

Title: Predictors and barriers for the management of non-communicable diseases among older Syrian refugees amidst the COVID-19 pandemic in Lebanon: A cross-sectional analysis of a multi-wave survey

Authors: Stephen J. McCall¹, Tanya El Khoury^{1*}, Noura Salibi^{1*}, Berthe Abi Zeid¹, Maria El Haddad¹, Marwan F. Alawieh³, Sawsan Abdulrahim^{4**}, Monique Chaaya^{2**}, Hala Ghattas^{1**}, Abba Sibai^{2**}

Affiliations:

¹Center for Research on Population and Health, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon

²Department of Epidemiology and Population Health, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon

³Norwegian Refugee Council (NRC), Beirut, Lebanon

⁴Department of Health Promotion and Community Health, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon

***Contributed equally **Senior authors (Listed alphabetically)**

Corresponding author: Stephen McCall, Center for Research on Population and Health, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon

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Key points (99/100)

Question: What are the predictors and barriers to managing NCDs as an older Syrian refugee in Lebanon?

Findings: This nested cross-sectional study assessed the predictors and barriers to managing any NCD, which included hypertension, diabetes, history of cardiovascular disease and chronic respiratory disease. Predictors included age, no cash assistance, household water insecurity, household food insecurity and having multiple chronic diseases. Primary reasons for not taking medications were unaffordability of the medication and belief medication was no longer required.

Meaning: Context-appropriate assistance is required to overcome financial barriers and enable equitable access to healthcare and medication required to manage NCDs.

Abstract (350/350)

Importance: Older Syrian refugees have a high burden of non-communicable diseases and economic vulnerability.

Objective: This study aimed to develop and internally validate a predictive model of the inability to manage non-communicable diseases (NCDs) in older Syrian refugees, and to describe barriers to adherence to NCD medication.

Design: A nested cross-sectional study within a longitudinal study.

Setting: Lebanon.

Population: Syrian refugees aged 50 years or older residing in Lebanon who self-reported having hypertension, diabetes, history of cardiovascular disease (CVD) or chronic respiratory disease (CRD).

Methods: All households with refugees aged 50 years or older who received humanitarian assistance from a non-governmental organization were invited to participate in a study examining the impact of COVID-19 on older Syrian refugees. Data were collected through telephone surveys between September 2020 and January 2021. The study outcome was self-reported inability to manage hypertension, diabetes, CVD or CRD. Predictors of inability to manage any NCD were assessed using a logistic regression models. The model was internally validated using bootstrapping techniques, which gave an estimate of optimism. The optimism-adjusted discrimination and calibration of the model were presented using C-statistic and calibration slope (C-slope), respectively.

Results: Out of 3,222 older Syrian refugees, 1,893 reported having at least one NCD including 43% who had hypertension, 24% diabetes, 24% history of CVD, and 11% CRD. There were 387 (20%) participants who were unable to manage at least one of their NCDs. Predictors for inability to manage NCDs were age, non-receipt of cash assistance, household water insecurity, household food insecurity, and having multiple chronic diseases. The model's adjusted C-statistic was 0.65 (95%CI:0.62-0.67) and C-slope was 0.88 (95%CI:0.73-1.03). The prevalence of non-adherence to medication was 9% and the main reasons were unaffordability of medication (41%) and the belief that they no longer required the medication after feeling better (22%).

Conclusions: This study identified that the predictors of inability to manage NCDs among older Syrian refugees in Lebanon are mainly related to financial barriers, which aids the targeting of assistance and interventions. Context-appropriate assistance is required to overcome financial barriers and enable equitable access to medication and healthcare.

Keywords: *Non-Communicable Diseases, Chronic Diseases, Syrian Refugees, Older adults, Vulnerable populations, Lebanon*

Introduction

Forcibly displaced populations have been recognized as vulnerable populations to the direct and indirect impacts of the COVID-19 pandemic.¹⁻³ Furthermore, older refugees are particularly vulnerable as they have a higher prevalence of pre-existing chronic disease⁴ and have an increased risk of hospitalization and mortality due to COVID-19.⁵ Even prior to the COVID-19 pandemic, poor management of non-communicable diseases (NCDs) was a global public health concern.⁶ NCD self-management, including lifestyle changes and adherence to medication, has been shown to reduce premature mortality and morbidity.⁷⁻⁹ In refugee populations, however, NCD management is problematic due to the competing demands of basic needs such as access to adequate food, shelter, protection and water. Furthermore, NCD self-management in refugee populations is exacerbated by poor access to health services, language barriers between the patient and the healthcare provider, being food insecure, and having limited health literacy.¹⁰

In Lebanon, large populations of Syrian refugees are situated in the Bekaa valley and North Lebanon and reside in informal tented settlements or residential areas.¹¹ These are areas where the Lebanese health system was already stretched to meet the needs of the host population, and since 2011 have faced unprecedented challenges in meeting the needs of Syrian refugees.¹² Refugees have access to subsidized healthcare services and medication mainly through the United Nations High Commissioner for Refugees (UNHCR); however, despite these subsidies they are often unable to cover the full cost of needed medication.¹³ The COVID-19 pandemic and the recent major economic crisis in Lebanon have impacted access to healthcare and supply of essential medicines¹⁴, which is likely to further exacerbate refugees' ability to manage chronic conditions.

Studies on the management of NCDs among refugees in Lebanon and the Middle East, a region that hosts one of the largest refugee populations, are scarce.¹⁵ Understanding the barriers and predictors of self-reported management of NCDs among older refugees, a population at high-risk, is important to allow resource allocation and contextualized humanitarian assistance to prevent premature mortality and morbidity. The present study aimed to elucidate the predictors of inability to manage NCDs in older Syrian refugees and describe barriers to accessing healthcare and managing these chronic conditions.

Methods

Study design, sample and study population

This was a cross-sectional study nested within a multi-wave longitudinal study, which aimed to examine the vulnerabilities of older Syrian refugees residing in Lebanon during the COVID-19 pandemic.¹⁶ The study included Syrian refugees aged 50 years and older, who were identified from a full listing of beneficiary households of a non-governmental humanitarian organization [Norwegian Refugee Council].

Within the beneficiary sampling frame, all households who had used services offered by the humanitarian organization between 2017 and 2020 and included an adult aged 50 years or older were contacted and were included in the study. If there were multiple adults aged 50 years or older within a household, one person was randomly selected and was assessed for capacity to consent, invited to participate, and provided oral consent to enter the study. The same respondent was approached to complete a telephone survey across different time points. The data for the present analysis were extracted from Waves 1 (September 2020-December 2020) and Waves 2 (October 2020-January 2021). This study was reported according to the TRIPOD reporting guideline for prediction modelling.¹⁷

Out of 17,384 households initially contacted at wave 1, 4,010 eligible beneficiary Syrian refugees aged 50 years and over were invited to participate; of those, 3,322 beneficiaries consented and participated in both waves 1 and 2 (Figure 1), 1893 respondents reported having at least one NCD and 387 reported being unable to manage at least one NCD.

Data sources

The questionnaire for each wave was developed using a combination of sources including validated questionnaire modules, contextually specific questions, and community-identified priorities. The survey was co-created by academics, humanitarian actors, local government officials, and focal points from the refugee communities. Modules varied between the waves; the demographic module was in wave 1, and the NCD and access to healthcare module was included in wave 2. The questionnaire was piloted internally with data collectors and local community focal points to ensure face validity. Trained data collectors administered the surveys in Arabic and entered data into structured electronic data collection forms hosted on Kobo toolbox. Data entry checks and monitoring were performed for quality assurance.

Outcome Measures

The outcome variable was self-reported inability to manage any NCD. This included the following conditions: hypertension, diabetes, cardiovascular disease or chronic respiratory disease. For each

condition, participants were asked the following question “Are you able to manage your [Insert condition]?”.

Candidate predictors

Using the literature, 16 potential predictors were identified for inability to manage NCDs and were included for model development. These included: age (continuous); sex (male/female); residence (outside/inside tented settlements); education (preparatory and elementary/never attended); smoking status (smoker/ex-smoker/never-smoker); number of chronic conditions (one/two/three or more); hypertension (yes/no); diabetes (yes/no); chronic respiratory disease (yes/no); cardiovascular disease (yes/no); living arrangement (alone/with someone); food insecurity measured using the Food Insecurity Experience Scale¹⁸ (severe food insecurity (raw score 7-8)/mild-moderate food insecurity (raw score 4-6)/food secure raw score 0-3)); employment status (yes/no); water insecurity measured using the short-form Household Water Insecurity Scale¹⁹ (yes/no); receipt of cash or voucher assistance (yes/no) and family debts (yes/no).

Missing data

The largest amount of missing data in any variable was 1.8%, and these were assumed to be missing at random, so we used complete case analysis.²⁰

Statistical Analysis

Absolute frequencies and proportions were presented alongside odds ratios and their 95% confidence intervals using unadjusted logistic regression models, which examined the odds of inability to manage any NCD for each candidate predictor.

All variables were categorical other than age, which had a linear relationship with inability to manage NCD. All candidate predictors of inability to manage NCD were entered into multivariable logistic regression models and removed using a stepwise backwards method using a $P < 0.157$ ²¹. This has been used as a proxy for the Akaike Information Criterion (AIC), where predictors are removed to obtain the lowest AIC. Multicollinearity was assessed using correlation matrices and variance inflation factor; a variance inflation factor > 5 indicated collinearity. Number of NCDs and each separate chronic condition were modelled in two separate models. Smoking status was removed from the final model to improve model fit and prevent overfitting.²²

The final model’s performance in terms of discrimination was assessed using the C-statistic, which ranges from 0.5 – 1.0 (this is also known as the area under the receiver operating characteristic curve (AUC-ROC)), where a value of 1.0 represents perfect discriminative ability between those with and without the

outcome, and 0.5 denotes a discriminative ability equal to chance. We also assessed the calibration of the final model, which describes the agreement between observed outcomes and predictive probabilities.²³ This was assessed using calibration plots, which categorizes patients into ten groups according to predictive probabilities, where the mean predicted risk within each of these groups is plotted against the mean observed proportion of events.^{23,24} If there is a perfect calibration, the graph will show a diagonal line where there is a slope of 1 and intercept of 0. A slope <1 suggests overfitting in the model, this is where respondents with high risk of the outcome have overestimated risk predictions while those with low risk of the outcome have underestimated risk predictions. In addition, we assessed whether there was an overall difference between the observed number of events and the average predictive risk using the calibration-in-the-large.

The final model's selection of predictors, discrimination and calibration estimates were internally validated using bootstrap methods; where 500 bootstrap samples with replacement were used to validate the model selection process and generate an estimate of optimism, optimism adjusted estimates of C-statistic and optimism-adjusted calibration plot were generated.^{20,23,25,26} Bootstrap shrinkage was applied to the final apparent model and the modified beta coefficients and odds ratios were presented. All analyses were conducted using Stata/SE 17.

Ethical approval

This study was approved by the American University of Beirut Social and Behavioral Sciences Institutional Review Board [Reference: SBS-2020-0329]. Refugees are considered vulnerable populations, and extensive efforts were made to ensure autonomy was respected throughout the data collection.

Results

Characteristics of the population

Out of a total of 1,893 participants, 387 noted that they were unable to manage their condition through any means (lifestyle or medication) (Table 1). Among these participants, 174 were unable to manage their NCD through medication. The study sample median age was 59 (IQR: 54-65), and 1089 (58%) were women. Hypertension topped the listed of reported NCDs (74%), this was followed by cardiovascular disease (42%), diabetes (41%), and chronic respiratory disease (19%).

Among 174 participants who were unable to manage their NCD through medication, the primary reasons included unaffordability of the medication (40.8%), feeling better and not needing the medication (22.4%) and medication not always available (14.4%). Unaffordability of medication remained the primary reason for hypertension, diabetes and cardiovascular disease when examining disease-specific reasons for non-adherence to medication (Figure 2a). In addition, there were 295 participants who were unable to manage their NCDs and unable to access primary health care. The primary reason for being unable to access primary care in this group was the cost of the doctor's visits, medication or tests (80.7%) (Figure 2b).

Unadjusted analysis

Unadjusted odds ratios of inability to manage NCD and 95% confidence interval of each potential predictor are reported in Table 1. This study identified different characteristics among older refugees that had increased odds of being unable to manage at least one NCD. These included being female compared to male (OR:1.28 (95% CI: 1.02-1.61)), having multiple chronic conditions (OR:1.39 (95% CI: 1.01-1.92)) compared to having none, having a history of cardiovascular disease (OR:1.38 (95% CI: 1.10-1.72)), diabetes (OR:1.31 (95% CI: 1.05-1.64)) or chronic respiratory disease (OR:1.98 (95% CI: 1.53-2.58)) compared to not having an NCD, not having received cash (OR:1.48 (95% CI: 1.17-1.87)) compared to receipt of assistance, and having experienced severe food insecurity compared to food security (OR:3.74 (95% CI: 2.14-6.55)) and household water insecurity (OR:1.66 (95%CI: 1.31-2.11)) compared to being water secure.

Predictors and model performance

The final model retained eight predictors of inability to manage NCD, which included age, self-reported hypertension, diabetes, cardiovascular disease and chronic respiratory disease (the more NCDs an individual possesses the higher the predicted risk of inability to manage them), severe household food insecurity, no receipt of cash assistance, and household water insecurity (Table 2). The final model had a moderate discriminative ability with an optimized adjusted C-statistic of 0.65 (95% CI: 0.62 – 0.68)

(Table 2 and Figure 3a). The calibration plot without correction for optimism is shown in Figure 3b and the optimism adjusted calibration plot is shown in Figure 3a which depicts the expected performance of the final model in future samples.^{23,27} The calibration slope after adjustment for optimism was 0.88 (95% CI: 0.73 - 1.03) (Table 2 and Figure 3a). The odds ratios and coefficients of the final model have been adjusted for overfitting and are presented in Table 2.

All the included predictors had the expected direction coefficient with the outcome. In particular, receiving no cash assistance, having household water insecurity or severe food insecurity had positive coefficients, and hence increased the likelihood of older Syrian refugees being unable to manage their NCDs. Age had a small negative coefficient with inability to manage NCDs.

To illustrate, the predicted risk of inability to manage NCDs for a Syrian refugee aged 60 years and over, with all four NCDs, severe household food insecurity, no receipt of cash assistance and household water insecurity was 51% (using the optimized-adjusted coefficients). Whilst the predicted risk of inability to manage NCDs for a Syrian refugee aged 60 years old with all four NCDs, who has received cash assistance and had no food insecurity and no household water insecurity was 19% (using the optimized-adjusted coefficients). For a Syrian refugee aged 60 years or old who had hypertension and diabetes without other NCDs the predicted risk was 9%.

In a sensitivity analysis, total number of chronic diseases was modelled as a categorical variable rather than each individual NCD. The predictors of this alternative model are: the number of chronic diseases, food insecurity and non-receipt of cash assistance. However, the discrimination (C-Statistics: 0.63 (95% CI: 0.60-0.66)) and calibration (C-Slope 0.86 (95%CI: 0.71-1.06)) of the optimized-adjusted model were poorer than the final model (Supplementary table 1).

Discussion

This study has identified predictors of inability to manage NCDs among older Syrian refugees in Lebanon during the COVID-19 pandemic. Younger age, not receiving cash assistance, household water insecurity, severe household food insecurity and co-morbidity were predictors of inability to manage NCDs. One of the key barriers for older Syrian refugees to adhere to medication was cost of the medication and beliefs that they did not require the medication anymore after feeling better. In addition, for older Syrians who were unable to access primary healthcare, the cost of the visit, tests or medications was the main reason.

Results in context

Our study showed that Syrian refugees who did not receive cash assistance had a higher likelihood of being unable to manage their NCDs. This finding concurs with a study conducted in Lebanon among Syrian refugees showing that receiving multipurpose cash assistance (MPC) lead to an increased access to primary health care for various illnesses, including chronic diseases.²⁸ The majority of Syrian refugees rely on cash assistance to cover their basic needs such as food, rent, water and healthcare.²⁹ Hence, one possible explanation is that without cash assistance resources are limited to the acute and immediate livelihood needs rather than managing a chronic disease. According to UNHCR, medications for chronic diseases are provided with a small handling fee to Syrian refugees in Lebanon. However, those with conditions requiring long term, high cost treatments, mainly related to chronic diseases, are not covered, which is a main gap to be addressed in the humanitarian response.¹² Furthermore, our results showed that affordability was the primary reason for not taking chronic disease medication or attending primary healthcare. Similarly, studies performed in Lebanon and Jordan among Syrian refugees showed that the inability to afford cost of the treatment and medications primarily prevent seeking health care for chronic disease.^{13,30} It remains crucial for humanitarian agencies to remove the financial barriers for older Syrian populations in accessing required healthcare and essential chronic disease medication.

Water insecurity and severe food insecurity among Syrian refugees are markers of severe economic vulnerability and low socioeconomic status.³¹⁻³³ As a result, households that are unable to meet their basic needs for food and water are unlikely to be able to use a proportion of their household income to pay for subsidized NCD medication. Furthermore, food insecurity has been shown to reduce overall dietary quality and diversity.³⁴⁻³⁶ Thus, food insecurity prevents refugees from modifying and improving their diet quality to manage their chronic disease.

Multimorbidity is common in older adults and it has implications on the self-management of these conditions.³⁷ Our results are consistent with previous research, which showed that older adults with multimorbidity had reduced adherence to the management of their NCDs.³⁸ Polypharmacy and complex

dosing regimens are common in older age,³⁹ these reduce compliance³⁸ as each medication may have its own special instructions to follow,⁴⁰ which can be increasingly difficult in older age.

Although there was a statistical association between younger age and self-management of NCDs, the magnitude of the estimand was small. Previous studies have shown that younger age was associated with lower medication adherence for depression⁴¹ and heart failure⁴². While other studies have suggested that there is no association between age and chronic medication adherence.

There is growing recognition that management of NCDs among refugee populations represents a challenge for humanitarian agencies, as these are costly to manage with limited resources available for healthcare¹³. Further advocacy is required to donor organizations to prioritize NCDs in this population so that the health and wellbeing of refugee older population can be maximized. With the recent and unfortunate war in Ukraine and worsening of humanitarian catastrophe, there have been growing calls for immediate and rapid access to medicines for individuals with NCDs.⁴³ In this context, reinforcing self-management protocols and health literacy, alleviating food insecurity and enabling dietary diversity are required to prevent secondary complications of unmanaged NCDs. Moreover, further studies targeting NCD interventions among this vulnerable population in the Middle East are crucial to reducing the disease burden especially in view of the very high prevalence of these conditions.

Strengths and Limitations

The present study has enhanced our understanding of the predictors of inability to manage NCDs among older Syrian refugees in Lebanon and fills a major gap in the international literature. Furthermore, this study is one of the largest on older Syrian refugees in the published literature with a high response rate of >85% among those who were eligible.¹¹ The study was limited as the predictive model had a moderate discriminative ability, which may be explained by missing predictors, such as perception of medication regime as being complicated, not knowing the purpose of the medication, accessibility issues, side effects due to medication, lack of healthcare support, lack of trust in doctors, stressful living conditions and time since diagnosis^{15,30,44,45}. Furthermore, the calibration of the model showed overfitting and may not perform well in future samples, hence, future studies should aim to be larger if they wish to develop a predictive model. Another limitation was that data were self-reported to data collectors so misclassification in the data is possible; however, we tried to limit this through data quality and consistency checks.

Conclusions

This study highlights that inability to manage NCDs was mainly related to financial barriers. The predictors from this study will allow healthcare professionals and humanitarian organizations to identify older refugees who are at a greater risk of being unable to manage their NCDs. These vulnerable groups should have the necessary assistance and support to allow an improvement in medication adherence and equitable access to healthcare. Furthermore, investment in NCD healthcare services in primary care will be beneficial to the prevention of premature mortality and morbidity from NCDs in Lebanon and elsewhere.

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Table 1. Characteristics and vulnerability markers of older Syrian refugees by the ability to manage their non-communicable disease

		Total n=1,893	Able to manage NCD (n=1,506(79.6%))		Unable to manage NCD (n=387(20.4%))		Odds ratio*	95% CI	P-value
		n (%)	n (%)		n (%)				
Socio-demographics									
Age (n= 1893)	Median (IQR)	59 (54-65)	59	(54-65)	58	(53-64)	0.98	(0.97- 1.01)	0.087
Sex									
	Male	804 (42.5)	658	(81.8)	146	(18.2)	1		
	Female	1,089 (57.5)	848	(77.9)	241	(22.1)	1.28	(1.02-1.61)	0.034
Head of Household									
	No	437 (23.1)	345	(79.0)	92	(21.0)	1		
	Yes	1,456 (76.9)	1,161	(79.7)	295	(20.3)	0.95	(0.73-1.24)	0.719
Governorate									
	North/Akkar	727 (38.4)	565	(77.7)	162	(22.3)	1		
	South/Nabatieh	312 (16.5)	236	(75.6)	76	(24.4)	1.12	(0.82-1.53)	0.466
	Beqaa/Baalbek-Hermel	826 (43.6)	684	(82.8)	142	(17.2)	0.72	(0.56-0.93)	0.012
	Beirut/Mount Lebanon	28 (1.5)	21	(75.0)	7	(25.0)	1.16	(0.48-2.78)	0.735
Residence									
	Inside informal tented settlements	689 (36.4)	552	(80.1)	137	(19.9)	1		
	Outside informal tented settlements	1,204 (63.6)	954	(79.2)	250	(20.8)	1.06	(0.84-1.33)	0.648
Living arrangement									
	Living with others	1,859 (98.2)	1,479	(79.6)	380	(20.4)	1		
	Living alone	34 (1.8)	27	(79.4)	7	(20.6)	1.01	(0.44-2.33)	0.983
Level of Education									
	Never attended school	1,013 (53.6)	797	(78.7)	216	(21.3)	1		
	Elementary	443 (23.4)	354	(79.9)	89	(20.1)	0.93	(0.70-1.22)	0.595
	Preparatory & Secondary+	434 (23.0)	352	(81.1)	82	(18.9)	0.86	(0.65-1.14)	0.295
	Missing		3		0				
Smoking status									
	Current smoker	538 (28.4)	430	(79.9)	108	(20.1)	1		
	Ex-smoker	255 (13.5)	213	(83.5)	42	(16.5)	0.79	(0.53-1.16)	0.227
	Non-smoker	1099 (58.1)	862	(78.4)	237	(21.6)	1.09	(0.85-1.41)	0.487
	Missing		1		0				
Self-reported health									
Number of chronic conditions									
	1	481 (26.0)	415	(86.3)	66	(13.7)	1		
	2	728 (39.3)	596	(81.9)	132	(18.1)	1.39	(1.01-1.92)	0.043
	3 or more	642 (34.7)	466	(72.6)	176	(27.4)	2.37	(1.74-3.24)	<0.001
	Missing		29		13				
Hypertension									
	No	498 (26.4)	402	(80.7)	96	(19.3)	1		
	Yes	1,388 (73.6)	1,098	(79.1)	290	(20.9)	1.1	(0.85-1.43)	0.443
	Missing		6		1				

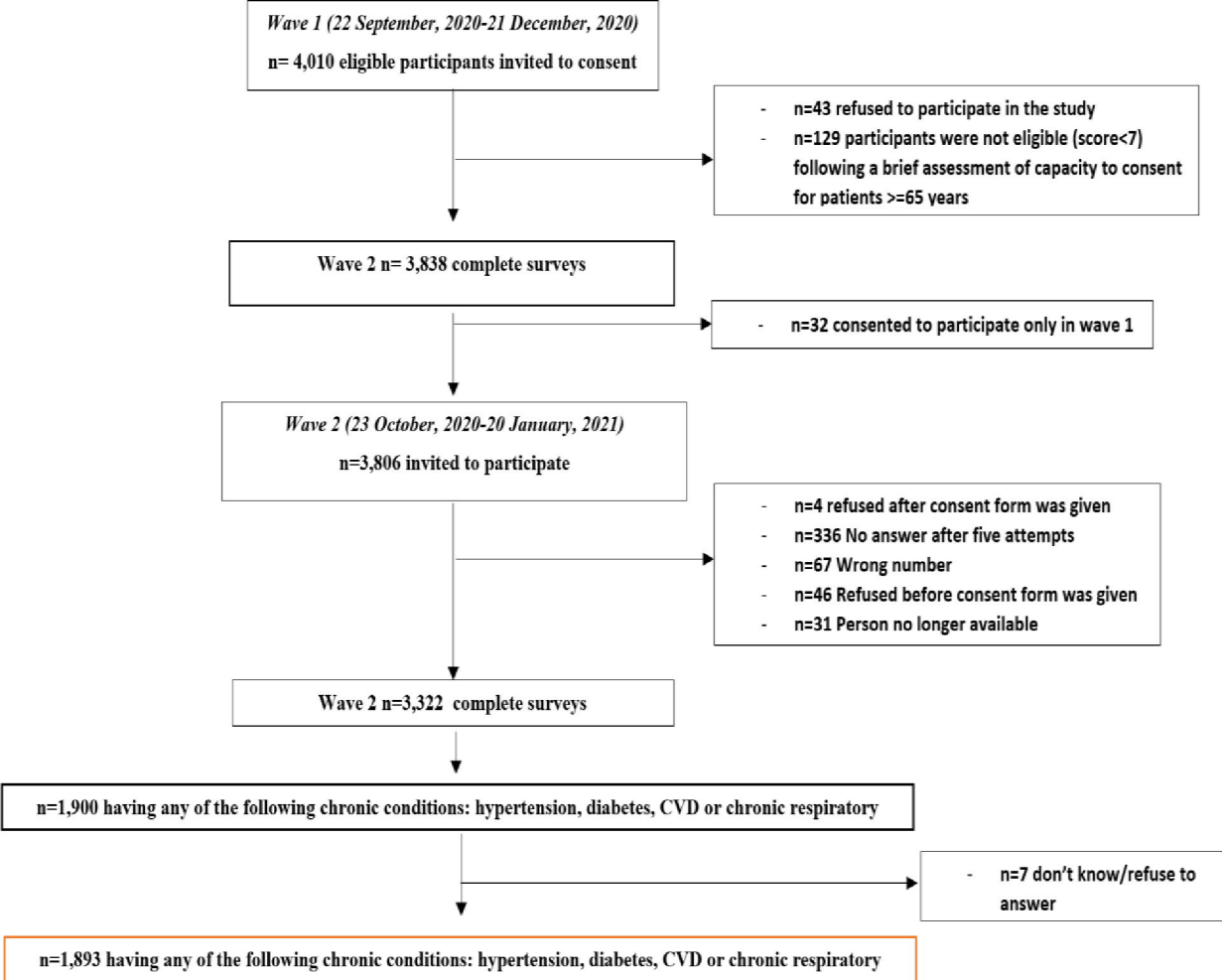
Cardiovascular Disease								
No	1,089 (57.8)	891	(81.8)	198	(18.2)	1		
Yes	794 (42.2)	608	(76.6)	186	(23.4)	1.38	(1.10-1.72)	0.005
Missing		7		3				
Diabetes								
No	1,105 (58.6)	901	(81.5)	204	(18.5)	1		
Yes	781 (41.4)	602	(77.1)	179	(22.9)	1.31	(1.05-1.64)	0.018
Missing		3		4				
Chronic Respiratory Diseases								
No	1,537 (81.4)	1,259	(81.9)	278	(18.1)	1		
Yes	351 (18.6)	244	(69.5)	107	(30.5)	1.98	(1.53-2.58)	<0.001
Missing		3		2				
Structural vulnerabilities								
Family debts								
No	71 (3.8)	59	(83.1)	12	(16.9)	1		
Yes	1,817 (96.2)	1445	(79.5)	372	(20.5)	1.27	(0.67-2.38)	0.464
Missing		2		3				
Receipt of cash or voucher assistance								
Yes	1,315 (69.5)	1073	(81.6)	242	(18.4)	1		
No	576 (30.5)	432	(75.0)	144	(25.0)	1.48	(1.17-1.87)	0.001
Missing		1		1				
FIES Categorical household food insecurity								
Food security	148 (8.0)	133	(89.9)	15	(10.1)	1		
Mild to moderate food insecurity	1,071 (57.6)	904	(84.4)	167	(15.6)	1.64	(0.94-2.86)	0.083
Severe food insecurity	640 (34.4)	450	(70.3)	190	(29.7)	3.74	(2.14-6.55)	<0.001
Missing		19		15				
Household Water Insecurity Experiences Scale								
No household water insecurity	1,372 (72.7)	1124	(81.9)	248	(18.1)	1		
Household water insecurity	515 (27.3)	377	(73.2)	138	(26.8)	1.66	(1.31-2.11)	<0.001
Missing		5		1				

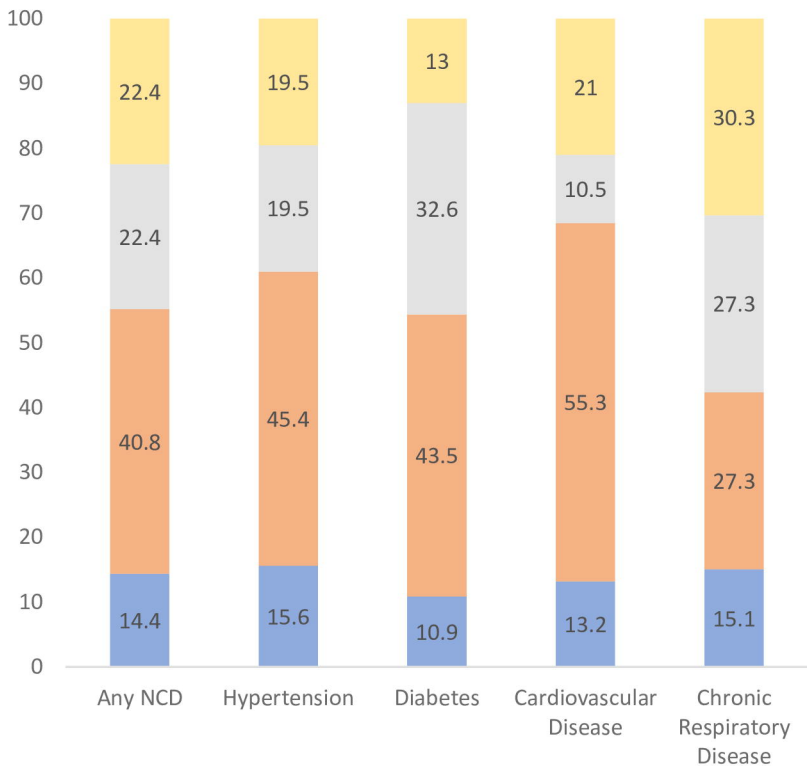
*Dependent (outcome) variable is unable to manage chronic disease compared to able to manage chronic disease.

Table 2. Multivariable model for predicting inability to manage any NCD

	Apparent model					Model adjusted by bootstrap shrinkage				
	Parameter estimate	(95%CI)	Odds Ratio	95% CI	P-value	Parameter estimate	(95% CI)	Odds Ratio	95% CI	P-value
Age	-0.01	(-0.03 - 0.00)	0.99	(0.97-1.00)	0.14	-0.01	(-0.02 - 0.00)	0.99	(0.98-1.00)	0.142
Self-reported medical history										
Hypertension	0.35	(0.06 - 0.64)	1.42	(1.07 - 1.89)	0.02	0.31	(0.06 - 0.56)	1.36	(1.06-1.75)	0.016
Diabetes	0.35	(0.11 - 0.60)	1.42	(1.11 - 1.81)	<0.001	0.31	(0.09 - 0.52)	1.36	(1.10-1.68)	0.005
Cardiovascular disease	0.22	(-0.02 - 0.46)	1.24	(0.98 - 1.58)	0.08	0.19	(-0.02 - 0.40)	1.21	(0.98-1.50)	0.075
Chronic respiratory disease	0.8	(0.50 - 1.09)	2.22	(1.66 - 2.96)	<0.001	0.70	(0.44 - 0.95)	2.01	(1.56-2.59)	<0.001
FIES Categorical household food insecurity										
Food secure	Ref					Ref				
Mild to moderate food insecurity	0.5	(-0.08 - 1.08)	1.64	(0.92 - 2.94)	0.09	0.44	(-0.07 - 0.94)	1.55	(0.93-2.57)	0.094
Severe food insecurity	1.21	(0.62 - 1.80)	3.37	(1.87 - 6.07)	<0.001	1.06	(0.55 - 1.58)	2.90	(1.73-4.85)	<0.001
Household Water Insecurity Experiences Scale										
No household water insecurity	Ref					Ref				
Household water insecurity	0.2	(-0.06 - 0.46)	1.22	(0.94 - 1.59)	0.14	0.17	(-0.06 - 0.40)	1.19	(0.95-1.50)	0.137
Receipt of cash or voucher assistance										
Yes	Ref					Ref				
No	0.3	(0.05 - 0.55)	1.35	(1.05 - 1.73)	0.02	0.26	(0.04 - 0.48)	1.30	(1.04-1.62)	0.02
Intercept	-2.48	(-3.63 - -1.33)	0.08	(0.03 - 0.26)	<0.001	-2.33	(-2.45 - -2.22)	0.10	(0.09-0.11)	<0.001
Calibration and discrimination of models										
	95% CI					95% CI				
C-statistic /Area under the curve	0.67	(0.638-0.701)				0.651	(0.621 - 0.677)			
C-slope	1	(0.805-1.195)				0.876	(0.728 - 1.033)			
Calibration in the large	0	(-0.119 - 1.119)				0.005	(-0.111 0.128)			

*Reference category for each self-reported medical condition is “no”.



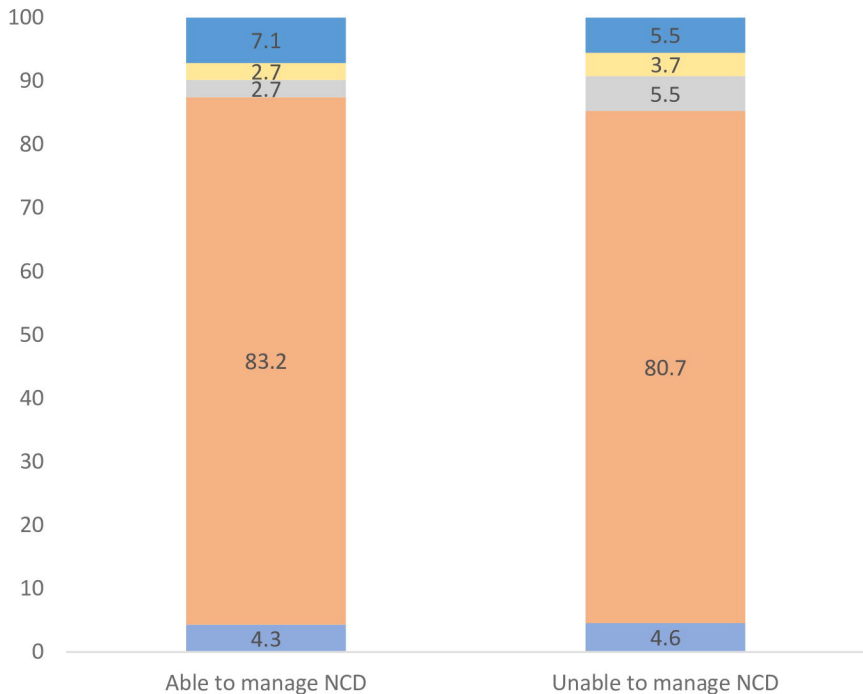


Other*

I felt better and stopped

Cannot afford medication in Lebanon

Medication is not always available



■ Other*

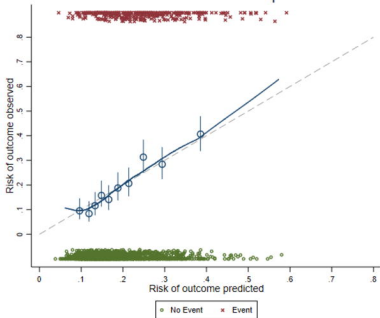
■ Fear of getting infected by COVID19

■ Not accepted/Long waiting time

■ Doctors visit fees/ Cost of drugs/diagnostic tests/ treatment

■ Distance of health center/transportation cost

Calibration plot



Performance measures:

Overall:
Brier_{model} (%) = 4.4

Discrimination:
C-Statistic = 0.651

Calibration:
E:O ratio = 0.996
Slope = 0.876
CITL = 0.005

