *P =value for the m*easure of effect modification on the multiplicative scale

Each model with an interaction term was controlled for age, sex, years since migration, ever-school, cash assistance, head of household, decision-making, safety, and worry.

The stratified ORs were calculated without controlling for all other variables.

[†] *Adjusted alpha level for multiplicity considering $\alpha = 0.01$*

Supplementary Table 2. The results of the logistic regression models for Error! Reference source not found. (path diagram for attending social events) represent the main exposure (attended social events), with the effect modifier domestic violence, the outcome (poor mental health), and all other independent and confounding variables. The table includes the beta coefficients (β), along with their standard errors, p-values, and 95% CI. The (β) were transformed to adjusted Odds Ratios (ORs) for simplicity.

		β				
Endogenous Variables	**Exogenous Variables**	**Coefficient**	**Std err**	**OR**	**P-value**	**95% CI[1]**
Mental Health (n= 3,322)						
	Attended social events	0.40	0.20	1.49	0.044*	(0.01, 0.80)
	Domestic Violence	0.38	0.16	1.46	0.015*	(0.07, 0.68)
	Sex	0.11	0.10	1.15	0.268	(-0.10, 0.31)
	Ever-attended School	0.06	0.10	1.06	0.572	(-0.14, 0.25)
	Worry	0.70	0.06	2.01	0.001*	(0.57, 0.82)
	Safety	-0.30	0.07	0.74	0.001*	(-0.42, -0.13)
	Age	-0.01	0.11	1.00	0.942	(-0.20, 0.21)
	Cash Assistance	-0.02	0.09	1.00	0.855	(-0.20, 0.20)
	Head of Household	-0.03	0.12	1.00	0.798	(-0.30, 0.20)
	Decision-making	0.003	0.34	1.00	0.933	(-0.06, 0.07)
Domestic Violence (n = 3,280)						
	Attended Social Events	0.31	0.22	1.36	0.154	(-0.12, 0.75)
	Sex	-0.34	0.14	0.71	0.013*	(-0.61, -0.07)
	Ever-attended school	0.34	0.13	1.40	0.012*	(0.10, 0.60)
	Safety	-0.74	0.07	0.48	0.001*	(-0.90, -0.60)
	Age	-0.56	0.18	0.57	0.002*	(-0.92, -0.20)
	Head of Household	0.04	0.17	1.04	0.819	(-0.30, 0.37)
Worry (n = 3,207)						
	Attended Social Events	-0.10	0.15	0.90	0.477	(-0.40, 0.20)
Safety (n = 3,180)						
	Attended Social events	-0.27	0.16	0.76	0.101	(-0.60, 0.10)
	Worry	-0.23	0.06	0.80	0.001*	(-0.35, -0.11)
Attending Social Events (n= 3,172)						
	Sex	-0.27	0.19	0.76	0.152	(-0.63, 0.10)
	Ever attended School	0.30	0.18	1.36	0.096	(-0.05, 0.70)
	Age	-0.32	0.24	0.73	0.172	(-0.78, 0.14)
	Cash assistance	0.38	0.19	1.46	0.043*	(0.01, 0.74)
	Years Since Migration	0.57	0.42	1.77	0.174	(-0.26, 1.40)
	Head of Household	0.21	0.24	1.23	0.380	(-0.26, 0.69)
	Decision-making	-0.15	0.06	0.86	0.019*	(-0.27, -0.02)
Cash Assistance (n = 3, 290)						
	Sex	-0.26	0.08	0.77	0.001*	(-0.41, -0.11)
	Age	0.07	0.10	1.07	0.454	(-0.12, 0.26)
	Years since migration	0.29	0.14	1.34	0.034*	(0.02, 0.55)
Head of Household (n = 3,317)						
	Cash assistance	0.09	0.09	1.10	0.349	(-0.10, 0.27)
Decision-making (n= 3,209)						
	Head of Household	-0.20	0.05	0.82	0.001*	(-0.31, -0.10)

OR = Odds Ratio, CI= Confidence Interval

[1]95% CI for coefficient

*Significant at $p<0.05$

Supplementary Table 3. The results of the logistic regression models for **Figure 3** (path diagram for mainly staying at home) represent the main exposure, mainly staying at home, with the effect modifier, domestic violence, the outcome (poor mental health), and all other independent and confounding variables. The table includes the beta coefficients (β), along with their standard errors, p-values, and 95% CI. The (β) were transformed to adjusted Odds Ratios (ORs) for simplicity.

		β				
Endogenous Variables	**Exogenous Variables**	**Coefficient**	**Std err**	**OR**	**P-value**	**95% CI**
Mental Health (n = 2,834)						
	Mainly staying at home	-0.17	0.10	0.84	0.096	(-0.38, 0.03)
	Domestic violence	0.38	0.16	1.46	0.013*	(0.08, 0.69)
	Sex	0.10	0.10	1.11	0.339	(-0.10, 0.29)
	Ever-attended school	0.07	0.10	1.07	0.486	(-0.12, 0.26)
	Worry	0.69	0.06	2.00	0.001*	(0.57, 0.82)
	Safety	-0.29	0.07	0.75	0.001*	(-0.43, -0.15)
	Age	-0.02	0.11	1.00	0.837	(-0.24, 0.20)
	Cash assistance	-0.01	0.09	1.00	0.930	(-0.20, 0.18)
	Head of household	-0.02	0.12	1.00	0.833	(-0.25, 0.20)
	Decision-making	-0.00	0.03	1.00	0.922	(-0.07, 0.06)
Domestic violence (n = 3,283)						
	Mainly stayed at home	0.18	0.15	1.20	0.239	(-0.12, 0.48)
	Sex	-0.34	0.14	0.71	0.014*	(-0.60, -0.10)
	Ever-attended school	0.34	0.13	1.40	0.012*	(0.07, 0.60)
	Safety	-0.73	0.07	0.48	0.001*	(-0.87, -0.58)
	Age	-0.56	0.20	0.57	0.003*	(-0.92, -0.20)
	Head of household	0.04	0.17	1.04	0.800	(-0.29, 0.37)
Worry (n = 3,209)						
	Mainly stayed at home	-0.01	0.08	1.00	0.942	(-0.16, 0.15)
Safety (n = 3,182)						
	Mainly stayed at home	-0.37	0.10	0.69	0.001*	(-0.56, -0.17)
	Worry	-0.23	0.06	0.80	0.001*	(-0.35, -0.11)
Mainly Stayed at Home (n = 3,175)						
	Sex	-0.33	0.10	0.72	0.001*	(-0.52, -0.13)
	Ever attended school	0.25	0.10	1.28	0.011*	(0.06, 0.44)
	Age	-0.33	0.10	0.72	0.001*	(-0.54, -0.13)
	Cash assistance	0.09	0.10	1.09	0.323	(-0.09, 0.27)
	Years since migration	-0.20	0.17	0.82	0.255	(-0.53, 0.14)
	Head of household	0.10	0.11	1.11	0.360	(-0.11, 0.31)
	Decision-making	-0.13	0.03	0.88	0.001*	(-0.20, -0.06)
Cash assistance (n = 3,290)						
	Sex	-0.26	0.08	0.77	0.001*	(-0.41, -0.11)
	Age	0.07	0.10	1.10	0.454	(-0.12, 0.26)
	Years since migration	0.29	0.14	1.34	0.034*	(0.02, 0.55)
Head of household (n = 3,317)						
	Cash assistance	0.09	0.09	1.10	0.349	(-0.08, 0.27)
Decision-making (n = 3,209)						
	Head of household	-0.20	0.05	0.82	0.001*	(-0.31, -0.10)

OR = Odds Ratio, CI= Confidence Interval

[1]95% CI for coefficient

*Significant at $p<0.05$

Supplementary Table 4. The results of the logistic regression models for **Figure 4** (path diagram for traveling to another governorate) represent the main exposure, traveling to another governorate, with the effect modifier, domestic violence, the outcome (poor mental health), and all other independent and confounding variables. The table includes the beta coefficients (β), along with their standard errors, p-values, and 95% CI. The (β) were transformed to adjusted Odds Ratios (ORs) for simplicity.

		β				
Endogenous Variables	**Exogenous Variables**	**Coefficient**	**Std err**	**OR**	**P-value**	**95% CI**
Mental Health (n = 3,322)						
	Traveled to another governorate	-0.20	0.20	0.82	0.317	(-0.60, 0.20)
	Domestic violence	0.38	0.16	1.46	0.014*	(0.08, 0.68)
	Sex	0.11	0.10	1.12	0.289	(-0.09, 0.30)
	Ever-attended school	0.06	0.10	1.06	0.521	(-0.13, 0.26)
	Worry	0.69	0.06	2.00	0.001*	(0.56, 0.26)
	Safety	-0.28	0.07	0.76	0.001*	(-0.42, -0.14)
	Age	-0.01	0.11	1.00	0.895	(-0.23, 0.20)
	Cash assistance	-0.01	0.09	1.00	0.900	(-0.20, 0.17)
	Head of household	-0.03	0.12	1.00	0.815	(-0.25, 0.20)
	Decision-making	-0.00	0.03	1.00	0.958	(-0.07, 0.07)
Domestic violence (n = 2,834)						
	Traveled to another governorate	0.13	0.26	1.14	0.619	(-0.38, 0.64)
	Sex	-0.34	0.14	0.71	0.012*	(-0.61, -0.08)
	Ever-attended school	0.34	0.13	1.40	0.011*	(0.08, 0.61)
	Safety	-0.73	0.07	0.48	0.001*	(-0.88, -0.59)
	Age	-0.56	0.18	0.57	0.002*	(-0.93, -0.20)
	Head of household	0.05	0.17	1.05	0.784	(-0.28, 0.37)
Worry (n = 3,283)						
	Traveled to another governorate	-0.14	0.16	0.87	0.402	(-0.45, 0.18)
Safety (n = 3,182)						
	Traveled to another governorate	-0.04	0.20	1.00	0.816	(-0.42, 0.33)
	Worry	-0.23	0.06	0.79	0.001*	(-0.34, -0.11)
Traveling to another governorate (n = 3,175)						
	Sex	-0.03	0.20	1.00	0.873	(-0.42, 0.36)
	Ever attended school	0.32	0.20	1.35	0.110	(-0.07, 0.70)
	Age	-0.32	0.25	0.73	0.231	(-0.81, 0.18)
	Cash assistance	-0.13	0.18	0.88	0.483	(-0.48, -0.23)
	Years since migration	0.28	0.38	1.32	0.465	(-0.47, 1.03)
	Head of household	0.08	0.24	1.10	0.751	(-0.40, 0.55)
	Decision-making	-0.23	0.07	0.79	0.001*	(-0.37, -0.09)
Cash assistance (n =3,290)						
	Sex	-0.26	0.08	0.77	0.001*	(-0.41, -0.11)
	Age	0.07	0.10	1.10	0.454	(-0.12, 0.26)
	Years since migration	0.29	0.03	1.34	0.034*	(0.02, 0.55)
Head of household (n =3,290)						
	Cash assistance	0.10	0.09	1.11	0.349	(-0.10, 0.27)
Decision-making (n =3,177)						
	Head of household	-0.20	0.09	0.82	0.001*	(-0.31, -0.10)

OR = Odds Ratio, CI= Confidence Interval

[1]95% CI for coefficient

*Significant at $p<0.05$

Supplementary Table 5. The results of the logistic regression models for **Figure 5** (path diagram for receiving visitors at home) represent the main exposure, receiving visitors at home, with the effect modifier, domestic violence, the outcome (poor mental health), and all other independent and confounding variables. The table includes the beta coefficients (β), along with their standard errors, p-values, and 95% CI. The (β) were transformed to adjusted Odds Ratios (ORs) for simplicity.

		β				
Endogenous Variables	**Exogenous Variables**	**Coefficient**	**Std err**	**OR**	**P-value**	**95% CI**
Mental Health (n = 2,833)						
	Receiving visitors at home	0.18	0.09	1.20	0.054	(-0.01, 0.36)
	Domestic violence	0.38	0.16	1.45	0.018*	(0.06, 0.67)
	Sex	0.10	0.10	1.11	0.305	(-0.10, 0.30)
	Ever-attended school	0.05	0.10	1.05	0.600	(-0.14, 0.24)
	Worry	0.70	0.06	2.01	0.001*	(0.57, 0.82)
	Safety	-0.28	0.07	0.76	0.001*	(-0.42, -0.14)
	Age	-0.02	0.11	1.00	0.875	(-0.24, 0.20)
	Cash assistance	-0.01	0.09	1.00	0.924	(-0.20, 0.18)
	Head of household	-0.03	0.12	1.00	0.791	(-0.26, 0.20)
	Decision-making	0.00	0.03	1.00	0.928	(-0.06, 0.07)
Domestic violence (n = 3,282)						
	Receiving visitors at home	0.35	0.12	1.42	0.003*	(0.12, 0.59)
	Sex	-0.35	0.14	0.70	0.011*	(-0.61, -0.08)
	Ever-attended school	0.34	0.13	1.40	0.012*	(0.07, 0.60)
	Safety	-0.73	0.07	0.48	0.001*	(-0.87, -0.59)
	Age	-0.57	0.20	0.57	0.002*	(-0.93, -0.21)
	Head of household	0.04	0.20	1.04	0.822	(-0.29, 0.37)
Worry (n =3,208)						
	Received visitors at home	-0.04	0.07	1.00	0.568	(-0.18, 0.10)
Safety (n = 3,181)						
	Received visitors at home	-0.18	0.08	0.84	0.032*	(-0.34, -0.01)
	Worry	-0.23	0.06	0.79	0.001*	(-0.35, -0.01)
Receiving visitors at home (n =3,174)						
	Sex	0.04	0.09	1.04	0.660	(-0.13, 0.21)
	Ever attended school	0.15	0.09	1.20	0.077	(-0.02, 0.32)
	Age	0.07	0.10	1.07	0.482	(-0.12, 0.26)
	Cash assistance	-0.05	0.08	1.00	0.570	(-0.21, 0.12)
	Years since migration	0.02	0.14	1.00	0.875	(-0.26, 0.30)
	Head of household	0.11	0.10	1.12	0.301	(-0.09, 0.31)
	Decision-making	-0.09	0.03	0.91	0.003*	(-0.15, -0.03)
Cash assistance (n =3,174)						
	Sex	-0.26	0.08	0.77	0.001*	(-0.41, -0.11)
	Age	0.07	0.09	1.01	0.454	(-0.12, 0.26)
	Years since migration	0.29	0.14	1.34	0.034*	(0.02, 0.55)
Head of household (n = 3,290)						
	Cash assistance	0.09	0.09	1.10	0.359	(-0.10, 0.27)
Decision-making (n = 3,177)						
	Head of household	-0.20	0.05	0.82	0.001*	(-0.31, -0.10)

OR = Odds Ratio, CI= Confidence Interval

[1]95% CI for coefficient

*Significant at $p<0.05$

Supplementary Table 6. The results of the logistic regression models for **Figure 6** (path diagram for wearing a mask) represent the main exposure, wearing a mask, with the effect modifier, domestic violence, the outcome (poor mental health), and all other independent and confounding variables. The table includes the beta coefficients (β), along with their standard errors, p-values, and 95% CI. The (β) were transformed to adjusted Odds Ratios (ORs) for simplicity.

		β				
Endogenous Variables	**Exogenous Variables**	**Coefficient**	**Std err**	**OR**	**P-value**	**95% CI**
Mental Health (n = 2,833)						
	Worn a mask	-0.13	0.14	0.88	0.358	(-0.41, 0.15)
	Domestic violence	0.38	0.16	1.46	0.015*	(0.07, 0.68)
	Sex	0.10	0.10	1.11	0.308	(-0.09, 0.30)
	Ever-attended school	0.05	0.10	1.05	0.584	(-0.14, 0.25)
	Worry	0.70	0.06	2.01	0.001*	(0.57, 0.82)
	Safety	-0.28	0.07	0.76	0.001*	(-0.42, -0.14)
	Age	-0.02	0.11	1.00	0.886	(-0.23, 0.20)
	Cash assistance	-0.01	0.09	1.00	0.953	(-.20, 0.18)
	Head of household	-0.03	0.11	1.00	0.827	(-0.25, .20)
	Decision-making	0.00	0.03	1.00	1.000	(-0.56, 0.75)
Domestic violence (n =3,282)						
	Worn a mask	-0.10	0.20	0.90	0.614	(-0.47, 0.27)
	Sex	-0.35	0.14	0.70	0.011*	(-0.61, -0.08)
	Ever-attended school	0.34	0.13	1.40	0.010*	(0.08, 0.61)
	Safety	-0.73	0.07	0.48	0.001*	(-0.88, -0.60)
	Age	-0.57	0.18	0.56	0.002*	(-0.93, -0.21)
	Head of household	0.05	0.17	1.05	0.772	(-0.28, 0.38)
Worry (n = 3,208)						
	Worn a mask	0.13	0.11	1.14	0.240	(-0.09, 0.35)
Safety (n =3,181)						
	Worn a mask	0.00	0.13	1.00	0.986	(-0.26, 0.26)
	Worry	-0.23	0.06	0.79	0.001*	(-0.35, -0.11)
Worn a mask (n =3,174)						
	Sex	0.12	0.14	1.13	0.381	(-0.15, 0.40)
	Ever attended school	0.03	0.14	1.03	0.819	(-0.23, 0.30)
	Age	-0.02	0.15	0.98	0.904	(-0.32, 0.28)
	Cash assistance	0.08	0.13	1.10	0.509	(-0.17, 0.34)
	Years since migration	-0.02	0.25	0.98	0.408	(-0.68, 0.28)
	Head of household	0.02	0.16	1.02	0.873	(-0.30, 0.33)
	Decision-making	-0.04	0.05	0.96	0.375	(-0.14, 0.05)
Cash assistance (n = 3,290)						
	Sex	-0.26	0.08	0.77	0.001*	(-0.41, -0.11)
	Age	0.07	0.09	1.07	0.452	(-0.12, 0.26)
	Years since migration	0.29	0.14	1.34	0.034*	(0.02, 0.55)
Head of household (n = 3,290)						
	Cash assistance	0.09	0.09	1.01	0.349	(-0.09, 0.27)
Decision-making (n =3,177)						
	Head of household	-0.20	0.05	0.81	0.001*	(-0.31, -0.09)

OR = Odds Ratio, CI= Confidence Interval

[1]95% CI for coefficient

*Significant at $p<0.05$

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