Access to Health Using Cell Phones by War Refugees

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Abstract

The world is experiencing the largest ever humanitarian crisis since World War II, with the largest number of world's refugees being hosted in the Eastern Mediterranean Region (EMR). Many of these refugees are females of reproductive age. Refugees require special healthcare services that host countries are not always able to provide. Mobile health (mHealth) technologies may serve as an added value to reduce the gap in this population. Mobile health (mHealth) is the support of medical and public health practice by mobile devices including mobile phones, patient monitoring devices, personal digital assistants, or other wireless devices. These technologies can facilitate access to unavailable services. In low- and middle-income countries mHealth interventions have improved treatment adherence and appointment compliance. Despite promising results and the presence of cell phone networks such as second, third, and fourth generation (2G, 3G, or 4G) and global positioning system (GPS), mHealth technologies are still not being implemented.

This chapter provides a holistic picture of refugee settlement in EMR by identifying the distribution of refugees, asylum seekers, and stateless people and mapping the published evidence on the use of mHealth interventions by refugees for improving maternal and child health in EMR. The use of combined methods provides more insight on the well-being of refugees in the EMR. A literature review to map the distribution of refugees per country within the EMR and scoping review methods for identifying published evidence on mHealth interventions on maternal and child health used among refugee populations in EMR were applied. The findings reveal the presence of only three interventions on maternal and child health in EMR. Only one study demonstrated that short message system (SMS) was an effective reminder system to improve compliance with immunization appointments and a source of motivation to show up on their appointments. This chapter highlights potential of SMS-based mHealth technologies and the general lack of evidence on effective mHealth technologies in EMR. It serves as the first step in this process of expanding mHealth to EMR and identifying priorities for further study.

Keywords

mHealth · Refugees · Maternal and child health · Eastern Mediterranean Region

Refugees' Needs and Healthcare Service Provision

Over 65.5 million refugees were displaced, due to persecutions, conflicts, violence, or other human rights violations in 2016. Of these, 22.5 million persons had to flee their countries (UNHCR 2016a). Various conflicts and wars make women and children among the most vulnerable (Otten 2017). Although the demographics of refugees vary, a large proportion of them are females of reproductive age (Table 1). The EMR countries (Countries within this region include Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen.), including Pakistan, Lebanon, and Iran, host the largest number of the world's refugees (UNHCR 2017a).

Refugees need different types of healthcare services, including care for mental health, noncommunicable diseases (NCDs), chronic obstructive pulmonary disease (COPD), diabetes, hypertension, and cardiovascular diseases (World Health Organization 2015). In addition to these chronic diseases, refugees in the EMR also need reproductive, maternal, and child healthcare services (World Health Organization 2015). Currently, there are low rates of antenatal care use and also high rates of caesarean sections (World Health Organization 2015). Further, due to lack of safe water, there is an increase in infections in children. The postponement of immunization campaigns means that there is an increased risk of disease outbreaks.

At the same time, the need for healthcare services is increased in hosting communities because of the increased numbers of refugees, resulting in a high physician to patient ratio. The countries of conflict have a shortage of surgeons, anesthesiologists, laboratory professionals, female reproductive health professionals, and mental health experts (World Health Organization 2015). This increased demand has increased healthcare costs and created service challenges such as delays in diagnosis and treatment and postponement of immunization campaigns (World Health Organization 2015). Given these challenges, many refugees face problems in accessing healthcare services in EMR.

Access to healthcare is further hampered by language differences on several levels of the healthcare system that is not only restricted to doctor-patient interactions but extends to the entire patient journey from making an appointment to filling a prescription. Differences in cultural beliefs also influence refugee healthcare choices, as refugees have different conceptions of prevention services, expectations of care, and stigma pertaining to their health conditions compared to their host communities (Morris et al. 2009). More general health system barriers also contribute to access problems, such as availability of transportation and appointments, difficulty in scheduling appointments, and waiting times (Morris et al. 2009). Because of the lack of timely care, services are often provided when problems are more serious, which places even more pressure on the health system and has serious consequences for public health in the EMR.

Given the health system challenges affecting refugee access to services for these conditions, innovations are needed to improve access to healthcare and to address the health of refugees in EMR.

Table 1 Demographics of registered refugees, asylum seekers, and stateless persons in countries within the EMR

	0–4 Years		5–11 Years		12–17 Years		18–59 Years		60 + years	
	M	F	M	F	M	F	M	F	M	F
Refugees, asylum seekers, and stateless persons in Afghanistan	262,281 (22%)	239,795 (21%)	237,597 (20%)	242,089 (21)	207,582 (17%)	188,178 (16%)	434,083 (36%)	434,462 (38%)	53,156 (4%)	45,006 (4%)
Refugees, asylum seekers, and stateless persons in UAE	54 (7%)	55 (7%)	165 (22%)	176 (23%)	290 (38%)	273 (36%)	219 (29%)	216 (29%)	29 (4%)	30 (4%)
Refugees, asylum seekers, and stateless persons in Bahrain	26 (13%)	17 (10%)	26 (13%)	30 (17%)	14 (1%)	14 (8%)	126 (62%)	112 (63%)	12 (6%)	5 (3%)
Refugees, asylum seekers, and stateless persons in Djibouti	1749 (13%)	1720 (14%)	2635 (20%)	2565 (20%)	1805 (14%)	1650 (13%)	6604 (50%)	6322 (50%)	412 (3%)	400 (3%)
Refugees, asylum seekers, and stateless persons in Egypt	17,277 (13%)	16,022 (13%)	21,932 (16%)	24,169 (19%)	22,747 (17%)	16,392 (13%)	70,419 (52%)	66,276 (52%)	3947 (3%)	4156 (3%)
Refugees, asylum seekers, and stateless persons in Iran	1945 (13%)	1828 (13%)	2516 (17%)	2516 (18%)	2933 (20%)	2762 (20%)	6391 (43%)	6403 (45%)	876 (6%)	602 (4%)
Refugees, asylum seekers, and stateless persons in Iraq	20,772 (14%)	19,896 (16%)	22,572 (15%)	21,441 (17%)	15,253 (10%)	13,492 (11%)	85,342 (58%)	68,793 (54%)	4226 (3%)	4652 (4%)
Refugees, asylum seekers, and stateless persons in Jordan	53,844 (15%)	50,847 (14%)	79,278 (22%)	74,806 (21%)	48,922 (14%)	46,393 (13%)	163,035 (46%)	173,119 (48%)	13,002 (4%)	17,566 (5%)
Refugees, asylum seekers, and stateless persons in Kuwait	45 (5%)	32 (4%)	150 (18%)	87 (11%)	122 (14%)	139 (18%)	488 (57%)	457 (59%)	44 (5%)	65 (8%)

(*continued*)

Table 1 (continued)

	0–4 Years		5–11 Years		12–17 Years		18–59 Years		60 + years	
	M	F	M	F	M	F	M	F	M	F
Refugees, asylum seekers, and stateless persons in Lebanon	91,985 (19%)	87,881 (16%)	125,298 (25%)	119,602 (22%)	69,769 (14%)	67,101 (12%)	192,848 (39%)	248,564 (46%)	12,553 (3%)	15,702 (3%)
Refugees, asylum seekers, and stateless persons in Libya	755 (3%)	737 (5%)	3064 (14%)	2904 (18%)	2063 (9%)	1856 (12%)	15,650 (69%)	9826 (62%)	1029 (5%)	663 (4%)
Refugees, asylum seekers, and stateless persons in Morocco	388 (9%)	384 (15%)	450 (11%)	432 (17%)	519 (12%)	329 (13%)	2757 (66%)	1351 (53%)	64 (2%)	59 (2%)
Refugees, asylum seekers, and stateless persons in Oman	43 (13%)	31 (9%)	46 (14%)	69 (20%)	43 (13%)	45 (13%)	188 (56%)	183 (52%)	14 (4%)	21 (6%)
Refugees, asylum seekers, and stateless persons in Pakistan	193,584 (15%)	165,688 (14%)	292,999 (22%)	260,958 (23%)	196,595 (15%)	164,671 (14%)	573,163 (43%)	519,356 (45%)	63,541 (5%)	46,931 (4%)
Refugees, asylum seekers, and stateless persons in Qatar	13 (8%)	16 (10%)	25 (16%)	22 (14%)	9 (6%)	19 (12%)	95 (60%)	93 (58%)	17 (11%)	10 (6%)
Refugees, asylum seekers, and stateless persons in Saudi Arabia	5 (5%)	7 (8%)	14 (13%)	10 (12%)	17 (16%)	16 (19%)	67 (64%)	49 (57%)	–	–
Refugees, asylum seekers, and stateless persons in Sudan	15,320 (14%)	14,837 (12%)	26,900 (24%)	26,334 (21%)	19,824 (17%)	19,910 (16%)	46,732 (41%)	56,510 (46%)	5676 (5%)	5685 (5%)
Refugees, asylum seekers, and stateless persons in Somalia	260,108 (30%)	199,298(26%)	236,043 (27%)	192,069 (25%)	115,219 (13%)	83,579 (11%)	229,954 (27%)	256,317 (34%)	24,305 (3%)	26,286 (3%)

(*continued*)

Table 1 (continued)

	0–4 Years		5–11 Years		12–17 Years		18–59 Years		60 + years	
	M	F	M	F	M	F	M	F	M	F
Refugees, asylum seekers, and stateless persons in Syria	2124 (14%)	2088 (13%)	3192 (20%)	3151 (19%)	2246 (14%)	2272 (14%)	6925 (44%)	8179 (49%)	1155 (7%)	917 (6%)
Refugees, asylum seekers, and stateless persons in Tunisia	20 (5%)	15 (6%)	45 (11%)	19 (8%)	35 (9%)	14 (6%)	255 (63%)	151 (60%)	6 (1%)	8 (3%)
Refugees, asylum seekers, and stateless persons in Yemen	120,315 (7%)	125,186 (8%)	427,717 (26%)	429,161 (26%)	307,157 (19%)	273,913 (2%)	716,408 (44%)	765,651 (47%)	62,705 (4%)	49,741 (3%)

Data source: (UNHCR 2016d)
M, males; F, females

Utilization of Mobile Health (mHealth)

Given the challenges in the current provision of healthcare to refugees, mobile health (mHealth) interventions may serve as a practical tool to enhance healthcare service provision in the EMR. Mobile health (mHealth) is the support of medical and public health practice by mobile devices including mobile phones, patient monitoring devices, personal digital assistants, or other wireless devices (World Health Organization 2011).

This includes the use of one or more utility provided by mobile phones, e.g., short messaging service (SMS), voice messages, more complex functions such as specific applications (apps), and/or Bluetooth technology. The cellular networks may include second, third, and fourth generation (2G, 3G, or 4G) and global positioning system (GPS) (World Health Organization 2011). mHealth interventions facilitate access to unavailable services (Opoku et al. 2017) and have improved treatment adherence and appointment compliance in low- and middle-income countries (Hall et al. 2014). In addition to this, mHealth is used in resource-limited settings to improve the quality of pregnancy care (both pre and post) and to enhance healthcare utilization (Sondaal et al. 2016). The use of mHealth interventions, particularly those delivered using SMS, increases utilization of healthcare, including pre- and postnatal healthcare services, skilled birth attendance, and vaccination (Nurmatov et al. 2014). Some mHealth interventions have also positively impacted the rates of exclusive breastfeeding for 3 or 4 months compared to those without mHealth interventions (Nurmatov et al. 2014). In the same study, the rates of initiating breastfeeding within 1 h after birth were also higher in the groups given a SMS/cell phone prenatal intervention than in groups not given the SMS/cell phone intervention (Nurmatov et al. 2014). Beyond health effects, mHealth is also an important data collection tool that can also assist in the development of support networks by health workers (Rajput et al. 2012). While these results on using mHealth are promising, there is little evidence of mHealth implementation within the EMR due to several barriers challenging the adoption of this technology (Aranda-Jan et al. 2014).The use of mHealth in EMR could be of great value to refugees in most countries given the challenges they face (Wallis et al. 2017) . In addition, most refugees live in areas connected to mobile phone networks, with access to second-generation (2G) and third-generation (3G) wireless technologies (Fig. 1).

Despite high cellular network coverage (including 2G and 3G technologies), with 48% of WHO Member States reporting using mobile devices in emergency and disaster situations, these technologies are not used in emergency and disaster situations in Africa or the EMR (World Health Organization 2011). This may be caused by several countries not adopting mHealth due to the increasing pressure to perform under various challenges within the healthcare system, including shortage of human resources and limited budgets (World Health Organization 2011).

The need for services by end-line users is an important factor to mHealth adoption among them, especially when faced with other barriers to access including travel time, waiting time, and travel costs (Opoku et al. 2017). As cell phone coverage is high and the need for solutions is urgent, mHealth could be used in EMR refugee

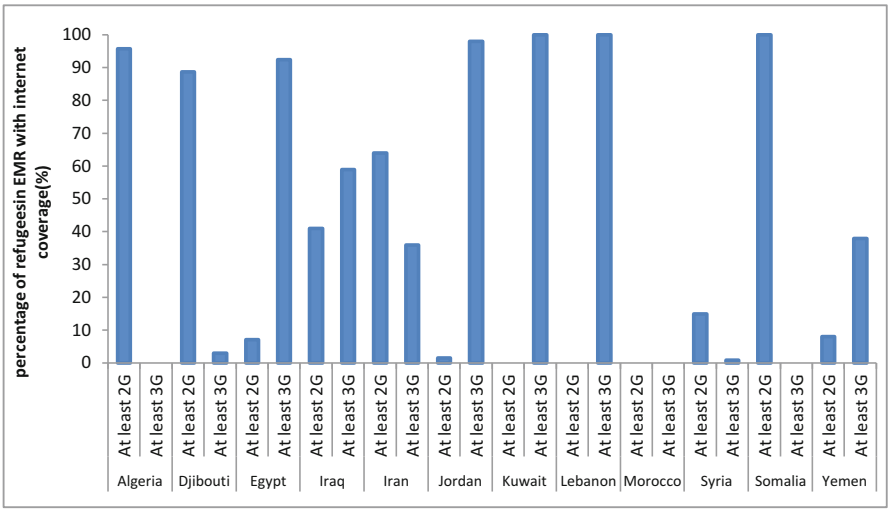

Fig. 1 Percentage of refugees in EMR living with Internet coverage. (This figure excludes refugees living with no geo-location data.). (Data Source: UNHCR 2016)

contexts. In order to start implementing mHealth, however, it is important to collate the evidence of the current use of mHealth approaches in these contexts and also to know the number of refugees settled in the area. Currently, the distribution of refugees in EMR hosting countries is based on different estimates from various reports and mHealth-related interventions. Information related to mother and child health that has been obtained and evaluated in a humanitarian setting is not available. In this chapter, we set out to achieve two aims: (1) to identify the distribution of refugees, asylum seekers, and stateless people in the EMR by reviewing reports of various organizations to obtain a holistic picture of refugee settlement and (2) to map the published evidence on the use of mHealth interventions by refugees for improving maternal and child health in EMR in order to identify gaps and priorities for further study through using scoping review methods.

We used a combined mixed-method approach: (1) we conducted a literature review to map the distribution of refugees per country, within the EMR, and their distribution based on gender and age group; and (2) we used scoping review methods for identifying published evidence on mHealth interventions on maternal and child health used among refugee populations in EMR. These combined methods gave greater insight on the situation of refugees, asylum seekers, and stateless persons in the EMR.

We used the following definitions of each group:

1. *Refugees* are people who have been forced to flee their country because of persecution, war, or violence. They are defined and protected by international law and cannot be expelled or returned to situations where their life and freedom are at risk (UNHCR 2017a).

Table 2 Distribution of refugees, asylum seekers, and stateless persons in the EMR (total number = N)

Country	Refugees N	Asylum seekers N	Stateless persons N
Afghanistan	239,477[a]	92[a]	–
Bahrain	–	–	–
Djibouti	63,684	2,641	–
Egypt	120,154	38,171	22
Iran	979,410	42	
Iraq	239,639	7,420	50,000
Jordan	2,839,437	24,935	–
Kuwait	741	900	93,000
Lebanon	1,240,000	12,139	473,671
Libya	9,305	27,479	–
Morocco	30,622	1,910	–
Oman	51,000	190	–
Pakistan	1,561,162	6,442	–
Palestine	2,051,096[b]	–	–
Qatar	120	118	1,200
Saudi Arabia	39,880	32	70,000
Somalia	48,161	12,635 (not specified)	–
Sudan	1,688	12,581	–
Syria	549,729[a]	5,251	160,000
Tunisia	665	90	–
UAE	663	421	–
Yemen	170,870	1,340	–

[a]average
[b]Palestinian nationals who were defined as refugees according to UNHCR (2016b, c, 2017b, c, d), UNICEF (2017), and UNRWA (2015)

2. *Asylum seekers* are individuals who have sought international protection and whose claims for refugee status have not yet been determined (UNHCR 2017a).
3. *Stateless persons* are persons who do not have a nationality of any country and have been denied the enjoyment of fundamental human, social, and political rights such as access to education and healthcare and freedom of movement (UNHCR 2015).

Distribution of Refugees in EMR

The EMR carries the largest burden of displaced populations globally with the flow and influx to it being larger than other countries. In fact, more than half of the world's refugees are hosted by countries in the EMR (Table 2) (UNHCR 2016a).

Table 3 Summary of the included studies

Study ID	Author	Study design	Intervention type and media used	Target population/ sample	Outcome
1	Schermerhorn	Mixed methods: cohort/ interview	SMS to parent's mobile phone	100 urban refugee children and 13 parents	Reminders: defaulter tracing Immunization
2	HaBaby app	N/A	Mobile phone app education based on trimester. Free, easy to use, multilingual, after download no need of connection	Transitionary and stationary women refugees. Specifically, in Syria, Iraq, Lebanon, Greece, Germany, France, UK, Sweden, Turkey, and Hungary	No outcome
3	VaccinePass	N/A	Mobile phone app for parents to keep track of their children's vaccinations. Data is only stored locally on the phone	For Syrian refugees staying in camps like Turkey	No outcome

Use of mHealth for Maternal and Child Services in the EMR

In addition to distribution of refugees in EMR, we identified three studies on use of mHealth for maternal and child services relevant to EMR (Table 3).

The refugee populations in the reviewed articles included urban refugee children and parents (study 1); transitioning and stationary women refugees in Syria, Iraq, Lebanon, and other countries (study 2); and Syrian refugees staying in Turkish camps (study 3).

Of the three included studies, one study was conducted using mixed methods including a cohort study with interview (study 1). The study was less than a year in duration. This intervention sent an SMS to parents via mobile phones to remind them of their children's immunization process. The aim was to initiate contact with immunization defaulters to improve their attendance. Study 2 was a description of an application. The application used was "HaBaby," a free and multilingual educational mobile application for prenatal and postnatal care among refugee women. The application could be used without an Internet connection and needed to be downloaded on the smartphone. The application allows women to access information regarding trimester details and symptoms as well as medications and

free support options within the country of residence. HaBaby also includes an anonymous message board and an option to live chat with a healthcare professional (Maternova n.d.). Study 3 was a prospective cohort study aimed of mobile phone application use as a reminder for parents to keep track of their children's vaccinations. The study also reported on the use of mHealth to schedule appointments for vaccination.

The application of mHealth in the EMR has not been evaluated in two of the studies we found (Crimi n.d.; Empower Hacks 2017; Maternova n.d.). However, where evaluated, it showed that an SMS reminder message increased the attendance for child immunization after a missed appointment (Schermerhorn 2015), where 77% of patients returned to care within a median of 16 days prior to the SMS reminder and were vaccinated a median of 1.5 days after the reminder was received by the caregiver (study 1). Positive responses were also seen regarding the utility of SMS reminders by the defaulters who did not show up on the scheduled appointment for their children's immunization. The system also provided a good platform to improve patient's perception in the healthcare system, therefore improving health-seeking behavior.

The refugee mothers in study 1 appreciated the provision of a Maternal-Child Health handbook, but it was utilized irregularly. Participants also reported missing immunization appointments simply because they forgot. However, the study results show that SMS messaging was an excellent reminder system to improve compliance with immunization appointments; participants reported that the text message served not only as reminder but had also motivated them to show up on their appointments (Schermerhorn 2015).

The world is currently experiencing the largest humanitarian crisis since World War II (UNHCR 2016a). Our results identified a high number of refugees settled in the EMR area, but only three studies on the use of mHealth for maternal and child health in these areas. Given that women and children are the most vulnerable group of refugees, and low rates of antenatal care identified (World Health Organization 2015), a finding which is of great concern. The presence of mHealth is essential, given its role in enhancing access to medical information and improving patient outcomes in resource-limited settings (Wright et al. 2015). The application of mHealth in such settings significantly improves case management as well as positively impacts health knowledge, attitudes, and practices (Higgs et al. 2014). Thus, in the absence of a structured healthcare system, mHealth is a means to fill the gaps.

This minimal engagement of mHealth could be due to barriers to implementation, such as conflicting health systems priorities, policies, cost-effectiveness, and knowledge (Fig. 2). Countries within the EMR report that the main barrier to mHealth implementation is due to conflicting health systems priorities, that funding is generally allocated to other programs ahead of mHealth, or a lack of general interest or understanding of the field. Most of the new applications can be more effective when implemented under an umbrella of eHealth strategy (World Health Organization 2011), although some elements of eHealth can be implemented separately. The lack of ministerial guidance and an absence of financial support from governments

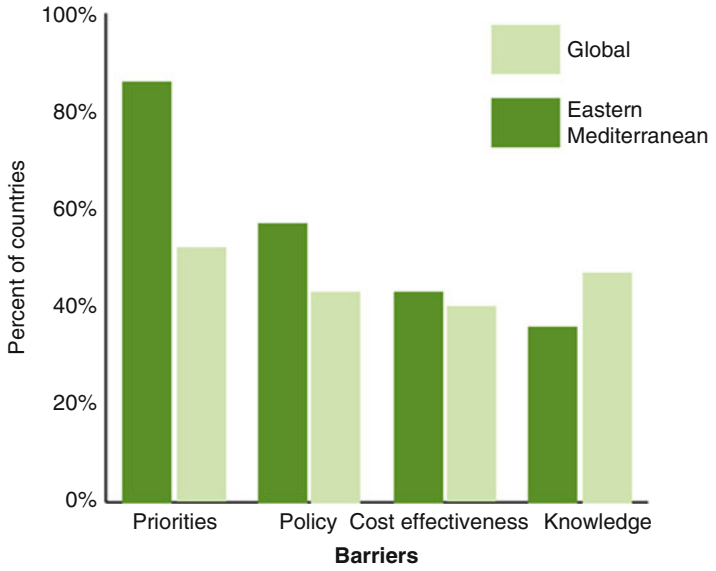

Fig. 2 Top four barriers to mHealth implementation in EMR

contribute to the failure of mHealth projects (Aranda-Jan et al. 2014). Another important barrier is not recognizing mHealth as an approach to health-related issues by the country or regional eHealth policy. In addition, the lack of knowledge and cost-effectiveness of mHealth applications and initiatives can also block the implementation in the EMR (Aranda-Jan et al. 2014) (Fig. 2).

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Another reason for the lack of implementation of mHealth for mother and child health could be the technical challenges in starting such an intervention. Technical challenges in the initial programming and rollout/uptake of the application as well as frequent crashes in its initial versions can decrease its [application] utility by interested providers, despite technical repairs (Doocy et al. 2017).

Cost and cost-effectiveness are significant barriers to the implementation of mHealth; the initial outlay and implementation costs can be high, such as in the Central African Republic. For this indicator, research is already available. For example, a 15-week pilot project conducted by the Ministry of Health at the Central African Republic and Médecins Sans Frontières, to test a disease surveillance app in 21 health facilities, shows that the total cost of the pilot project was US$41,300$. El-Khatib et al. estimated a cost of US$18,000 for communication fees to maintain the app in the 21 facilities (El-Khatib et al. 2018)**.** Despite the initially high outlay costs, mHealth can be used in health campaigns for a lower cost and broader reach, as in Bangladesh (World Health Organization 2011).

There are other examples of the potential cost-effectiveness (lower cost and broader reach) of mHealth. For example, in Bangladesh, nationwide SMS health campaigns are conducted at no cost for both the mobile telephone users and the Ministry. This leaves the Ministry with the cost of the bulk SMS service for its health staff members only, and mobile operators are paid less than one cent of a Bangladeshi Taka (BDT) per SMS message. Subscribers pay for the campaign at a discounted rate. This means that operational costs are minimal at the Ministry level, since staff members do the work as part of their duties. The long-term sustainability of this project is ensured by the Ministry's budget and political support (World Health Organization 2011). In a sub-Saharan setting such as in Rwanda, blood testing machines based on mobile phone technology were combined with cloud-based medical records. These were shown to cost less compared to other alternatives. In particular, the mobile blood testing devices cost US$1,000 – compared to US$19,000 for benchtop machines (Hall et al. 2014). In another African setting in Malawi, St Gabriel's Hospital piloted a scheme aiming to overcome the barriers of poor doctor-patient ratio and distance to hospitals through interventions done by community health workers. Seventy-five community health workers generally volunteering from villages were given mobile phones and trained to use them for patient adherence reporting, appointment reminders, and communication with physicians regarding tuberculosis. The piloted scheme resulted in a total saving of US$ 2,750, mainly due to reduced fuel costs providing a chance to effectively double tuberculosis treatment due to an increase in time available to community health workers (Hall et al. 2014).

These examples of cost-effectiveness should be taken into account when promoting and planning mHealth services in the EMR. Important in this regard is also improving knowledge of these alternatives, to support prioritization and policy alternatives for using mHealth. These are areas where further research is needed.

Conclusion

The EMR hosts a large number of refugees with limited access to healthcare services. We identified only three implementations of mHealth approaches for maternal and child health in the region, despite its potential benefits for healthcare access. As a first step in this direction, mHealth interventions based on SMS messaging show promising results in terms of improving compliance to healthcare services. This may be worth exploring for future policy-oriented work, especially when addressing access to healthcare services. On a broader level, adopting mHealth requires changes within healthcare systems to support feasibility and facilitate adoption of mHealth interventions. This process requires coordination and support from governments, funders, and industries. We need to address the barriers identified: knowledge of the systems and cost-effectiveness, priority setting, and policies. Evidence is already available on the cost-effectiveness, policies, and knowledge of mHealth from other settings, and further evidence is needed within the EMR.

Well-conducted studies and evaluations can provide evidence of mHealth interventions that can support national and regional policies and prioritization of discussions.

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References

Aranda-Jan CB, Mohutsiwa-Dibe N, Loukanova S (2014) Systematic review on what works, what does not work and why of implementation of mobile health (mHealth) projects in Africa. BMC Public Health 14(1). https://doi.org/10.1186/1471-2458-14-188

Crimi A (n.d.) Hababy: a web app for prenatal and postnatal care for refugee women. Retrieved October 30, 2017, from http://www.alessandrocrimi.com/hababy/

Doocy S, Paik K, Lyles E, Tam HH, Fahed Z, Winkler E, … Burnham G (2017) Pilot testing and implementation of a mHealth tool for non-communicable diseases in a humanitarian setting. PLOS Curr Disasters, (Edition 1). https://doi.org/10.1371/CURRENTS.DIS.E98C648AAC93797B1996A37DE099BE74

El-Khatib Z, Shah M, Zallappa SN, Nabeth P, Guerra J, Manengu CT et al (2018) SMS-based smartphone application for disease surveillance has doubled completeness and timeliness in a limited-resource setting–evaluation of a 15-week pilot program in Central African Republic (CAR). Confl Heal 12(1):42

Empower Hacks (2017) Mobile phone apps: empowering women and girls refugees. Retrieved February 5, 2017, from https://github.com/empowerhack

Hall CS, Fottrell E, Wilkinson S, Byass P (2014) Assessing the impact of mHealth interventions in low- and middle-income countries – what has been shown to work? Glob Health Action 7(1):25606. https://doi.org/10.3402/gha.v7.25606

Higgs ES, Goldberg AB, Labrique AB, Cook SH, Schmid C, Cole CF, Obregón RA (2014) Understanding the role of mHealth and other media interventions for behavior change to enhance child survival and development in low- and middle-income countries: an evidence review. J Health Commun 19(sup1):164–189. https://doi.org/10.1080/10810730.2014.929763

Maternova (n.d.) HaBaby: The app for pregnant refugees. Retrieved from https://maternova.net/blogs/news/hababy-the-app-for-pregnant-refugees

Morris MD, Popper ST, Rodwell TC, Brodine SK, Brouwer KC (2009) Healthcare barriers of refugees post-resettlement. J Community Health 34(6):529. https://doi.org/10.1007/s10900-009-9175-3

Nurmatov UB, Lee SH, Nwaru BI, Mukherjee M, Grant L, Pagliari C (2014) The effectiveness of mHealth interventions for maternal, newborn and child health in low– and middle–income countries: protocol for a systematic review and meta–analysis. J Glob Health 4(1). https://doi.org/10.7189/jogh.04.010407

Opoku D, Stephani V, Quentin W (2017) A realist review of mobile phone-based health interventions for non-communicable disease management in sub-Saharan Africa. BMC Med 15(1):24. https://doi.org/10.1186/s12916-017-0782-z

Otten C (2017) Mosul's war widows face new challenges in displacement. Retrieved from http://www.unhcr.org/news/latest/2017/7/595b86554.html

Rajput ZA, Mbugua S, Amadi D, Chepngeno V, Saleem JJ, Anokwa Y et al (2012) Evaluation of an Android-based mHealth system for population surveillance in developing countries. J Am Med Inform Assoc 19(4):655–659. https://doi.org/10.1136/amiajnl-2011-000476

Schermerhorn JT (2015) Reminders, refugees, and Ramadan: characterizing missed immunization appointments among Palestinian refugees in Jordan. Duke University. Retrieved from https://pdfs.semanticscholar.org/f984/551d2718c99193a53daf78cb457231e09a5c.pdf

Sondaal SFV, Browne JL, Amoakoh-Coleman M, Borgstein A, Miltenburg AS, Verwijs M, Klipstein-Grobusch K (2016) Assessing the effect of mHealth interventions in improving maternal and neonatal care in low- and middle-income countries: a systematic review. PLoS One 11:e0154664. https://doi.org/10.1371/journal.pone.0154664

UNHCR (2016a) Global trends: forced displacement in 2016. Retrieved from http://www.unhcr.org/globaltrends2016/

UNHCR (2016b) Iran factsheet. Retrieved from http://www.unhcr.org/protection/operations/50002081d/iran-fact-sheet.html

UNHCR (2016c) Morocco-Factsheet. Retrieved from http://www.unhcr.org/protection/operations/567162f79/morocco-fact-sheet.html

UNHCR (2016d) Population statistics. Retrieved January 25, 2018, from http://popstats.unhcr.org/en/time_series

UNHCR (2017a) Figures at a glance. Retrieved November 12, 2017, from http://www.unhcr.org/figures-at-a-glance.html

UNHCR (2017b) Horn of Africa Somalia Situation. Retrieved from https://data2.unhcr.org/en/situations/horn?id=197

UNHCR (2017c) Regional refugee and migrant response plan. Retrieved from http://data.unhcr.org/yemen/regional.php#_ga=2.52767528.1048049647.1496428038-1809794175.1496428038

UNHCR (2017d) UNHCR statistics-the world in numbers. Retrieved from http://popstats.unhcr.org/en/overview#_ga=2.258346634.1048049647.1496428038-1809794175.1496428038

UNICEF (2017) UNICEF Syria crisis situation report April 2017 – humanitarian results. Retrieved from https://reliefweb.int/report/syrian-arab-republic/unicef-syria-crisis-situation-report-april-2017-humanitarian-results

UNRWA (2015) UNRWA in figures. Retrieved from https://www.unrwa.org/sites/default/files/unrwa_in_figures_2015.pdf

Wallis L, Hasselberg M, Barkman C, Bogoch I, Broomhead S, Dumont G et al (2017) A roadmap for the implementation of mHealth innovations for image-based diagnostic support in clinical and public-health settings: a focus on front-line health workers and health-system organizations. Glob Health Action 10. https://doi.org/10.1080/16549716.2017.1340254

World Health Organization (2011) mHealth: new horizons for health through mobile technologies. Observatory 3(June):66–71. https://doi.org/10.4258/hir.2012.18.3.231

World Health Organization. (2015). Refugees and internally displaced persons in the Eastern Mediterranean Region: a health perspective. Retrieved from http://www.emro.who.int/images/stories/eha/documents/migrants_refugees_position_paper.pdf?ua=1

Wright V, Dalwai M, Smith RV, Jemmy J-P (2015) Médecins Sans Frontières' Clinical Guidance mobile application: analysis of a new electronic health tool. Public Health Action 5(4):205–208. https://doi.org/10.5588/pha.15.0057