Prevalence of Non-Communicable Diseases and Associated Medication Use Among Syrian Refugees in Lebanon: An Analysis of Country-Wide Data from the Sijilli Electronic Health Records Database

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Research

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Abstract

Background

Globally, the number of forcibly displaced individuals has reached 70.8 million. Lebanon, a middle income country, hosts the highest number of refugees per capita worldwide. The majority of refugees are Syrians who have fled the Syrian war that started in 2011. The migration journey exposes refugees to increased susceptibility to a wide range of medical issues including non-communicable diseases (NCDs). This study aims to determine the prevalence of NCDs among adult Syrian refugees in Lebanon, with a focus on hypertension, diabetes, cardiovascular diseases (CVD) and cancer. The study also aims to explore factors potentially related to the prevalence figures and understand the medication use associated with these morbidities.

Methods

This study is a secondary analysis of de-identified data from the “Sijilli Electronic Health Records for Refugees” Database comprising data on 10,082 Syrian refugees from across informal tented settlements located all over Lebanon. A total of 3,255 records of Syrian refugees aged above 18 years old and reporting having at least one condition of the following were included in the analysis: hypertension, diabetes, Cardiovascular diseases or cancer. Pearson’s Chi-square, independent t-test, and multivariate logistic regressions were used for data analysis.

Results

Hypertension was the most prevalent (10.0%) NCD among refugees, and a higher age was associated with higher NCDs prevalence. A strong linkage has been reported between smoking status and alcohol intake, and increased risk for NCDs. Study findings also revealed that the highest prevalence of hypertension, diabetes and CVDs was observed among refugees originating from Idlib, Aleppo and Homs. An association between adherence to medication and location of diagnosis was noted, with females who were diagnosed before moving to Lebanon being more likely to take corresponding medications compared to those diagnosed in Lebanon, with no difference reported among males.

Conclusions

Our findings suggest that efforts should be directed towards the employment of innovative low-cost approaches for NCD detection and control among refugees, with a focus on the importance of adherence to medication. Such efforts remain imperative to control the increasing burden of NCDs amongst refugee populations and improve equitable access to NCD services.

Background

The Global Refugee Status

Globally, the number of forcibly displaced individuals including refugees has reached the highest levels on record (1). Official figures from the United Nations High Commissioner for Refugees (UNHCR) indicate that 70.8 million individuals have been forcibly displaced (1). Among these are nearly 26 million refugees, half of whom are below the age of 18 (1). Notably, the highest number of refugees has been hosted by low- and middle-income countries (LMICs) (2), with inconsistent and varying numbers reported (3).

The majority of refugees are of Syrian nationality (4) who have fled to Syria’s neighboring countries-namely Lebanon, Jordan, Egypt, Turkey and Iraq since the eruption of the Syrian conflict in 2011 (5). As a result, a significant internal and external displacement of over 13 million Syrian refugees has been witnessed (6). Approximately, 6.6 million Syrian refugees were displaced within Syria itself (6) and 5.6 million escaped to Syria’s neighboring countries (7), which are currently heavily burdened, hosting nearly 95% of the total number of registered Syrian refugees worldwide (6). With such unprecedented figures, the Syrian crisis has been widely described as ‘one of the biggest and worst humanitarian crises of our time’ (8).

The Context of Lebanon

Lebanon, an LMIC with a population of over 4 million (9), has become, as reported in 2015 (10), the country with the highest concentration of refugees per capita worldwide (11). Recent data shows that around 1.5 million Syrian refugees reside in Lebanon (11), a number equivalent to 25% of Lebanon's population size (12, 13). More than half of them are women and children who are in urgent need for healthcare services (14). Additionally, nearly 450,000 Palestinian refugees among which 50,000 are Palestinian refugees from Syria (PRS) (15), and around 18,000 Iraqi and Sudanese refugees among others reside in Lebanon (11).

Many Syrian refugees have been settled in the poorest and most underserved areas in Lebanon, leading to an increased socio-economic vulnerability of both refugees and host communities (16). The dense distribution of refugees in such areas with suboptimal capacities created social tensions and competition for access to basic healthcare services (17, 18). This, in turn, overburdened the Lebanese healthcare system, which already suffers from significant fragmentation prior to the influx of Syrian refugees. As a result, the already limited capacities characterized by insufficient staff, medications and equipment, made it even more challenging to deal with the additional load (9). An estimated 50% increase in healthcare services utilization was reported as a result of the influx of Syrian refugees to Lebanon (19). Of specific note, a two-fold increase in services occurred at the primary healthcare level related to vaccination, management of communicable diseases, and non-communicable diseases (NCDs), including hypertension, cardiovascular diseases (CVDs), diabetes, chronic respiratory diseases and arthritis (19).

In response to the exponential increase in demand for healthcare services, joint efforts have been made among different healthcare stakeholders present in Lebanon to respond to the needs of refugee populations and to ensure the widest possible coverage of services (20). Yet, these efforts were inefficient (21) due to several impediments (22), with inability to pay out-of-pocket costs, and lack of knowledge about available healthcare services reported as the major barriers to access among refugees (23).

Disease Profile of Refugees

Refugees are at an increased risk of health problems due to the traumatic and stressful events they are exposed to pre-, during- and post- the migration journey, coupled with the compromised access to healthcare in host countries (24). Evidence suggests that communicable diseases, NCDs (25, 26), mental health disorders mainly depression and post-traumatic stress disorder (PTSD) (27), obstetrics and gynecologic (OBGYN) conditions, accidental injuries, malnutrition and anemia (28) emerge as the top prevalent health conditions among refugees. Women, children and older adults are particularly vulnerable to develop such serious health conditions (29).

Over the past decades, refugee populations underwent an epidemiologic transition from communicable diseases, maternal, neonatal, and nutritional conditions to NCDs (30–32). As such, a steady rise in NCDs burden has been marked in the refugee context and calls for specific attention (9, 33). Recent evidence indicates that healthcare systems face challenges in addressing and managing these diseases (33), mainly due to the high expenses and the limited resources available for refugee healthcare (30, 34).

Burden of Non-communicable Diseases (NCDs) Among Refugees

NCDs are the leading causes of morbidity and mortality worldwide (33, 35). Globally, over 70% of annual deaths are attributable to NCDs, mainly CVDs, diabetes, cancers, chronic respiratory diseases and cerebrovascular diseases (36, 37). The burden of NCDs is unevenly distributed between high-income countries (HICs) and LMICs, with around 85% of premature deaths occurring in LMICs (37). Notably, the effects of this heavy burden are more pronounced in fragile and conflict-affected countries in the Middle East and North Africa (MENA) region that are receiving large numbers of refugees fleeing conflict (33). High rates of NCDs have been reported among these countries with percentages of concomitant deaths reaching 89% in Lebanon (37).

There is a growing evidence that refugees are at high risk of developing NCDs (37). Although causes are not fully extrapolated, it is hypothesized that stress, acquired as a result of displacement, emerges as one of the contributing factors (38, 39). The poor living conditions accompanied by shortages in medication supplies (40), poor chronic diseases management, and improper lifestyle habits could be recognized as additional potential contributing factors to the occurrence and worsening of NCDs (41, 42).

Aspects of NCDs Among Syrian Refugees in Lebanon

The burden of NCDs is growing swiftly among Syrian refugees in Lebanon and the region (43). Previous studies found a high prevalence of reported hypertension, diabetes, CVDs and other NCDs amongst Syrian refugees in Lebanon (43, 44), and prevalence was most pronounced among adults above 40 (45). One study indicated that the prevalence rates reached 21% for hypertension,

11% for CVDs and 10% for diabetes (46). In Lebanon, prevalence of hypertension and diabetes has been estimated to be 28.8% (47–50) and 14.9% (51), respectively among the general population. The prevalence of hypertension in Syria was reported to be 24.9% (47–50), while diabetes and CVDs accounted for 8.8% (51) and 5.8%, respectively (52). Moreover, around 77% of total deaths in Syria were attributable to NCDs, with CVDs alone being responsible for 44% of total deaths (53). CVDs, as well, and type II diabetes are considered the leading causes of morbidity and mortality in Syria (45, 54), while cancer is responsible for 9% of total deaths in the country (55).

Although the prevalence of NCDs among the Syrian refugee population in Lebanon has reached alarming rates and regardless of the presence of healthcare actors to respond to the needs of the refugee population, very little is being done to control and manage these costly diseases which remain to be a heavy burden within this population (44).

Care-seeking and Associated Medication Use Among Syrian Refugees with NCDs in Lebanon

Given the large caseload of Syrian refugees with NCDs in Lebanon coupled with the high costs of providing NCD care, implications on the Lebanese healthcare system are substantial (56). In light of this, the Lebanese Ministry of Public Health (MoPH) and the UNHCR undertook measures in response to the Syrian crisis to provide primary healthcare services for Syrian refugees through the primary healthcare centers (PHCs) across the country's governorates at subsidized costs (44, 45, 57). The UNHCR pays 75% or up to 100% of hospitalization costs for the most vulnerable refugees and for those who need life-saving (9). However, due to limited funding, the UNHCR has insufficient capacities to provide health coverage for chronic conditions such as renal failures, diabetes and certain cancers, except for life-threating cases (9, 58). In parallel to the Lebanese MoPH system, international non-governmental agencies have been providing free-of-charge primary care for Syrian refugees with NCDs, including diabetes and hypertension, in both North Lebanon and in the Bekaa valley since early 2012 (57, 59), and in South of Beirut since 2013 (44).

Based on some evidence, care-seeking for NCDs among Syrian Refugees in Lebanon was high (82.9%), distributed as: 88.2% for diabetes, 82.6% for CVDs and 80.9% for hypertension (45). Comparable findings were reported with regards to NCD-associated medication use (60, 61); however, interval discontinuation of medications was documented (19, 62). Nonetheless, despite the reportedly high rates of healthcare seeking, Syrian refugees in Lebanon declared that they faced complications in seeking healthcare to manage their NCDs (44). The primary obstacle that limited these populations from seeking NCDs healthcare in Lebanon was the costs of NCDs treatment. It was stated that 33–77% of Syrian refugees in Lebanon suspended NCDs treatment due to high costs (61). Coupled with other barriers that involved transportation costs, limited capacities of healthcare facilities, and suboptimal NCDs health education, where only 39% of Syrian refugees in Lebanon reported attending healthcare facilities or mobile clinics of local non-governmental organizations (NGOs) to receive NCDs health education (44).

The number of studies evaluating the prevalence of NCDs among Syrian refugees in Lebanon is on the rise; however, literature still lacks a country-wide study with a representative large sample size of Syrian refugees through which prevalence of NCDs can be widely studied.

With that being said, this study aims to determine the prevalence of NCDs among adult Syrian refugees in Lebanon, with a focus on hypertension, diabetes, CVDs and cancer. The study also aims to explore factors potentially related to the prevalence figures, and understand the medication use associated with these morbidities.

Methods

Study Design and Population

This study is a secondary analysis of de-identified data from the Sijilli Database. The 'Sijilli Electronic Health Records (63) for Refugees' Database comprises data on 10,082 Syrian refugees in Lebanon (64). Data included in this database was collected between July 2018 and January 2020 through primary field-based data collection conducted by the Global Health Institute at the American University of Beirut in partnership with Epic Systems Corporation. Data collection took place in different refugees' informal tented settlements across Lebanon covering all four locations adopted by UNHCR for data reporting (Bekaa, North Lebanon, Beirut/Mount Lebanon, and South Lebanon). The sample size in each of this location was proportionate to the overall

Syrian refugee population residing in the latter based on UNHCR data (65). The 10,082 data records were distributed as such: 3565 refugee records (35.4%) from Bekaa, 2657 refugee records (26.4%) from North Lebanon, 2146 refugee records (21.3%) from Beirut, and 1714 refugee records (17.0%) from South Lebanon. Records in the Sijilli EHR Database included data on 10,082 Syrian refugees of all ages and covered seven sections; these are: socio-demographic information, social and lifestyle habits, medical and surgical history, OBGYN conditions, medication use, vaccination history, and mental health screening. The socio-demographic section includes basic socio-demographic information such as age, gender, Syrian city of origin, location of the settlement, and year of migration to Lebanon. Risk factors were identified through data from the social and lifestyle section that namely addressed smoking, alcohol drinking, and physical exercise. Data on morbidities was noted from medical and surgical history section that followed the International Classification of Diseases (ICD) 10 by the World Health Organization to report conditions (66). Medication use was deduced from the medications section in the Sijilli EHR Database, which reported namely chronic medications. Categorization of medications was based on Davis's Drug Guide for Nurses, which classifies medications according to their type (67).

Inclusion Criteria

All records of refugees aged 18 years or above were eligible for inclusion. Only those who had hypertension, diabetes, CVDs, or cancer reported as a morbidity in the medical conditions section were included in the analysis. The year 2011 was used as reference year for move date given that the Syrian conflict that triggered the massive migration started in the year 2011.

Data Analysis

Data collected were coded and exported to SPSS v 26 (68). Dates of birth, and displacement to Lebanon were used to calculate age and period of displacement. Prevalence of hypertension, diabetes, CVDs and cancer, referred to as NCDs in the results section, were summarized by age groups, gender, smoking and alcohol intake status, and physical activity using frequency and percentages and tested for statistical significance using the Pearson's Chi-square. Average years of displacements per disorders were tested using the independent t-test. Most frequent medication used were identified, tabulated, and tested for association with hypertension, diabetes, and CVDs using the Pearson's Chi-square. Multivariate logistic regressions were built to assess independent effect of factors on the prevalence of the three major disorders. Coefficients and Standard errors were exponentiated to create odds ratios, and 95% confidence interval. All analyses were run at the 0.05 statistical significance level.

Results

NCDs Prevalence by Sample Characteristics

Out of 3,255 records of Syrian refugees aged 18 years or older, 523 refugees (16.0%) reported having at least one of the following conditions: hypertension, diabetes, CVDs or cancer (Table 1). Of these 523 refugees, the majority (10.0%) reported having hypertension, while diabetes was the second most reported NCD (5.7%), followed by CVDs (5.4%) and cancer (0.6%). The prevalence of all investigated NCDs increased significantly ($p < 0.001$) with age. Males reported significantly ($p = 0.004$) higher prevalence rate (7.0%) of CVDs compared to females (4.6%) with no significant differences noted for the other conditions. Regarding the smoking status, former smokers were recorded to have significantly higher prevalence of hypertension (24.2%; $p < 0.001$), diabetes (11.0%; $p = 0.048$), and CVDs (18.7%; $p < 0.001$). For alcohol intake on the other hand, former drinkers were recorded to have significantly higher CVDs prevalence (22.2%; $p = 0.048$), while current drinkers were noted to have significantly higher cancer prevalence (5.9%; $p = 0.013$). For adult refugees who moved to Lebanon after 2011 (start year of the Syrian conflict), there was no statistical significance in the mean years spent in Lebanon with or without the respective morbidity except for hypertension whereby a higher mean was reported for years spent in Lebanon with the morbidity ($M = 5.1$, $SD = 2.1$) .

Table 1
Prevalence of Non-communicable Diseases (NCDs) by Sample Characteristics

Variable/Disease	Hypertension N (%)	Diabetes N (%)	CVDs N (%)	Cancer N (%)
Prevalence	326 (10.0%)	185 (5.7%)	175 (5.4%)	20 (0.6%)
Age (years)				
18–39	57 (2.8%)	22 (1.1%)	46 (2.2%)	11 (0.5%)
40–59	169 (17.6%)	111 (11.6%)	82 (8.6%)	7 (0.7%)
60+	100 (43.5%)	52 (22.6%)	47 (20.4%)	2 (0.9%)
p-value	< .001	< .001	< .001	
Sex				
Male	97 (9.1%)	63 (5.6%)	75 (7.0%)	3 (0.3%)
Female	229 (10.5%)	122 (5.9%)	100 (4.6%)	17 (0.8%)
p-value	.202	.732	.004	.087
Smoking Status				
Never Smoker	197 (9.3%)	111 (5.3%)	94 (4.5%)	13 (0.6%)
Current Smoker	95 (10.3%)	58 (6.3%)	57 (6.2%)	5 (0.5%)
Former Smoker	22 (24.2%)	10 (11.0%)	17 (18.7%)	1 (1.1%)
p-value	< .001	.048	< .001	.807
Alcohol Intake				
Never Drinker	299 (10.0%)	177 (5.9%)	158 (5.3%)	16 (0.5%)
Current Drinker	2 (11.8%)	0 (0.0%)	0 (0.0%)	1 (5.9%)
Former Drinker	3 (33.3%)	1 (11.1%)	2 (22.2%)	0 (0.0%)
p-value	.067	.471	.048	.013
Physical Activity				
No	236 (10.1%)	131 (5.6%)	113 (4.9%)	15 (0.6%)
Yes	56 (9.2%)	35 (5.7%)	38 (6.2%)	1 (0.2%)
p-value	.475	.923	.174	.151
Years Spent in Lebanon (> 2011)				
Mean (SD)				
With Disorder	5.1 (2.1)	5.0 (2.1)	4.8 (2.1)	5.2 (1.9)
Without Disorder	4.8 (2.1)	4.8 (2.1)	4.8 (2.1)	4.8 (2.1)
p-value	.020	.205	.807	.393

Prevalence of NCD Comorbidities

Presence of comorbidities was explored among hypertensives, diabetics and adult refugees with CVDs, excluding adults with cancer. A total of 506 (15.5%) adult refugees reported at least one of the three conditions, while 2,749 (84.5%) were free of the three conditions. Among the 506 adult refugees with at least one NCD condition, only 0.9% reported having the three conditions simultaneously. Among those presenting with precisely two NCDs, only 2.3% of adults suffered from hypertension and diabetes,

1.2% suffered from hypertension and CVDs, and 0.2% suffered from diabetes and CVDs. Prevalence rates were relatively higher when it comes to having one condition only with 5.6% reporting having hypertension only, 3.1% having CVDs only, and 2.2% having diabetes only (Fig. 1).

Figure 2 presents the governorate of origin of adult refugees reporting to have hypertension, diabetes, CVDs or cancer. Aleppo, Idlib, and Homs were noted to be the main three governorates of origin for refugees with hypertension, diabetes or hypertension, while multiple governorates were reported as the main origins of refugees with cancer.

Medication Use

Table 2 presents the medication use among adult refugees reporting to have at least one condition of the following: hypertension, diabetes, or CVDs. Data on medication use indicates that beta-blockers are the most used drug class among hypertensive adult refugees generally (17.2%) and among those reporting only having hypertension as NCD (12.6%). When analysis was restricted to adult refugees who reported taking only one medication, Beta-blockers were still the most used drug class in both groups (20.4% among all hypertensive adults, and 15.0% among those only reporting hypertension). Similarly, biguanides were noted to be the most used medications among diabetic adult refugees generally (35.1%) even when diabetes is the only NCD reported (34.2%). Biguanides remained the most used medications among these two groups when only one medication was reported to be used. This same medication was the most used one among adults who reported having both hypertension and diabetes, whether these adults were taking only one medication (30.0%) or more than one (32.0%). On the other hand, salicylates were noted to be the most used medications among adult refugees with CVDs, generally (33.7%), even when CVD was the only NCD reported (26.0%). Salicylates were also the most used medications when these groups of adults reported taking only one medication. This same medication was the most used among adults reporting having CVDs with other NCDs (i.e. CVDs and hypertension (42.1%), CVDs and diabetes (57.1%), or a combination of the three medical conditions (43.3%)).

Table 2
Most Frequently Used Type(s) of Medication by Condition

Conditions	Top Medication if Taking 1 Drug	N	%	Top Medication in General	N	%
All Hypertension	Beta-blocker	31	20.4%	Beta-blocker	56	17.2%
All Diabetes	Biguanide	37	38.5%	Biguanide	65	35.1%
All CVDs	Salicylate	20	54.1%	Salicylate	59	33.7%
Only Hypertension	Beta-blocker	12	15.0%	Beta-blocker	23	12.6%
Only Diabetes	Biguanide	16	41.0%	Biguanide	25	34.2%
Only CVDs	Salicylate	7	66.7%	Salicylate	26	26.0%
All NCDs	N/A			Salicylate	13	43.3%
Hypertension &Diabetes	Biguanide	3	30.0%	Biguanide	24	32.0%
Hypertension & CVDs	Salicylate	1	20.0%	Salicylate	16	42.1%
Diabetes & CVDs	N/A			Biguanide & Salicylate	4	57.1%

Further analysis was performed to understand the characteristics of medication-use among adult refugees. Table 3 shows that the majority of the adult refugees having either hypertension or diabetes take corresponding medications (59.5% and 67.0% respectively), with the majority taking one medication for their respective condition. For CVDs on the other hand, the proportion of those who take medication (49.1%) is very similar to those who don't (50.9%), with the majority of the former taking more than 1 medication (28.0%). Based on analysis performed comparing medication-among those diagnosed prior or after the move date to Lebanon, a significantly higher proportion of female adult refugees who were diagnosed with hypertension before moving to Lebanon were on medication (78.9%) compared to those diagnosed after moving to Lebanon (59.7%). No differences were reported for female adult refugees with diabetes and CVDs with regards to medication use based on diagnosis date/location. On the other hand, a higher proportion of male adult refugees who were diagnosed with diabetes after moving to Lebanon were on medication

compared to those diagnosed in Syria prior to displacement. No differences were noted for males with hypertension or CVDs regarding medication-use based on diagnosis date/location.

Table 3
Characteristics of Medication Use of Adult Syrian Refugees Reporting Hypertension, Diabetes, and Cardiovascular Diseases (CVDs)

	Hypertension		Diabetes		CVDs	
	N	%	N	%	N	%
Taking Medication						
No	132	40.5%	61	33.0%	89	50.9%
Yes	194	59.5%	124	67.0%	86	49.1%
Number of Medications						
1	152	46.6%	95	51.4%	37	21.1%
2	29	8.9%	26	14.1%	18	10.3%
3+	13	4.0%	3	1.6%	31	17.7%
Females Taking Medication						
Among those diagnosed before moving to Lebanon	45	78.9%	28	87.5%	9	50.0%
Among those diagnosed after moving to Lebanon	46	59.7%	29	63.0%	14	42.4%
p-value	.019		.607		.603	
Males Taking Medication						
Among those diagnosed before moving to Lebanon	19	73.1%	19	73.1%	15	71.4%
Among those diagnosed after moving to Lebanon	20	62.5%	17	85.0%	19	70.4%
p-value	.393		.038		.936	

Factors Associated with NCDs Among Syrian Refugees

The Logistic Regression for Hypertension, Diabetes and CVDs based on baseline characteristics showed that being a female was associated with higher odds of having hypertension (OR = 1.55, p = 0.034), but rather lower odds of having CVDs with borderline significance (OR = 0.62, p = 0.05) (Table 4). Older age groups were at a significantly higher risk of being hypertensive, diabetic, or suffering from CVDs (p < 0.001). Higher odds of CVDs were found in former smokers with borderline significance noted (OR = 2.30, p = 0.052). Alcohol intake was found to be not associated with any of the three conditions. A higher odds of being hypertensive was observed in those who have been longer in Lebanon (OR = 1.070; p = 0.037). Moving to Lebanon on the year 2011 or after was associated with higher odds of being hypertensive (OR = 3.715; p = 0.032) or diabetic (OR = 11.54; p = 0.035).

Table 4
Logistic Regression Model for Hypertension, Diabetes and CVDs by Sample Characteristics

	Hypertension				Diabetes				CVDs			
	OR	95% CI		*p*-value	OR	95% CI		*p*-value	OR	95% CI		*p*-value
Gender												
Male	1.00	–	–		1.00	–	–		1.00	–	–	
Female	1.55	1.03	2.33	.034	1.00	0.62	1.60	0.998	0.62	0.38	1.00	0.050
Age Groups (years)												
18–39	1.00	–	–		1.00	–	–		1.00	–	–	
40–59	6.79	4.41	10.47	< .001	8.32	4.60	15.02	< .001	4.52	2.60	7.88	< .001
60+	30.33	18.10	50.83	< .001	22.59	11.61	43.95	< .001	11.61	6.11	22.07	< .001
Smoking Status												
Never Smoker	1.00	–	–		1.00	–	–		1.00	–	–	
Current Smoker	0.99	0.67	1.47	0.968	0.89	0.55	1.43	0.625	0.84	0.50	1.41	0.510
Former Smoker	2.02	0.95	4.30	0.070	1.05	0.41	2.73	0.916	2.30	0.99	5.32	0.052
Alcohol Intake												
Never Drinker	1.00	–	–		1.00	–	–		1.00	–	–	
Current Drinker	0.90	0.04	18.59	0.946	*	*	*		*	*	*	
Former Drinker	6.42	0.68	60.87	0.105	2.90	0.23	37.29	0.414	3.47	0.29	41.35	0.324
Length of Stay in Lebanon (years)	1.070	1.00	1.14	.037	1.09	0.99	1.18	0.068	1.05	0.96	1.15	0.258
Year Moved to Lebanon												
< 2011	1.00	–	–		1.00	–	–		1.00	–	–	
≥ 2011	3.715	1.11	12.34	.032	11.54	1.18	112.59	.035	3.200	.611	16.755	.168

*****_Cell numbers too few to produce estimate_

Discussion

Prevalence of NCDs

This study examined the prevalence of hypertension, diabetes, CVDs and cancer among Syrian refugees settled in refugees' informal tented settlements across Lebanon. It also shed light on medication-use patterns associated with these NCDs.

Analysis revealed that hypertension was the most prevalent (10.0%) among the included NCDs. Our findings are in accordance with previous reports from the literature indicating hypertension as the most prevalent NCD among Syrian refugees in Lebanon (19, 45). Prevalence rates of hypertension in our study are comparable to rates (7.4%) reported by a study conducted among Syrian refugee adults in Lebanon (45), but lower than estimates reported by other sources (19, 23, 44, 46, 69).

Diabetes was the second highest prevalent condition after hypertension in our study. These findings are congruent with a study conducted among Syrian refugee adults in Lebanon (19); however, discordant prevalence rates were observed. The overall prevalence of diabetes in our study corresponded to 5.7%, while others reported higher prevalence rates (19, 44, 46). Yet, comparable figures of diabetes prevalence rates (3.3%) were also reported by previous studies (45, 70). With regards to other conditions, the prevalence of CVDs in our study was 5.4%, consistent with rates (3.3%) reported by others (45). On the other hand, cancer prevalence was very low (0.6%); however, slightly lower than UNHCR survey estimates (2%) among Syrian refugees in Lebanon (23).

Discrepancies in the prevalence rates reported in our study and those reported elsewhere in the literature could be explained in different ways. One possible explanation could be linked to the location of refugees whether in camp or non-camp settings and the associated differences in the levels of access to healthcare. The variations in the availability of interventional programs across refugees' informal tented settlements targeted to control NCDs could provide additional explanation. Another potential explanation for the dissimilarities observed in prevalence rates could be related to underreported cases, which reflect poor access to healthcare leading to undiagnosed hidden cases.

Looking at the non-modifiable risk factors for NCDs, we found that higher age was associated with higher NCDs prevalence, consistent with previous findings (45, 63). This is further supported by evidence suggesting that susceptibility to NCDs increases with age (71). Regarding gender-related prevalence of NCDs, our study findings indicate that both genders reported comparable rates of hypertension, diabetes and cancer. Males, however, reported significantly higher prevalence rates of CVDs compared to females. Although the incidence of CVDs in males is higher than in females (72), the prevalence of CVDs in females could be underestimated based on the misperception that females are usually protected from CVDs (73). The neglect of attention to CVDs among Syrian refugee females could explain the observed variations in prevalence rates.

In terms of modifiable risk factors for NCDs, a strong linkage has been reported between smoking status and alcohol intake, and increased risk for NCDs (74). This concurs with our findings, where former smokers were recorded to have significantly higher prevalence of hypertension (24.2%; $p < 0.001$), diabetes (11.0%; $p = 0.048$), and CVDs (18.7%; $p < 0.001$) compared to current smokers and never-smokers. A potential explanation of our findings could be that these individuals may have reached high-risk or advanced stages of these NCDs that necessitated them to quit smoking, or alternatively became aware that smoking could aggravate their health status and decided to quit. On the other hand, while there was no association between physical activity and prevalence of NCDs for all conditions in our study, a strong correlation between low physical activity and increased risk for NCDs is reported in literature (75). The lack of association between physical activity and NCDs prevalence in the present study may be due to the low prevalence of physical activity amongst the study population.

As for other determinant factors that relate to the development of NCDs, we found an association between the governorate of origin of Syrian refugees and prevalence of NCDs. This is supported by evidence indicating that the prevalence of NCDs such as hypertension and diabetes is affected by refugees' region of origin (76). Study findings revealed that the highest prevalence of hypertension, diabetes and CVDs was observed among refugees originating from Idlib, Aleppo and Homs. This could relate to the fact that health systems in these governorates were significantly damaged as a result of the Syrian conflict (77). Around 80% of health facilities in Idlib, and 60% of health facilities in Aleppo were completely or partially damaged as of February 2017. This, in turn, influenced the capacities of these health systems to deal with the increasing burden of NCDs (77). The Syrian conflict has also led to a shortage of healthcare professionals who were forced to leave, and to a shortage in supply of medical equipment and medications (77). All these factors could have contributed to the high prevalence of NCDs in these governorates, translated into a high burden of NCDs among refugees originating from these governorates. Prevalence estimates on NCDs in Syria's governorates are limited; however, available data from Aleppo show that the prevalence of diabetes (20.5%) (47) is consistent with our estimates (20%). Yet, reported hypertension prevalence in Aleppo is greatly higher (45.6%) (78) than prevalence estimates (16.9%) among

Aleppian hypertensives in our study, while CVDs prevalence estimates are lower (5.4%) (47) than ours (16.6%). Furthermore, cancer cases in our study were mostly reported among Aleppian refugees, which is in line with previous reports indicating that cancer cases are mostly located in Aleppo among other governorates of Syria (79).

Medication Use Patterns

Regular medication use may be challenging in the context of displacement (80). Literature has shown disparities in the findings. Nearly 75% of Syrian refugees with an NCD in Lebanon reported taking their prescribed medications (60, 61). Other indications suggested that 56.1% of Syrian refugee households in Lebanon had a member with an NCD that was unable to access medications (70).

Our findings indicate that compliance to medication-use was relatively high for hypertension (59.5%) and diabetes (67.0%). This is in agreement with a previous study conducted among Syrian refugees in Lebanon (56). However, the latter reported interval interruptions in medication use for both conditions due to financial constraints (19, 62). In our study, reasons for the incompliance rates in medication use for all conditions could be in line with previous reports from the literature. Inability to afford the high costs of medications in Lebanon compared to the pre-conflict costs in Syria was the main reported causative factor for medication non-adherence (19, 62). Lack of knowledge of where to buy medications and physical disabilities which limit movement provide other potential contributing factors (19).

Study analysis revealed an association between adherence to medication and location of diagnosis, which relatively differed by gender. For all three NCDs, females who were diagnosed before moving to Lebanon were more likely to take corresponding medications compared to those diagnosed in Lebanon. However, diagnosis location/date (pre- or post- move) did not really affect the medication use among males. Even more, a higher proportion of male adult refugees who were diagnosed with diabetes after moving to Lebanon were actually on medication compared to those diagnosed in Syria prior to displacement. This observed gender gap in medication use based on the migration journey may be rooted in existing gender dynamics within refugee communities where men's/husbands' health may be often prioritized over women's/wives' health given that the husband is perceived as the primary bread winner of the family. Therefore, investing in buying a medication is more worth when it is for the male, while other conflicting priorities may emerge vis-à-vis buying a medication for the female.

The findings from this study also demonstrated that the patterns of medication use for all conditions with or without comorbidities abided by the general recommended guidelines (81–83). Consistent with our findings, beta-blockers and biguanides are the most frequently prescribed medications for hypertensive patients (81) and for diabetics (82), respectively, while salicylates are among the top medications used for patients with CVDs (83).

Strengths and Limitations

The present study has several strengths. One of its strengths lies in its large sample size. In addition, the study draws on data from refugees' informal tented settlements in different areas in Lebanon; the sample population is therefore representative of Syrian refugees in Lebanon. Furthermore, assessing disease prevalence involved the inclusion of factors known to influence the outcome measure such as region of origin, social and lifestyle behaviors, comorbidities, and number and medication use patterns. The results of this study should however be considered in light of certain limitations. First, the Sijilli EHR Database mainly relies on self-reported data for the variables of interest which could have introduced some bias. An underestimation of the NCDs conditions may have taken place, given the Database might have missed reporting on undiagnosed cases. Second, self-reported adherence to medications may be associated with recall bias.

Conclusions

Nine years into the Syrian crisis, Lebanon has made remarkable efforts to respond to the healthcare needs of the Syrian population on its territories. However, providing high-quality NCDs services remains challenging in light of the high burden of NCDs that requires continuity of care, and the costly medications that are accompanied by funding shortfalls. Findings from this study suggest the possibility of many undiagnosed cases. Our findings suggest that efforts should be directed towards the employment of innovative low-cost approaches for NCD detection and control among refugees, with a focus on the importance of adherence to

medication; examples of such approaches were reported in literature (84). Such efforts remain imperative to control the increasing burden of NCDs amongst refugee populations and improve equitable access to NCD services.

Declarations

Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to the institutional ownership of data, but are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study has been approved by the Institutional Review Board at the American University of Beirut.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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This study is unfunded.

Authors' contributions

SS led the conceptualization and design, guided on analysis and write up, and reviewed the final draft. LA was majorly involved in the write up of the original draft, editing, and review of the final draft. HD and RH were responsible for data analysis and write up as well as review of the final draft. DN, ZJ, and NH were involved in the write up, conceptualization, and review of the last draft. NEA was majorly involved in conceptualization and design, write up of the original draft, and review of the final version.

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Figures

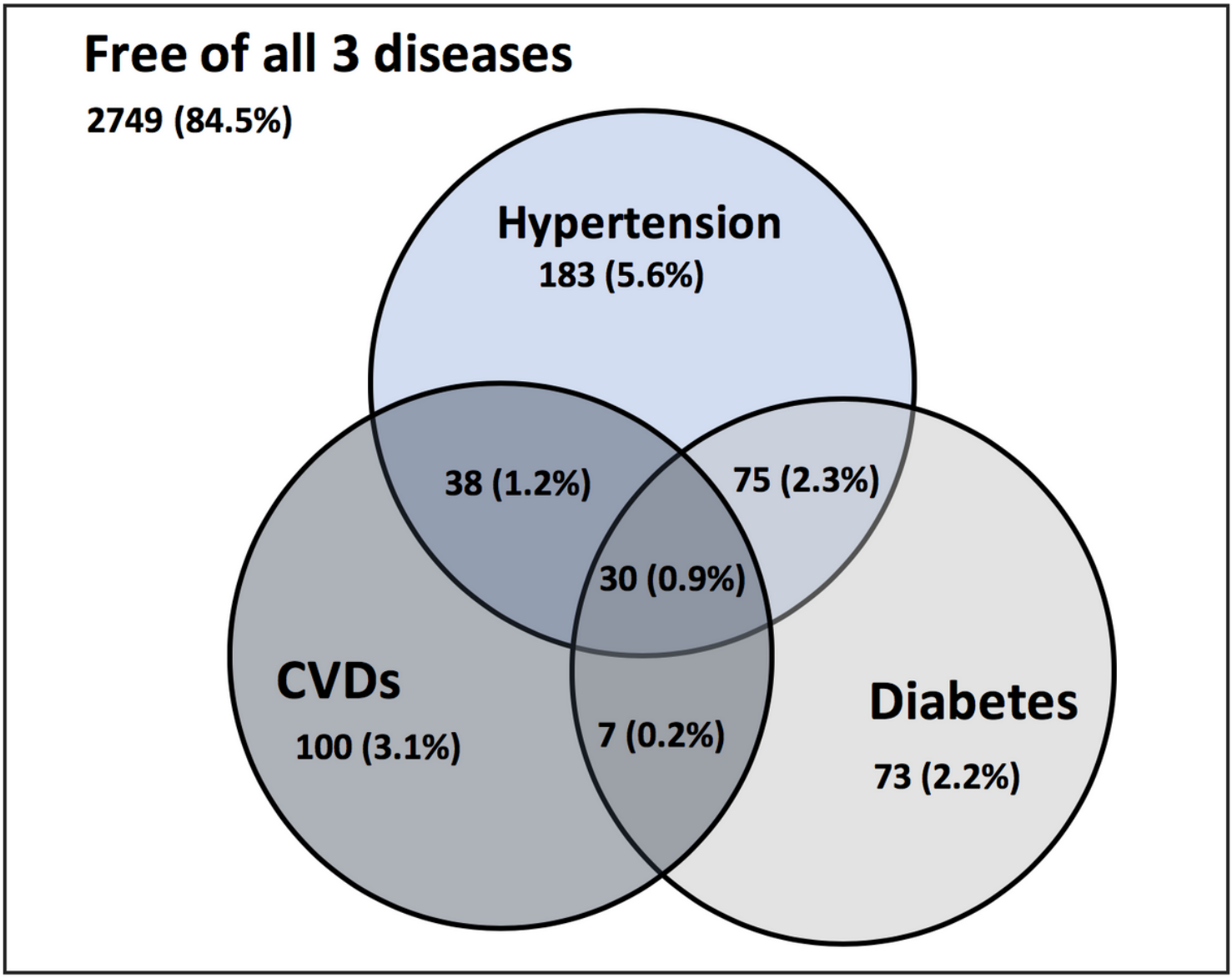

Figure 1

Visual representation of the prevalence of hypertension, diabetes, and CVDs among adult Syrian refugees, and the overlap among these conditions indicating the presence of comorbidities.

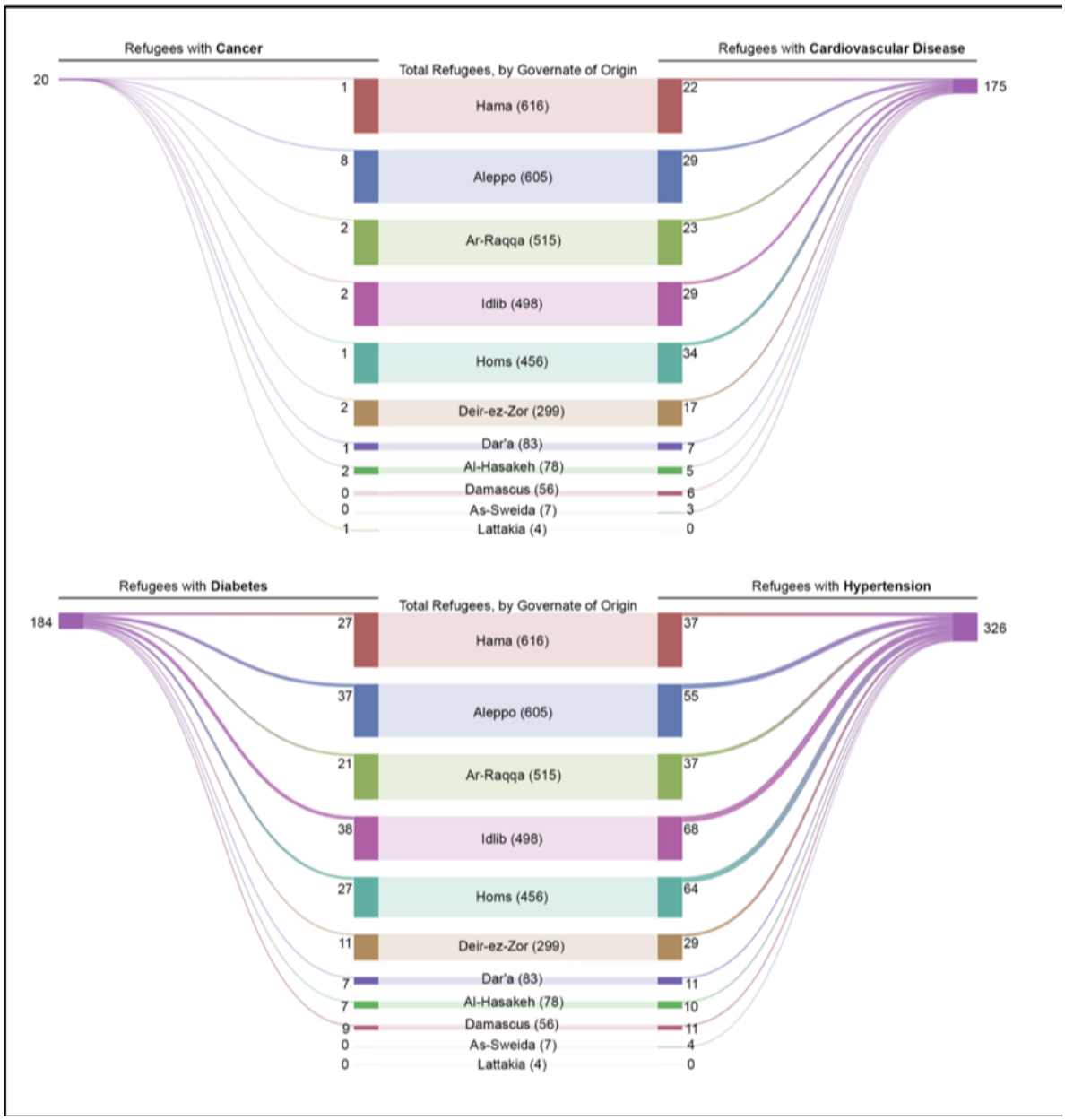

Figure 2

Visual representation of the governorate of origin of adult refugees with hypertension, diabetes, CVDs, or cancer.