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ORIGINAL ARTICLE

eHealth as a facilitator of equitable access to primary healthcare: the case of caring for non-communicable diseases in rural and refugee settings in Lebanon

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Abstract

Objectives Assess the effect of selected low-cost eHealth tools on diabetes/hypertension detection and referrals rates in rural settings and refugee camps in Lebanon and explore the barriers to showing-up to scheduled appointments at Primary Healthcare Centers (PHC).

Methods Community-based screening for diabetes and hypertension was conducted in five rural and three refugee camp PHCs using an eHealth netbook application. Remote referrals were generated based on pre-set criteria. A phone survey was subsequently conducted to assess the rate and causes of no-shows to scheduled appointments. Associations between the independent variables and the outcome of referrals were then tested.

Results Among 3481 screened individuals, diabetes, hypertension, and comorbidity were detected in 184,356 and 113 per 1000 individuals, respectively. 37.1% of referred individuals reported not showing-up to scheduled appointments, owing to feeling better/symptoms resolved (36.9%) and having another obligation (26.1%). The knowledge of referral reasons and the employment status were significantly associated with appointment show-ups.

Conclusions Low-cost eHealth netbook application was deemed effective in identifying new cases of NCDs and establishing appropriate referrals in underserved communities.

Keywords Primary healthcare · eHealth · Diabetes · Hypertension · Referrals · Appointment no-show

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Abbreviations

NCDs	Non-communicable diseases
PHC	Primary healthcare
LMICs	Low- and middle-income countries
SMS	Short message service
CHWs	Community health workers
PHCCs	Primary healthcare centers
WHO	World Health Organization
CLI	Collaborative for Leadership and Innovations in Health Systems
AUB	American University of Beirut
MOPH	Ministry of Public Health
UNRWA	United Nations Relief and Works Agency
IDRC	International Development Research Center
BMI	Body mass index
DB	Diabetes
FBS	Fasting Blood Sugar
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
HTN	Hypertension
WC	Waist circumference
DSME	Disease self-management education
OR	Odds ratio
RR	Response rate
US	United States
UK	United Kingdom

Introduction

Non-Communicable Diseases (NCDs) are the leading causes of mortality and morbidity worldwide, with 80% of the deaths occurring in low- and middle-income countries (LMICs) (Amara and Aljunid 2014; Beaglehole et al. 2008; World Health Organization 2005). The global burden of disease attributed to NCDs, specifically diabetes mellitus and hypertension is expected to increase significantly to reach as high as 69% of all global deaths by 2030 (Amara and Aljunid 2014; Beaglehole et al. 2008; Khader et al. 2014; Samb et al. 2010).

Globally, 50% of individuals with hypertension and 46.5% of those with diabetes are undiagnosed or unaware that they have the disease (International Diabetes Federation 2015; International Society of Hypertension 2015). In the Middle East and North Africa (MENA) region, 40.6% of adults with diabetes are undiagnosed (International Diabetes Federation 2015). This necessitates investments in interventions embedded into the primary healthcare (PHC) system, since it facilitates the entry of patients into the rest of the health system and supports the provision of universal, equitable, and accessible healthcare (Maher et al. 2009, 2012; World Health Organization 2005).

Countries in which health systems are based on PHC are characterized by a better response to the burden of NCDs (Beaglehole et al. 2008; Starfield et al. 2005). However, the limited access to sustainable, reliable, and equitable PHC services persists in several LMICs, resulting in delays in diagnosis and treatment of patients with NCDs, poor control of the chronic conditions (e.g., lack of optimal glycemic or blood pressure control), and higher proportion of preventable morbidities and mortalities (Gamm et al. 2010; Starfield et al. 2005); (Maher et al. 2009, 2012; Norris et al. 2006; Samb et al. 2010). Health inequities in the management of chronic diseases are further aggravated among populations living in rural areas and refugee camps (Oyebode et al. 2015; Amara and Aljunid 2014; Maher et al. 2012; Ouma and Herselman 2008; Wakerman and Humphreys 2011; Wilson et al. 2009).

The Role of eHealth in addressing chronic diseases

eHealth is an information and communication technology that facilitates the automated transmission and exchange of health-related data (Hogan et al. 2011; Islam and Tabassum 2015; Ouma and Herselman 2008). The employment of low-cost eHealth carried advancements in healthcare delivery in several countries, including provision of appropriate, accessible, equitable, affordable, and sustainable PHC services to underserved communities (Islam and Tabassum 2015; Ouma and Herselman 2008; Wakerman and Humphreys 2011). Different forms of eHealth interventions, including Short Message Services (SMS), have been shown to improve health outcomes of individuals with NCDs (Gray et al. 2014; Islam et al. 2014; Paré et al. 2007; Youssef 2014), through the delivery of health awareness messages, as well as medications and appointments reminders (Gray et al. 2014; Islam et al. 2014; Paré et al. 2007; Youssef 2014). Enhancing access to care could be realized through trained community health workers (CHWs) using eHealth applications to screen residents of underserved areas; a strategy shown to improve NCD-related outcomes and communities' level of knowledge (Islam and Tabassum 2015; Paré et al. 2007; Wilson et al. 2009).

However, the implementation of eHealth technologies entails several challenges including: (1) patients' and providers' limited awareness about the usefulness of eHealth (Hogan et al. 2011); (2) providers' resistance to eHealth technologies due to fearing its negative effect on the workflow (Hogan et al. 2011; Katz and Moyer 2004); (3) data security and privacy (Gray et al. 2014; Katz and Moyer 2004; Serocca 2008); (4) lack of standards and policies facilitating accessibility and exchange of information (Gray et al. 2014; Serocca 2008); and (5) financial challenges associated with sustainable implementation of eHealth projects (Serocca 2008). Therefore, integration of

eHealth has to be contextualized to countries' capacities, digital expertise, and available infrastructure (Katz and Moyer 2004).

Context of Lebanon

NCDs are Lebanon's main public health concern contributing to 45% and 38.7% of premature deaths in men and women, respectively (Ministry of Public Health 2016; World Health Organization 2015; Yamout et al. 2014). NCDs are driving a substantial increase in the total healthcare costs and in the per capita expenditure on health (Ministry of Public Health 2016; World Health Organization 2015). Underprivileged populations residing in rural and refugee settings are at greater risks of developing diseases due to poor screening and low early detection rates (Yamout et al. 2014). For instance, one-third of Palestinian refugees residing in Lebanon suffer from NCDs according to the 2011 estimates of the United Nations Relief and Works Agency (United Nations Relief and Works Agency 2011).

PHC centers (PHCCs) are the only healthcare facilities available in underprivileged rural and refugee settings (Ammar 2009; Chen and Cammett 2012; Yamout et al. 2014). Reinforcement of PHC services in these areas remains necessary to prioritize equitable provision of NCDs' care between and within different settings.

This study is part of a larger one entailing a community-based intervention called e-Sahha project (Arabic word for e-health). To ensure the scientific grounding of the study, the Health Education Awareness Research Team (HEART) conceptual framework was adopted (Fig. 1) (Balcázar et al. 2012). The framework is based on an ecological approach to the conduct of community participatory-based research (CPBR). The framework includes three key pillars: intervention, evaluation and CPBR. For this segment of the study, the intervention pillar includes using a community-based screening for diabetes and hypertension with online referrals for diagnosed and suspected cases. The evaluation component includes short phone surveys with referred individuals to check compliance with scheduled appointments. Finally, the larger project activities have CPBR as an overarching approach from the design phases to the implementation to evaluation aspects.

The primary aim of this study is to assess the association of a community-based eHealth intervention employed in rural and refugee settings in Lebanon with the detection and referrals rates related to diabetes and hypertension. The study further examines whether the employment of low-cost eHealth tools (e.g., community screening, online referrals and scheduling) facilitates the access of undiagnosed and pre-diagnosed diabetes/hypertension patients to PHC. The study further analyzes the reasons for not showing-up to scheduled appointments and means to surmount the identified barriers.

To our knowledge, there are no existing studies in literature addressing the effectiveness of employing eHealth strategies on diabetes and hypertension detection and referral rates in Lebanon or other LMICs of the region.

Fig. 1 Conceptual framework guiding this study. Adapted from: Balcázar et al. (2012)

Methods

Study design

This study examined diabetes and hypertension detection and referral rates through community screening in five rural areas and three Palestinian refugee camps across Lebanon. A community mapping of all households located in these areas was implemented and all individuals aged 40 and above and living in these households were eligible and approached for participation in the study. Compliance with scheduled appointments and the underlying reasons for no-show-ups were examined through a cross-sectional design employing a semi-structured questionnaire. The study received ethical approval from the Institutional Review Board of the American University of Beirut (AUB).

Study setting

The study relied on data drawn from the community-based intervention of the e-Sahha project carried out by the American University of Beirut in collaboration with the Lebanese Ministry of Public Health (MOPH) and the United Nations Relief and Works Agency (UNRWA). The eHealth-assisted community-based intervention included screening for diabetes and hypertension in the catchment area of eight PHC centers entailing five MOPH centers and three UNRWA centers. The five MOPH PHCCs were randomly selected from a list of all the PHCCs that belong to the MOPH PHC National Network, stratified by governorate. Consequently, one MOPH PHCC center was chosen from each stratum (governorate): North, Bekaa, South, Nabatieh and Mount Lebanon. On the other hand, the three UNRWA centers were randomly chosen from Palestinian refugee camps in Lebanon, with two centers selected from the South governorate and one from Beirut.

Participant selection and data collection

A written informed consent was obtained from each household prior to the initiation of the screening and data collection activities. Using an eHealth-assisted netbook application, trained CHWs conducted outreach screenings for diabetes and hypertension in eight catchment areas of selected PHCCs from May 2015 until November 2015. An online appointment system was designed and implemented to allow for remote appointment scheduling. During community visits, referrals were made remotely through the eHealth-assisted netbook application linked to the PHCC of the corresponding area. Details of the screening and referral processes are shown in Fig. 2.

Within 1 month of the appointment, a short phone survey was conducted with referred individuals to determine their compliance with visits (i.e., show-ups/no-shows) and reasons for no-show up to scheduled appointments. To increase the response rate, three attempts were established with non-respondents. The semi-structured questionnaire was developed according to a study by Lacy et al. (2004) and included the following questions: (1) What made it hard to keep the appointment with the doctor/health professional? and (2) Do you have to make any special arrangements to get to the PHC Center?

Study variables

The variables included in this study are summarized in Table 1 along with their corresponding measurements. Independent variables of interest included: type of setting (completed by the researchers in accordance with the location of each PHCC), self-reported participants' demographic and socioeconomic characteristics such as age, gender, marital status, educational status, employment status, and insurance status. Information on the reasons for referrals was elicited from the central computer database in the research office, after being synced with CHWs' handheld computers. Knowledge for the reason of referral was also surveyed to investigate the influence of patients' knowledge on their compliance with visits. The outcome of referral, which is the dependent variable in this study, was measured at the onset of the phone survey through asking respondents the following question "Did you attend your scheduled appointment at the PHCC?" and was recoded as a dichotomous variable (yes/no), allowing us to assess compliance with visits.

Statistical analysis

Data collected were analyzed using the Statistical Software Package for Social Sciences version 23. Frequencies and percentages were used to summarize the characteristics of the total sample population. The pre-set screening criteria described in Fig. 2 were used to identify suspected cases of diabetes and hypertension, and a short survey was administered to identify pre-diagnosed cases. Disease detection rates per 1000 population were computed for diabetes and hypertension, as well as for suspicion and pre-diagnosis for both diseases. The differences in rates across the two settings (rural areas versus refugee camps) were further analyzed using the Pearson's Chi-square test (χ^2). Similarly, the differences in proportions of absence of regular provider among pre-diagnosed cases, stratified by setting, were estimated using a Chi-squared test. Highly suspected cases and those pre-diagnosed with no regular provider for more than a year were referred to PHCCs ($N = 278$), out of

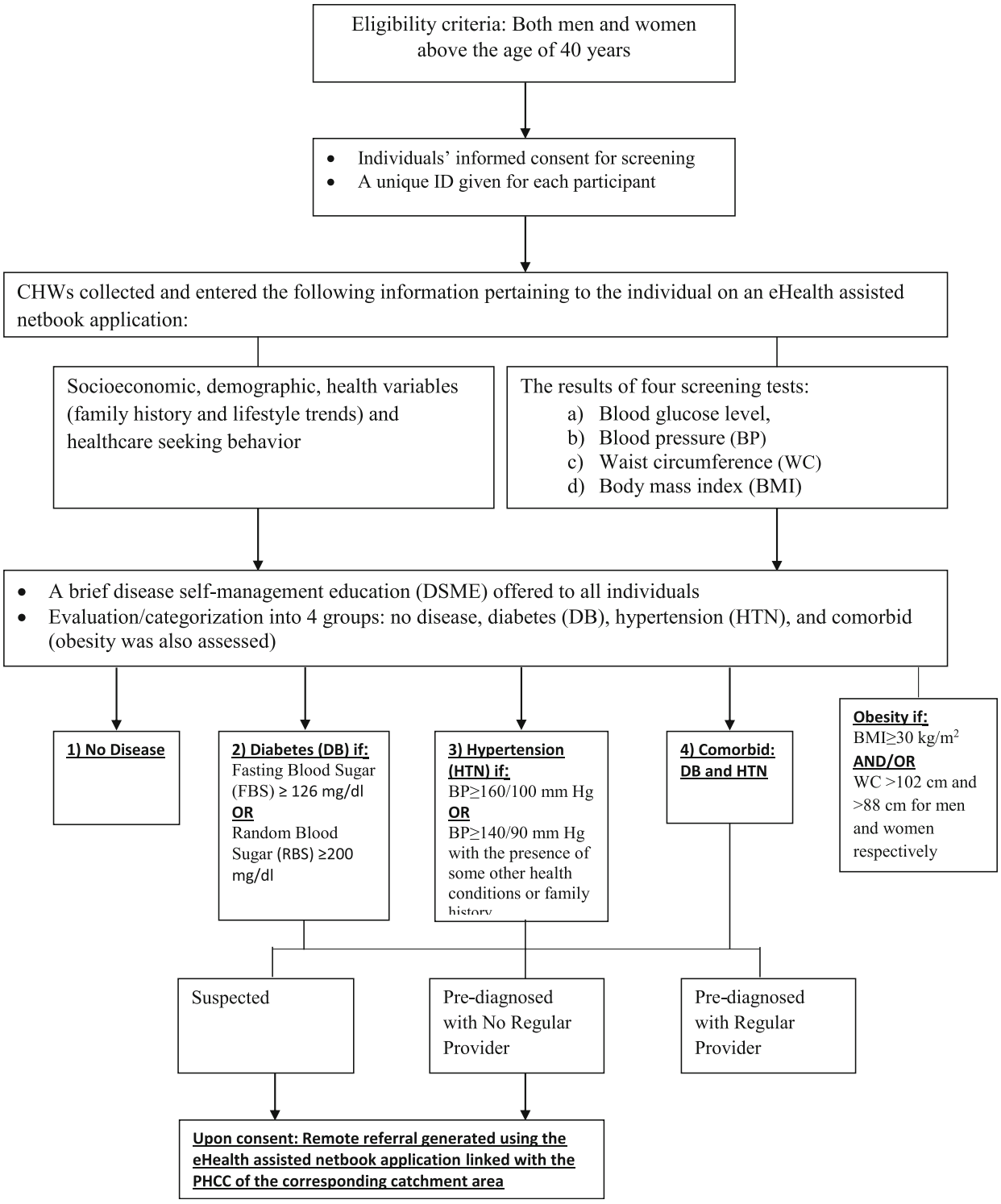

Fig. 2 Flow diagram of the screening and referral processes of screened individuals as implemented by the community health workers through the eHealth-assisted netbook application during the community screening visits (Country: Lebanon; Year: 2015)

whom 175 (62.9%) responded to the telephone survey. The difference in the response rate across the two settings was tested for significance. The sociodemographic characteristics of the 103 non-responding cases were compared with those of the 175 respondents, and differences were assessed using the Chi-squared test.

Compliance with visits was determined through the calculation of percentage of consultation visits to

Table 1 Summary of the study variables (Country: Lebanon; Year: 2015)

Variable	Type	Number of measurements	Measurements
Type of setting	Independent	2	Rural area
	Categorical		Refugee camp
Age group	Independent	3	40–49
	Categorical		50–65
			> 65
Gender	Independent	2	Male
	Categorical		Female
Marital status	Independent	3	Single
	Categorical		Married
			Divorced/separated/widowed
Educational status	Independent	4	Illiterate
	Categorical		Reads and writes
			High school/vocational graduate
			University degree
Employment status	Independent	2	Employed
	Categorical		Unemployed
Insurance status	Independent	3	No insurance
	Categorical		Public insurance/private insurance/others
			UNRWA
Reasons for referrals	Independent	4	Suspected DB
	Categorical		Suspected HTN
			Pre-diagnosed with DB with no regular provider
			Pre-diagnosed with HTN with no regular provider
Knowledge for the reason of referral	Independent	2	Yes
	Categorical		No
Outcome of referral	Dependent	2	Did show-up to scheduled appointment (yes)
	Categorical		No show-up to scheduled appointment (Norris et al. 2006)

DB diabetes, *HTN* hypertension, United Nations Relief and Works Agency (United Nations Relief and Works Agency)

appointments. Quantitative data on reasons for no-show and special arrangements needed to get to the PHCCs were also analyzed. Showing-up to the scheduled appointment (outcome of referral) was defined as the dependent variable in the subsequent analysis. Descriptive statistics on the 175 followed-up cases was performed. Reason for referral, knowledge for the reason of referral, age, gender, marital status, education, employment, and insurance status were used as independent variables to explain the dependent variable, and differences in proportions were tested for statistical significance using the Chi-squared test. A multivariate logistic regression using the backward selection technique was performed, whereby variables that were statistically significant and variables that might have had a confounding effect remained in the model. The coefficients produced by the model were exponentiated to produce Odds Ratios, and their standard errors were used to calculate the 95% confidence intervals. All analyses were carried at a 0.05 significance level.

Results

Sociodemographic characteristics

Among 3559 individuals invited to participate in this study, 3481 consented for screening (response rate = 97.8%). The majority of participants were females (61.4%), married (78.2%), with high school education (61.3%), unemployed (75.3%), and uninsured (51.7%) (Table 2). With respect to the setting, approximately three quarters of the sample were from rural areas (74.4%) and the rest from refugee camps.

Prevalence of diabetes and hypertension

Results of prevalence rates reveal a detected rate of diabetes of 183.5 per 1000 where the vast majority (173.2 per 1000) were already detected, and 10.34 per 1000 were

Table 2 Demographic and socioeconomic characteristics of individuals screened during the community screening (Country: Lebanon; Year: 2015)

	Total	
	N	%
Total number of screened individuals	3481	100.00
Gender		
Male	1345	38.64
Female	2136	61.36
Age groups		
40–49	1178	33.84
50–65	1347	38.70
> 65	956	27.46
Marital status		
Single	302	8.67
Married	2721	78.17
Divorced/separated/widowed	458	13.16
Educational status		
Illiterate	773	22.21
Reads and writes	422	12.12
High school/vocational graduate	2135	61.33
University degree	151	4.34
Employment status		
Unemployed	2621	75.29
Employed	860	24.71
Insurance status		
No insurance	1800	51.71
Public insurance	671	19.28
Private insurance	76	2.18
Others	65	1.87
UNRWA[a]	869	24.96
Setting		
Rural area	2588	74.35
Refugee camp	893	25.65

[a]UNRWA: Palestinian refugees registered in UNRWA are eligible to benefit from UNRWA coverage for healthcare services

suspected to have the disease (Table 3). Similarly, the pre-diagnosis rate for hypertension was 268.60 per 1000, and 87.3 per 1000 for suspected cases, giving a total hypertension detection rate of 355.9 per 1000. The rate of comorbidity (diabetes and hypertension) was calculated at 110 per 1000 for pre-diagnosed individuals, and 2.5 per 1000 for the suspected ones (Table 3).

Controlling for the variable of setting, no significant difference in hypertension and comorbidity detection rates when compared between rural areas and refugee camps was detected (Table 3). Conversely, when diabetes detection rates were compared, a significant difference between the two settings ($p = 0.046$) was found, with higher diabetes pre-diagnosis in rural areas. Individuals in refugee camps had a higher hypertension pre-diagnosis rate instead.

Absence of a regular provider

Screening results showed 603 cases in the eight areas were pre-diagnosed with diabetes; of whom, 58 (9.6%) did not have a regular provider for more than a year. The lack of a regular provider was less observed among the 935 cases pre-diagnosed with hypertension, whereby 65 (6.9%) were not regularly followed-up. Additionally, 24 (6.2%) out the 383 cases pre-diagnosed with both diseases did not have a regular provider. Although no significant difference was found between those pre-diagnosed with no regular provider in rural areas versus refugee camps, the lack of a regular provider was more accentuated among rural areas as compared to refugee camps.

Referrals to PHCCs and compliance with visits

Among the 3481 individuals screened, CHWs generated 278 eHealth-assisted referrals on the basis of disease(s) suspicion ($n = 180$) and/or pre-diagnosis with no regular provider for more than a year ($n = 98$). To assess compliance with visits, all 278 beneficiaries referred were subsequently contacted for a phone survey (Fig. 3). Records of 175 beneficiaries (62.9%) were retained for analysis after excluding 103 cases. A significant difference in the response rate between the two target populations was detected ($p = 0.018$), whereby a higher response rate was noted in refugee camps (RR = 73.5%) in comparison with rural areas (RR = 58.5%). No non-response bias was observed after comparing the sociodemographic characteristics of non-respondents to those of respondents. No statistical significance was found between age, gender, marital status, education, and employment status of non-respondents compared to those of respondents. The surveys' results revealed a 63% compliance with visits among respondents.

Barriers to show-up and needed arrangements

The research team conducted a short survey with patients who did not show-up to scheduled appointments ($n = 65$; 37.1%) to understand underlying barriers. Two commonly reported barriers to appointments' show-up were identified: 1) feeling better/symptoms resolved ($n = 24$; 36.9%), and 2) not showing-up because of another obligation ($n = 17$; 26.1%). Other less common barriers included forgetting appointment's date and time, having personal reason, no specific reason, or simply not being interested. When asked if arranged transportation or work replacement would

Table 3 Diabetes and hypertension detection rate among individuals screened during the community screening presented per 1000 population (Country: Lebanon; Year: 2015)

	Total	Suspected	Pre-diagnosed
Diabetes detection rate (per 1000 population)	183.56	10.34	173.23
Rural areas	191.27	11.21	180.06
Refugee camps	161.25	7.84	153.42
P value	0.046*	0.391	0.070^^^
Hypertension detection rate (per 1000 population)	355.93	87.33	268.60
Rural areas	350.46	91.58	258.89
Refugee camps	371.78	75.03	296.75
P value	0.233	0.131	0.028*
Diabetes and hypertension comorbidity detection rate (per 1000 population)	112.61	2.59	110.03
Rural areas	117.85	2.70	115.15
Refugee camps	97.42	2.24	95.19
P value	0.096	0.813	0.100

*Refers to Statistical Significance at 0.05 CI

^^^Refers to borderline Significance

facilitate showing-up for PHCC appointment, only 15.3% respondents reported the need for such arrangements.

Associations with outcome of referral

Bivariate analysis showed no significant difference in the outcomes "No Show-Up" and "Did Show-Up", for the four different reasons of referrals. Similarly, there was no significant difference in the latter outcomes in relation to respondents' age, gender, marital status, education, setting, and insurance status. However, a significant difference was observed in the outcomes of referral according to the knowledge for the reason of referral ($p < 0.001$). In fact, the proportion of those who did not know why they were referred was statistically higher (27.7%) among those who did not show-up compared with those who did (7.2%). Employment status was of borderline significance, with 40.0% of those not showing-up being employed compared to 27.3% of those showing-up ($p = 0.081$).

Controlling for education, employment status was found to be associated with not showing-up; those who were employed were twice as likely not to show to the appointment (OR = 2, 95% CI (1.01–4.18), $p = 0.047$) (Table 4). Likewise, knowledge for the reason of referral was statistically associated with not showing-up. Those reporting not knowing why they were referred were five times more likely not to show to the appointment compared with those reporting knowing the reason for their referral (OR = 4.9, 95% CI (1.97–12.26) $p = 0.001$).

Discussion

In this study, the prevalence of diabetes and hypertension in rural and refugee settings in Lebanon was estimated through a community-based eHealth intervention.

The overall diabetes prevalence was 18.3% for individuals older than 40, which is higher than the national prevalence reported in the adult population in Lebanon (14.6%) (International Diabetes Federation 2017), and much higher than the 7.7% prevalence rate in the EMR (Mousa et al. 2010; Sabatinelli et al. 2009). Findings of higher overall diabetes detection rate in rural areas of Lebanon compared to refugee camps could be explained by the considerable higher number of previously detected diabetic cases in rural areas. The diabetes detection rate of 16.1% reported among Palestinian refugees included in this study was higher than that reported for Palestinian refugees in several countries of the EMR including Jordan, Syria, Lebanon, the West Bank and the Gaza Strip, which had a rate of around 9.8% for individuals older than 40 (Amara and Aljunid 2014).

On the other hand, a prevalence of hypertension of 355.9 per 1000 population or 35.5% was recorded in this study, higher than the EMR estimate of 26.0% (Mousa et al. 2010; Sabatinelli et al. 2009). With regards to setting, significant difference was only detected at the level of pre-diagnosed cases of hypertension in individuals living in refugee camps, which was higher than that of individuals living in rural areas ($p = 0.028$). Similarly, the recorded hypertension prevalence rate among those living in Palestinian refugee camps in this study is higher than the 20.2% reported in the previous studies from Lebanon on

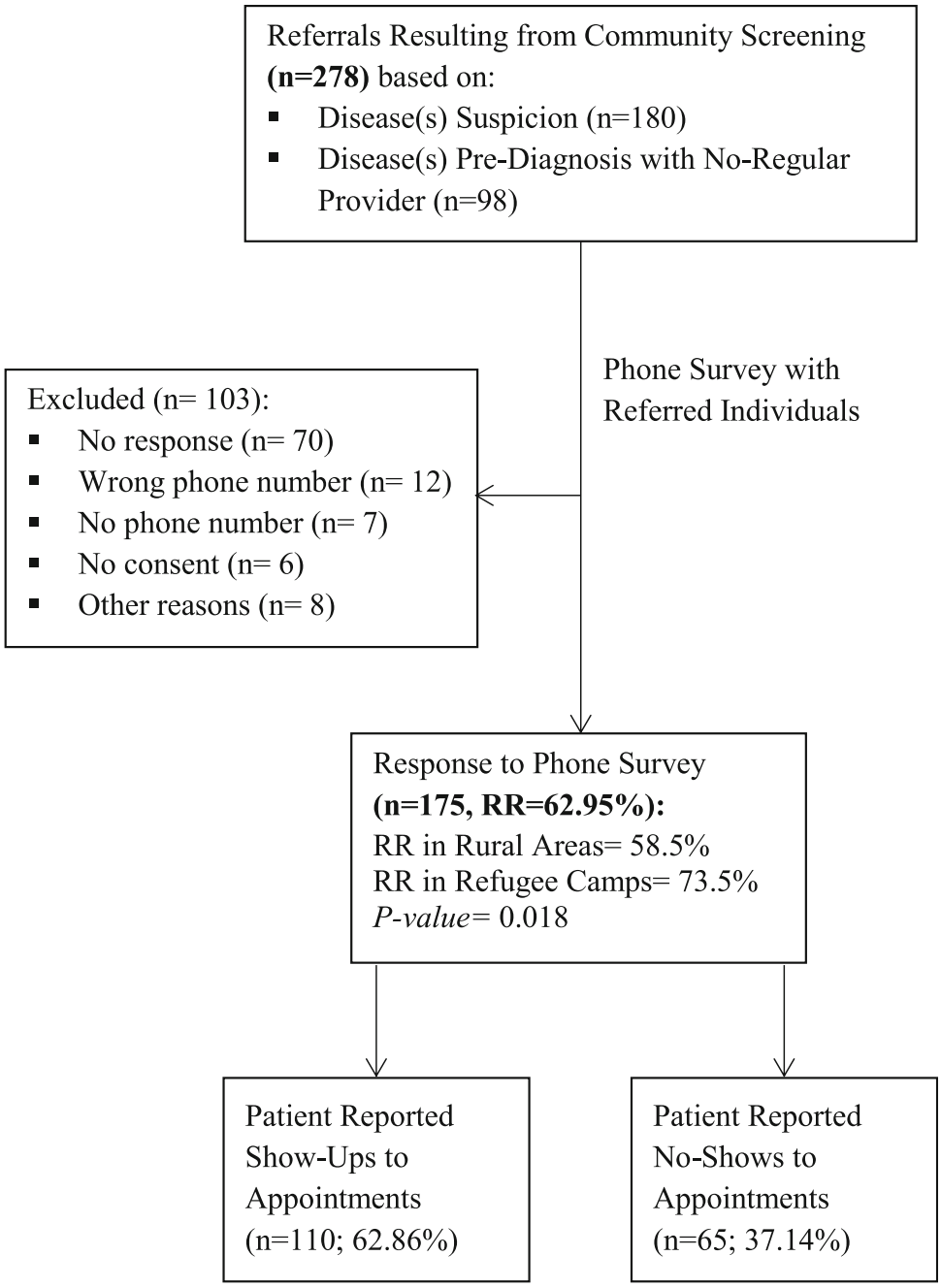

Fig. 3 Flow diagram showing results of show-up and who responded to phone survey (Country: Lebanon; Year: 2015)

Palestinian refugees (Sabatinelli et al. 2009), and the approximate 18.7% prevalence rate reported in other countries of the Middle East (Amara and Aljunid 2014), respectively.

In terms of care, it is well reported in the literature that sub-optimal care for people with NCDs exacerbates the burden of diabetes and hypertension (Gamm et al. 2010; Maher et al. 2012). In this study, the absence of a regular provider was observed among those diagnosed with diabetes and to a lesser extent among individuals with hypertension or comorbidities in both rural and refugee settings. Inadequate follow-up was more pronounced in rural areas, underscoring the importance of reducing existing inequities in access to NCDs care, particularly diabetes and hypertension, among people living in resource-scare settings. This could be done through the adoption of a PHC approach consisting of proper referrals of undiagnosed individuals and those pre-diagnosed with no regular provider to nearest PHCCs for adequate follow-up.

The contribution of the employed eHealth tool in minimizing inequities in access to needed NCD health services

Table 4 Multivariate logistic regression of referred patients' characteristics with outcome of referral (no show-up, did show-up) (Country: Lebanon; Year: 2015)

Variables	Outcome of referral		
	OR	95% CI	*P* value
Knowledge for reason of referral			
Yes (ref)	1.00	–	
No	4.91	(1.97, 12.26)	0.001
Employment status			
Unemployed (ref)	1.00	–	
Employed	2.05	(1.01, 4.18)	0.047

Model corrected for patients' education status, due to its confounding role with employment status, all other variables where tested for significance and removed from model when p value > 0.10 using the backward selection

by facilitating access of these cases to PHCCs was assessed in our study via phone surveys. Around 37.1% of individuals who responded to the survey reported no-show to scheduled referral appointments with the most common reported barriers to showing-up being either feeling better, having the symptoms resolved or having other commitments and obligations. This finding falls within the range of the United States (US) no-show rate (5–55%), yet, it is slightly higher than the reported rate in Saudi Arabia (29.51%) (George and Rubin 2003). Unlike other studies, logistical challenges were less commonly reported in this study (Lacy et al. 2004; Neal et al. 2005; Sharp 2001). Our findings suggests that self-deception is common among non-attenders with 36.9% of non-attenders reporting feeling better as a reason for no-show; a percentage that is higher than the 11.4% reported in a study from UK (Neal et al. 2005). This highlights the importance of enhancing patients' awareness of the seriousness of diabetes and hypertension and the importance of both compliance to treatment and regular follow-ups. Concomitantly, a patient-centered approach that emphasizes patient empowerment should be taken into consideration to overcome deception and promote self-management of chronic diseases (Anderson and Funnell 2010). Appointment reminders sent to the corresponding individuals could also be used as a complementary approach to enhance a behavioral change towards higher compliance rate. The adoption of a more flexible scheduling system by assigning appointments based on patients' preferences may also be of help (Sharp 2001).

The study also explored the association between knowledge of the reason for referral and showing-up to a scheduled appointment, where significance was detected with patients who did not show-up and did not know the reason for their referral having nearly five times the odds of those who reported knowing their referral reason. This is in line with the results of a US study indicating that non-attenders are less likely to know the purpose of their appointment (Lacy et al. 2004). This points to the necessity of training physicians on communicating health information with their patients to increase their awareness about their disease condition and the importance of compliance.

Employment status was found to be associated with not showing-up to the appointment when controlled for education in the backward selection model of a multivariate logistic regression analysis. This association relatively explains the finding of another Lebanese study indicating that unemployed women are the greater users of PHCCs (Yamout et al. 2014). This reinforces our findings about employment as a barrier for showing-up to appointments with employed individuals being more likely to miss an appointment compared to their unemployed counterparts. This raises again the need to modify the opening hours of PHCCs to better accommodate employed patients (Yamout et al. 2014).

Limitations

Although this is a multi-center study covering five MOPH PHCCs and three UNRWA centers, the situation in these centers may not be reflective of all centers included in the MOPH PHC National Network in Lebanese rural areas nor all of the UNRWA centers in Palestinian refugee camps. However, PHCCs were evenly distributed across governorates. Another limitation is the response rate to phone surveys (62.9%) which may limit the generalizability of the study findings when it comes to showing-up to appointments. Yet, no non-response bias was observed, as the characteristics of non-respondents were similar to those of respondents when assessed using the Chi-squared test. Furthermore, compliance with visits or showing-up to appointments were dependent on self-reporting, characterized by certain weaknesses including recall-bias, information and social desirability bias which might underestimate the no-show rate in this study.

Conclusions

Community screening employing the netbook application revealed higher diabetes and hypertension detection rates than the previously reported estimates in Lebanon. The low-cost eHealth strategies (online referrals and scheduling) facilitated equal access to NCDs services in PHC and provided newly identified and pre-diagnosed cases having no regular provider with the opportunity to benefit from the continued healthcare provision in PHCCs. Furthermore, this study demonstrates that showing-up to scheduled appointments is multifactorial, with not knowing the reason

of referral as an intrinsic barrier to show-up and being employed as an external barrier. This study also represents a key pilot test assessing the relevance of employing eHealth strategies in the context of Lebanon before the actual implementation of the national eHealth policy in Lebanon. The information generated provides foundation for future research, as well as important evidence informing key decision makers. The findings of this study mobilize the MOPH in Lebanon and UNRWA to invest in the integration of eHealth technology in other PHC centers to enhance equity at the national level and to widen the compass of health services coverage.

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Author contributions SS and MA have conceptualized the study. MA and HD advised on the study design and data analysis. SS supported the implementation of the study. HD led the data analysis. SS, MA, AF, and NEA contributed significantly to the interpretation and development of the manuscript. AF, NEA, CEM, and CM made significant contributions to the write-up of the manuscript. All authors read and approved the final manuscript.

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Compliance with ethical standards

Ethics approval and consent to participate Prior to commencing the study, ethical approval was obtained from the Institutional Review Board of AUB. Written informed consent was used at all stages; participation was completely voluntarily and the data collected was completely confidential.

Availability of data and materials The data sets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Conflict of interest The authors declare that they have no competing interests.

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