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Service Design applied to a Health Record System. A prototype for a refugee field hospital in Iraq

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Disclaimer

This is an original dissertation, purposedly made for the completion of my master's degree, and all authors whose studies and publications were used to complete it are duly acknowledged.

It represents research in progress along the completion of this dissertation, and hence much of its content is a compilation and extraction (especially in chapter 3, representing the Methodology and Outcomes of the research) of the following published papers:

- *AHFE 2022 - International Conference on Applied Human Factors and Ergonomics and the Affiliated Conferences*

  Camacho, L., Penedos-Santiago, E., Ferreira, E. (2022). Health and Design at Service of a Refugee Camp in Iraq. In: Raposo, D., Martins, N. and Brandão, D. (eds) Human Dynamics and Design for the Development of Contemporary Societies. AHFE (2022) International Conference. AHFE Open Access, vol 25. AHFE International, USA. http://doi.org/10.54941/ahfe1001412

  contributing with the initial background and literature review followed with the Ethnographic observational study (Service Safari).

- *ehSemi 2022 - 2nd students' seminar on Ehealth and Wellbeing*

  Camacho, L., Penedos-Santiago, E., & Santos, E. (In press). Design for a Health Record System: A Service Prototype for a refugee camp in Iraq. In Coleção DigiMedia

  developing the initial hospital's health record system journey map, to the first health record prototype (paper based), followed by a benchmarking analysis to electronic health record software's and the second prototype, digital.

- *DIGICOM - 6th International Conference on Digital Design and Communication*

  Camacho, L., Penedos-Santiago, E., & Santos, E. (2022, November). Service Design applied to a Health Record System. A prototype for a refugee field hospital in Iraq [Paper presentation]. DIGICOM, Barcelos, Portugal

  exploring the electronic prototype through a Speed consulting workshop.

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Abstract and Keywords

The recent humanitarian crisis has led millions to flee their homes and find refuge in other areas. Health non-governmental organizations (NGO), such as Adventist Help (AH), arose from the need to provide aid and lessen human suffering. However, working in this context over the past 5 years, I witnessed a compromised quality of care, due to uncertain and limited health record (HR) system.

Quality in healthcare has been associated with a functional HR system for its management, delivery, and safety. Therefore, the identification and implementation of such a system is imperative. Systematic collection of patients' health features and continuity of care to a database is crucial to ensure high standards of care, particularly in contexts where health systems are destroyed or disrupted, leaving the population without proper care.

Using a mix methods approach with a service design methodology, this dissertation aims to develop an HR system's service blueprint within an emergency field hospital inside a refugee camp in Iraq, to avert a scenario of a meager patient care. A Service Safari, with informal ethnographic interviews, was conducted initially to understand the current situation for the development of a prototype. A Speed Consulting workshop followed, with national and international health professionals working at AH's field hospital, to explore opportunities for improvement of the system. Finally, a User Experience Flowchart was created, outlining the flow of the HR system when used by healthcare professionals.

An open-source EHR system was identified, which can be used in contexts such as the present, as well as the main problems regarding its customization. This system, when adequately customized to the clinical context, has the potential to be distributed free of charge to all health stakeholders, who lack a simple and effective clinical registration tool.

keywords: **humanitarian crisis**; **health record system**; **service design**; **service blueprint**

Resumo e Palavras-chave

A recente crise humanitária já levou milhões de pessoas a fugirem para procurar refúgio noutras regiões do mundo. Organizações não-governamentais (ONG) de emergência médica, como é o caso do Adventist Help (AH), surgiram da necessidade de prestar auxílio e diminuir o sofrimento humano. O contato direto nos últimos 5 anos com o AH evidenciou um cenário de perigo e imprevisibilidade na prestação de cuidados, que advém de um pobre ou inexistente sistema de registo clínico (SRC).

Tendo por pressuposto que um SRC funcional é um componente fulcral para uma gestão, prestação e segurança de cuidados de qualidade, a identificação e, por conseguinte, a implementação de tal sistema, é imperativa. A necessidade de haver um sistema capaz de manter um histórico dos cuidados prestados para garantir elevados padrões de cuidado em saúde acresce no contexto de crise humanitária, em que o sistema de saúde é interrompido ou destruído, deixando a população sem cuidados adequados.

Através de uma abordagem de métodos mistos e com uma metodologia de Service Design, esta dissertação tem como objetivo desenvolver um Service Blueprint do SRC de um hospital de emergência médica, dentro de um campo de refugiados no Iraque. Inicialmente foi realizado um Service Safari, com entrevistas etnográficas informais, a fim de compreender a situação presente para o desenvolvimento de um protótipo. Seguiu-se um workshop de Speed Consulting, com profissionais de saúde nacionais e internacionais a trabalhar no hospital do AH, a fim de explorar oportunidades de melhoria do presente sistema. Por fim, um User Experience Flowchart foi criado, delineando o fluxo do SRC aquando usado pelos profissionais de saúde.

Foram identificados um SRC eletrónico open-source, passível de ser utilizado em contextos como o vigente, assim como os principais problemas no que diz respeito à customização do mesmo. Este sistema, quando devidamente personalizado ao contexto clínico, tem o potencial de ser distribuído gratuitamente a todos os parceiros de saúde que careçam de uma ferramenta de registo clínico simples e eficaz.

palavras-chave: **crise humanitária**; **sistema de registo clínico**; **service design**; **service blueprint**

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List of Acronyms and Abbreviations

AH	Adventist Help
ECG	Electrocardiogram
EHR	Electronic Health Record
EHR	Electronic Health Record
HIS	Health Information System
HR	Health Record
HR	Health Record
ID	Identity
IDP	Internally Displaced Person
KRI	Kurdistan Region of Iraq
MDM	Médecins du Monde
MSF	Médecins sans Frontières
NCD	Non-communicable disease
NGO	Non-Governmental Organization
UN OCHA	United Nations Office for the Coordination of Humanitarian
PBHR	Affair Paper-Based Health Record
PHC	Primary Health Clinic
R&D	Research and Development
SDG	Sustainable Development Goals
SWOT	Strengths, weaknesses, opportunities, and threats [analysis]
UN	United Nations
UN DESA	United Nations Department of Economic and Social Affairs
UNHCR	United Nations High Commissioner for Refugees
USA	United States of America
WHO	World Health Organization

1

INTRODUTION

OBJECTIVES

RESEARCH QUESTIONS

According to the United Nations Office for the Coordination of Humanitarian Affair (UN OCHA), in 2018, over 140 million people in 37 countries were directly affected by Humanitarian crises and more than 65 millions of these people have been forcibly displaced from their homes (Daar et al., 2018). In 2022, the same organization estimates that 274 million people will need humanitarian assistance and protection worldwide (UNHCR, 2021).

Refugees and migrants are a diverse group, shaped by experiences from their country of origin, their migration journey, their host country's entry and integration policies, living and working conditions, and are especially vulnerable to chronic and infectious diseases (WHO, 2022).

For a better understanding of the concepts above, it is necessary to define some core concepts. The United Nations Department of Economic and Social Affairs (UN DESA) defines migrants as people who changes their home of residence frequently, within their home country or internationally, regardless of their migration reason. As for refugees, the United Nations High Commissioner for Refugees (UNHCR) defines refugees as people who fled to another country for international protection due to conflict, violence, or persecution, fearing for their lives (United Nations, 2022). Contrary to refugees, Internally Displaced Persons (IDP) have been forced to flee their homes but haven't crossed a border to find safety (UNHCR, n.d.).

This presents a significant challenge and a major health burden to hosting countries (El-Khani et al., 2019), especially if the region is poor, disrupted by conflict or has limited resources in healthcare (Abbas et al., 2018; Brotherton et al., 2022; Debarre, 2018; Kohrt et al., 2019; Toole & Waldman, 1997). Independently of the context of the humanitarian crisis, it always involve complex situations and requiring of aid (Jordan et al., 2021), leaving the displaced population in continual health threats (Brotherton et al., 2022). In this circumstances, humanitarian assistance is essential to provide immediate aid and actions to prevent and prepare such situations (Daar et al., 2018), to save lives and alleviate human suffering (Berlaer, 2017; Daar et al., 2018; ReliefWeb, 2008).

However, humanitarian aid usually relies on international professionals and volunteers (Berlaer, 2017; Debarre, 2018; Sphere Association, 2018) which must overcome cultural and language barriers to improve health outcomes (Brotherton et al., 2022; Jordan et al., 2021; Kohrt et al., 2019; Shen et al., 2017). Furthermore, humanitarian organizations often have limited resources and lack the leadership needed for a personalized approach in healthcare delivery (Spiegel, 2017). Particularly, services considered essential for patient safety in modern healthcare settings, such as comprehensive Electronic Health Records (EHR), are usually very rudimentary or totally absent (Doocy et al., 2015).

I observed this phenomenon in 2017 when, as a consequence of forced displacement, Greece received refugees from Afghanistan that were placed in an old, fenced factory, partially renovated for the purpose. As I moved to Athens to start working with an emergency medical Non-governmental Organization (NGO) called Adventist Help (AH) as a nurse, the problem that soon started to be noticeable, was the lack of a standardized efficient and effective health record (HR) system. Besides AH, another medical organization called Médecins du Monde (MDM) was also providing healthcare in the same camp, even though there wasn't any sort of communication system between the two organizations, leading to a compromise of patient continuity of care. MDM was using both electronic and a paper-based health record (PBHR) system that aside from being recorded in Greek, we could only have access to a very brief patient attendance's list to their facilities. Adventist Help was using an Electronic Health Record (EHR) system through a google sheet, where doctors and nurses could register patient data, clinical findings and treatment given, however resulting in a fragmented patient health record history and a cumbersome structure to access information. Both scenarios resulted in a frustrating delivery of care prone to clinical errors.

My experience in Iraq was similar. In 2017, a field hospital was rapidly established to meet, on a temporary basis, the immediate emergency necessities (Berlaer, 2017; Norton et al., 2013) outside the city of Mosul. The problem started to become evident when communication between health stakeholders were hindered by a precarious and non-standardized HR system (El-Khani et al., 2019). The lack of a simple yet functional system capable of accounting the healthcare provided (Brooks, 2021), facilitating communication between stakeholders (Mathioudakis et al., 2016; NHS, 2018; Pullen &

Louden, 2006), supporting transparency of care and enhancing its efficiency and effectiveness (El-Khani et al., 2019; Lippeveld et al., 2000) deterred the performance of the health system in place (Aqil et al., 2012; Thieren, 2005; Zegers et al., 2011).

This was the scenario that motivated me to research in the field of Design for Health and Wellbeing through the Polytechnic of Leiria – Escola Superior de Arte e Design, Caldas da Rainha, in which I'm graduating on the Master of Design for Health and Wellbeing, where I had the opportunity to associate my previous health and nursing experience with Design methodologies to identify problems and ideate solutions to a field Hospital in Iraq.

1.1. Objectives

To ensure high standards of care, a service blueprint of the emergency field hospital's health record system is proposed, as my main research goal, for a future re-design of the system.

1.2. Research questions

1) How can a service blueprint help identify opportunities to improve HR system in humanitarian crises?
2) To what extent can a Service Design approach improve healthcare standards and delivery of better care in humanitarian crises?

2

HEALTHCARE WITHIN HUMANITARIAN CRISIS

HISTORIC CONTEXT OF IRAQ

CONFLIC-AFFECTED PERSONS: HEALTHCARE CHALLENGES

HEALTH SYSTEM'S RESPONSE IN CRISIS SETTINGS

HEALTH INFORMATION SYSTEMS

2.1. Historic context of Iraq

Iraq was only defined with territorial limits, without any account to the different ethnic and religious groups within, after the Ottoman Empire rule was ended in the First World War. It became an independent kingdom in 1932 just for 20 years when it was introduced a republic, only to be replaced 10 years later by a secular Sunni party (Ba'ath Party). Under Saddam Hussein's leadership, Iraq invaded Iran in 1980 leading to the Iran-Iraq War and then invaded and occupied Kuwait in 1990, just to be defeated by an international coalition leaded by the United States of America (USA) in the Gulf War. It was shortly after that a nationwide uprising against Saddam failed, that a no-fly zone implemented by the United Nations (UN) led to the de facto establishment of the Kurdistan Region of Iraq (KRI) (Department of Foreign Affairs and Trade, 2020; Government, 2022) as an autonomous region. KRI borders Syria, Turkey, and Iran, which the regional capital is Erbil.

In 2007/2008 a USA troop surge succeeded in power after the insurgency against USA-led coalition forces when Saddam and the Ba'ath Party were removed from power in 2003 creating a power vacuum. Nevertheless, after USA's withdraw in 2011, ongoing religious tensions fueled the rise of Da'esh, which occupied large parts of Iraq in 2014. It was only after 3 years of conflict that the government finally declares victory over the Da'esh, who significantly damaged the Iraqi economy and continue to be a threat (Department of Foreign Affairs and Trade, 2020).

Iraq has an estimate population of 40 million people, and according to the UNHCR since 2014 around 6 million Iraqis have been displaced across the country. As of July 2020, Iraq had reached 1,4 millions of IDPs, with a large number taking refuge in the KRI (Department of Foreign Affairs and Trade, 2020). The humanitarian context it's still delicate, with disrupted access to basic services and a widespread displacement, even more than three years after the liberation of the Islamic State of Iraq and the Levant (ISIL) (OCHA, 2020).

Health services were already inadequate prior to the conflict, exacerbated with the additional burden of the COVID-19 pandemic, and the consolidation of many IDP camps throughout the country to larger ones, means that humanitarian actors need to ensure minimum standards are delivered, including medical services (Department of Foreign Affairs and Trade, 2020;

OCHA, 2019). Many efforts have been done by the Iraqi Government, UN agencies, national and international NGOs to end displacement, albeit the need for humanitarian assistance will continue to subsist (UNHCR, 2021).

As of August 2022, a total of 25 formal camps remains open (UNHCR, 2022), and only 1% of the IDPs expressed an intention of returning to their area of origin the next year (UNHCR, 2021) whence lack of services continued to be a barrier for their return (Department of Foreign Affairs and Trade, 2020; UNHCR, 2021, 2022).

2.2. Conflict-affected persons: healthcare challenges

Humanitarian crisis brings many impacts on the environment as on health, whereas the systems are disrupted or overwhelmed and pre-existing problems are exacerbated (Kohrt et al., 2019), and the different needs from displaced and host population strain the health system's coping mechanism. All parts of a country's health system can be affected by a conflict, weakening the existing one and damaging essential infrastructures that support the health system (Debarre, 2018).

Regardless of context, a humanitarian crisis always involve complex situations and needs (Jordan et al., 2021), leaving the displaced population in continual health threats (Brotherton et al., 2022), which represents one of the main global public health crises of our century (Androutsou & Metaxas, 2019). The damages caused by armed conflicts affects:

- essential health-supporting infrastructure such as food, sanitation, water safety and supply, increasing the population's vulnerability to disease outbreaks and the spread of infectious diseases (Debarre, 2018; WHO, 2022; Zangana, 2015);
- shortage of medicines and medical supplies affect pre-existing health conditions (Debarre, 2018; Zangana, 2015);
- high prevalence of non-communicable diseases (NCDs) poses challenges to appropriate continuity of care and access to medication (Androutsou & Metaxas, 2019; Doocy et al., 2015);

- deficient access to sexual and reproductive healthcare (Androutsou & Metaxas, 2019) are the prime cause of morbidity and mortality among women and girls (Debarre, 2018; WHO, 2022);
- interruption of immunization campaigns due to insecurity (Zangana, 2015)
- mental healthcare services which are very difficult to find, leading to permanent psychological needs due to the high levels of trauma and stress (Androutsou & Metaxas, 2019; Debarre, 2018; WHO, 2022);
- lack of qualified personnel (Debarre, 2018; Zangana, 2015); and
- greater risk of infection and death by COVID-19, as for limited protective equipment and the unlikelihood of social distancing and self-isolation (WHO, 2022);

In this situations, humanitarian assistance is essential to provide immediate action to prevent and prepare such situations (Daar et al., 2018).

As conflict-affected areas are particular settings, where big groups of people have to shelter together in exacerbated fragile states, efforts to reach the Sustainable Development Goals (SDG) #3 of Good Health and Wellbeing (United Nations, 2015), must contemplate its unique physical, mental and environmental challenges (Asi & Williams, 2018). It is the main goal of any health response during a humanitarian crisis to provide Quality of Care[1], preventing and reducing mortality and morbidity, as populations will be significantly affected (Sphere Association, 2018).

By understanding the setting and challenges of such environments, humanitarian actors can develop strategies more specific and appropriate to the context (Debarre, 2018; Kohrt et al., 2019). More frequently and wide spreading, humanitarian crisis are becoming the norm rather than the exception, intensifying the need for the development and evaluation of health interventions that are possible, fitting and effective for the context (Kohrt et al., 2019).

[1] The WHO defines quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with evidence-based professional knowledge." (WHO, 2020, p.6), and it should be at the core of health systems and the human right to health (Global Health Cluster Quality Improvement Task Team, 2020; Kruk et al., 2018).

2.3. Health systems' response in crisis settings

The humanitarian system is constantly evolving and consists of a diverse and differentiated group of actors, where NGOs are part of that, and the affected population ideally should be in the center of the decision-making process. Like in any emergency response, a steady command and structure is necessary to make difficult decisions (Spiegel, 2017). In emergencies, the World Health Organization (WHO) (2019) recommends that the humanitarian health partners are led by a Global Health Cluster, a "platform for organizations to work in partnership to ensure collective action results in more timely, effective and predictable response to health emergencies." (What is the Health Cluster?). Its purpose is to empower actors to improve their response to crises (Spiegel, 2017; WHO, 2019), providing expertise, capacity building, information, guidance and ensures the political and financial support needed for essential health care (OCHA, 2019). For this standard of organization, coordination among health actors is key, especially when facing emergency situations (Debarre, 2018; Spiegel, 2017; WHO, 2019).

The challenge lies on the implementation of health services that are properly planed and managed, to address people's needs (Tusiime & Byrne, 2011). Overall, it is recognized that leadership and coordination in preparedness and response to humanitarian emergencies has been substandard (Spiegel, 2017). Notwithstanding, as Tarimo and Creese (1990) long ago denotes, "There are no general blueprints (…) but there may be parallels, similarities, hints and lessons (…) which offer insights and suggest possible solutions to problems." (p.V).

2.4. Health information systems

The topic of health information systems (HIS) being central for achieving health, has long been identified by the WHO. In his research, Thieren (2005) defined HIS in emergencies as "a set of data collection platforms implemented by a coordinated group of humanitarian actors generating information to support strategic decisions, monitor changes, prioritize action and allocate resources (…)" (p.585). HIS are swiftly changing and developing, thus the need to efficiently manage essential information at all levels of health services is vital. One of the features for enabling health management to ultimately improve the systems' performance is a strong HIS capable of producing data that is reliable and timely to generate evidence-

informed decision making (Barry et al., 2017; Lippeveld et al., 2000).

An effective response to the health needs, in a conflict-affected setting, depends on the coordination between all humanitarian actors, and accountability for the services provided, being the collection and sharing of health data one of the factors in the assessment of the health professional's performance (Debarre, 2018; Jordan et al., 2021; Thieren, 2005). Before conflict broke in many of the affected countries, the HR system were already weak and collapsed completely after, making decisions and interventions difficult to implement (Debarre, 2018; WHO, 2017b). In emergency situations, as it seems no one is in charge of health systems, health actors mainly use HIS to take decisions upon the continuity of their programs and not patient record keeping (Thieren, 2005). For those organizations that become established, they may develop their own HR system to meet their needs, a good governance and transparency of clinical care, but become more reluctant to shift to a uniform system (Aqil et al., 2012; WHO, 2017), even if the improvement is just at the individual stakeholder's level and difficult to scale or sustain over time (Kruk et al., 2018).

The development and intervention of health strategies, outside the humanitarian context, has been proven not to be an effective or efficient strategy (Kohrt et al., 2019). Some of the obstacles to a robust HIS's implementation (and subsequently an HR system) can arise from the lack of training, motivation or engagement of health workers; inadequate functionality of the electronic systems (Aqil et al., 2009; El-Khani et al., 2019); and restricted systems' ownership (Thieren, 2005). The delivery of care that improves or maintains health is only achieved through a consistent optimization of healthcare by a high-quality health system. Such a system is rooted in the populations' health needs and expectations, platforms that assist care delivery, and data tools and resources that will help the system to learn from it (Kruk et al., 2018).

2.4.1. The gap in health information data

Good health decisions are prompt by good (clinical) data (Health Data Collaborative, 2017). It is recognized that in several affected countries the existent HR system were already weak before conflict broke, hindering implementation and decision making interventions (Debarre,

2018; Sphere Association, 2018; WHO, 2017b), especially in emergency situations, where HISs are primarily used to administrative and logistic purposes (Thieren, 2005). This kind of situations usually bring multiple actors to assist, leading to as the WHO (2007) says, "a paradoxical situation in which leadership is weaker than usual because it has been disrupted or divided, but the need for leadership is even greater" (WHO, 2007).

High-quality care should be an imperative regardless how differently health systems behave depending on their specific setting (Kruk et al., 2018) in spite of the many efforts to unify information systems (Thieren, 2005). It is also known that quality of recorded information is a predictor of quality care (Zegers et al., 2011).

Paper-based record keeping has fall short in the dissemination of information with migrant population as opposed to an EHR system (Asi & Williams, 2018), which is an efficient and effective tool among the multidisciplinary team to monitor, register and improve these population's health status (Chatterjee et al., 2021; Chiesa et al., 2019; WHO, 2012). EHR should not take the focus of using the data for better delivering of care, serving as a support tool to expedite communication and decision making (Lippeveld et al., 2000; Tang & McDonald, 2014). Shifting from a paper-based to an EHR system can rise interest for stakeholders, but can also be overwhelming and presenting many obstacles such as technology availability, insufficient funding, lack of technical skills and digital literacy or electricity and privacy and security concerns (Asi & Williams, 2018; Chiesa et al., 2019; Perakslis, 2018; WHO, 2012).

Nevertheless, cloud-based systems are demonstrating to be a cost-effective method in these settings, overcoming the lack of infrastructures (Asi & Williams, 2018; Nagata et al., 2013). Coupled with pre-existing open-source medical record systems (as OpenMRS), it is possible to speed up the development of a tailored HR system ready to use and free of charge (Jobanputra et al., 2017). Allied to a positive user experience, with intuitive and user friendly interface indispensable for achieving high-quality care, we can expect an improved technical quality and confidence in the health system (Kruk et al., 2018; Tang & McDonald, 2014).

2.4.2. Digital innovative solutions

The humanitarian sector undergoes numerous funding limitations (Aly, 2016; Debarre, 2018; Kohrt et al., 2019), specially affecting health organizations working with refugees, as numerous operate without a standardized HR system (Brotherton et al., 2022; Jafar et al., 2015). This situation results in a non-standardized system, deterring quality control, communication and data analysis and effectual health responses (Berlaer, 2017; Jafar et al., 2015).

Literature has long-established that medical records are central for good clinical practice (Aqil et al., 2012; Berlaer, 2017; Brotherton et al., 2022; El-Khani et al., 2019; Lippeveld et al., 2000; Mathioudakis et al., 2016; Tang & McDonald, 2014; Zegers et al., 2011). A paper-based recording system is the simplest and less expensive method to be applied in this kind of settings (Jabeen & Jafar, 2020). However, humanitarian action can be improved through innovation and technology, as HR and its data management can profit from the use of EHR system (Brotherton et al., 2022; Pullen & Louden, 2006; Shen et al., 2017; Spiegel, 2017), specifically tailored to this kind of settings (Asi & Williams, 2018; Brotherton et al., 2022; Perakslis, 2018; Saleh et al., 2020; Shen et al., 2017).

Health technology is speedily advancing (Perakslis, 2018), to meet up with the EHR system's needs (Tang & McDonald, 2014). In the humanitarian context, in order to improve and meet the demand, changes are more frequently required (Daar et al., 2018; Debarre, 2018; El-Khani et al., 2019; Kohrt et al., 2019; Lippeveld et al., 2000). Nonetheless, one of the remaining problems with refugees and IDPs is the access to medical records. The need for innovative digital solutions capable of improving access to health services is pressing (Saleh et al., 2020).

Some examples of implemented EHR system in humanitarian crisis' settings are the cases of:

- RAIS, a web-based system to monitor, track, and provide assistance to Iraqi refugees,
- in Jordan (Mateen et al., 2012);
- MSF, that developed an open source EHR system for the Ebola data management, in Sierra Leone (Jobanputra et al., 2017);
- UNRWA's, that developed an EHR system for Palestinian refugees in Jordan, Syria, Lebanon, West Bank and Gaza (Ballout et al., 2018);

- Sijilli, a mobile cloud based EHR system for Syrian refugees, in Lebanon (Saleh et al., 2020);
- Hikma Health, an open source EHR system specifically for displaced populations (Brotherton et al., 2022)

3

DESIGN: A MEAN TO IMPROVE THE SYSTEM

ETHNOGRAPHIC OBSERVATIONS

PAPER-BASED SERVICE PROTOTYPING

ELECTRONIC SERVICE PROTOTYPING

SPEED CONSULTING WORKSHOP

SERVICE BLUEPRINT

How can Design contribute to a non-designer working in the field, eager to understand and improve the current health system's mechanism? According to the Merriam-Webster dictionary, to design is to "plan and make (something) for a specific use or purpose; to conceive and plan out in the mind; a mental project or scheme in which means to an end are laid down" (Merriam-Webster, n.d.). Service Design has been associated with healthcare innovation, holistic and iterative approach to new services, focused on the ideation, prototyping and implementation of its creative process to understand healthcare services and acting upon service innovation trough design (Patrício et al., 2019). Thus, my intent is to lay down on paper the problems and ideas of the current HR system for a future re-design.

We need services that are easy to work on/with, usable and also desirable… this is the core of Service Design (Design Council and Technology Strategy Board, 2015). Using Design methodologies, and by identifying the HR system's service *touchpoints* (interactions between user and service) (IDF, 2021), I expect to understand how they interact with each other and the user, enabling solutions to be developed and the system to be improved. The mix methods approach will enable a more in-depth perspective as well as the possibility to generalize to a population/system (Crewswell & Creswell, 2018).

3.1. Ethnographic observations

As we might act differently if we know that we are being observed, studied, having a more "naturalistic" approach – studying a phenomena in their natural environment -, to a specific ecosystem can reduce the impact the researcher, to comprehend how and why people behave as they do (Crewswell & Creswell, 2018). This is where the ethnographic observations with informal interviews fall in place.

To understand the current situation regarding the HR system functioning and management, a service safari to in-country health NGO's working with IDPs was proposed. User shadowing (Design Council and Technology Strategy Board, 2015), as a technique of Ethnographic Observations, with an informal ethnographic interview script were implemented to document the present system, as well as *touch points* and any

opportunities/pain points (problems in the user's experience with a service) (Gibbons, 2021) of the system.

3.1.1. Sample Selection

IDP and refugee camps are spread all around the country. To the study in question, the sample selection was conducted through an analysis of the existing camps, and the inclusion criteria consisted of camps inside Kurdistan's region (represented with the red outline on figure 1 below) and that would be present inside or around the refugee camp area that the field Hospital is located – Al-Hamdanya.

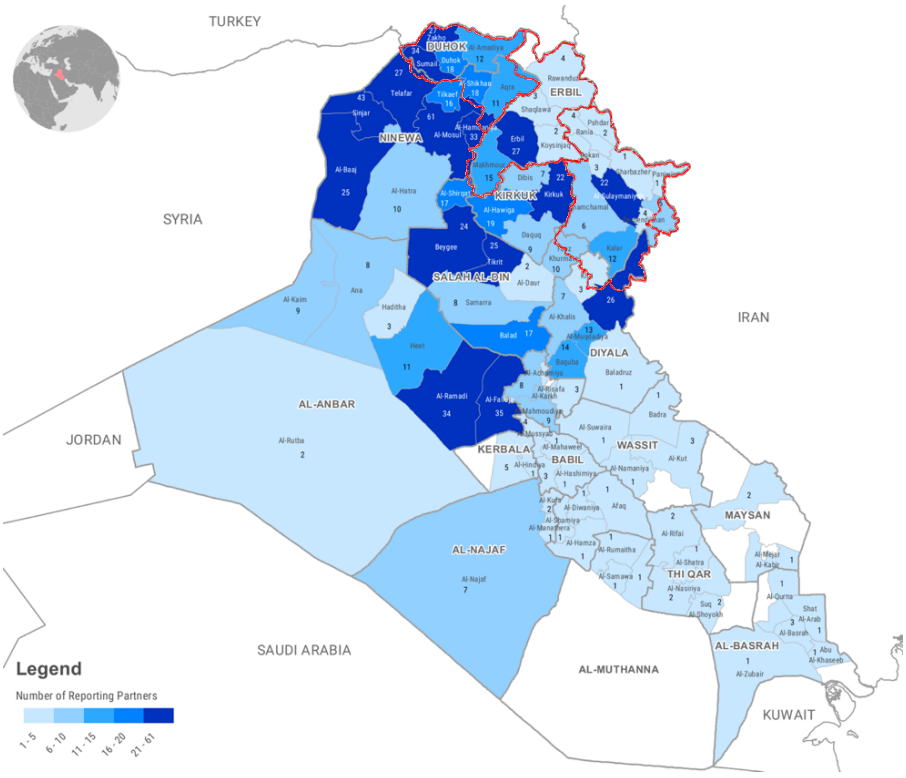


Figure 1 . *Iraq map showing the areas where health partners are present. (OCHA, 2021) Kurdistan area delineated in red.*

The camps were identified and the corresponding acting health organizations, as represented in Table 1, for the ethnographic observations.

GOVERNORATE	CITY	HEALTH ORGANIZATIONS
Al-Sulaymaniyah	Al-Sulaymaniyah	*DoH- Sulaymaniyah, Heevie, Zhian, KSC*
	Chamchamal	*Jiyan*
	Kalar	*DoH- Sulaymaniyah, Zhian, AAF*
	Pshdar	*Zhian*
Duhok	Al-Amadiya	*Harikar, Zhian, DAMA*
	Duhok	*Harikar, Zhian*
	Sumail	*Harikar, Heevie, JRS, IOM, Zhian, DAMA*
	Zakho	*Harikar, Heevie, Zhian, Caritas- Iraq*
Erbil	Erbil	*DoH-Erbil, Heevie, Zhian*
	Rawanduz	*Zhian*
Ninewa	**Al-Hamdaniya**	***DoH-Erbil, Heevie, JRS, VIYAN, Zhian, UPP***

Table 1. *IDP and refugee camps in Iraq, according to Governorate and cities.*

3.1.2. Service Safari

Through discussion with a representative doctor from one organization, a senior nurse from another and a pharmacist from the other, a Service Safari was developed in three different clinical settings. The idea of observing the HR system first hand would elucidate on some core workflow phases, previously identified through the multidisciplinary discussion, to be studied by the observational study: 1- is there an HR system present?; 2- is it paper-based, digital or both?; 3- is the record in a single sheet or multiple record sheets for one patient?; 4- is it possible to access a single patient record file?; 5- who is handling the records?; 6- how many people are involved in the service?; 7- how is the reporting system process?.

The observations where conducted to the health organizations actively working in the area and scheduled according to staff availability, happening in a period of three months, being the first two observations in December and the last in February. All HR, if present at an observation site, will be coded to merely represent the existing and different records. The first observation site was to a Coronavirus Clinic, which was

specifically established as a referral center to manage suspected and confirmed cases of Covid-19 from a cluster of IDP camps. The interview was scheduled to be no longer than 45 minutes to understand the patient's journey and assess how effectively the HR system displayed the interaction between the patient and the health professional. The HR system process in the clinic is as follows: A health record sheet (A) is populated by the treating nurse, consisting of a brief single-line-per-patient entry with patient details, clinical diagnosis, and a treatment summary. Record sheet (B) is then completed – it is a registry of all suspected Covid-19 patients that present at the clinic, containing patient general information such as name, age, tent number, phone contacts, etc. At the end of the shift, records are conveyed to a central office, were a data clerk transfers all data to a central excel database. After the information is registered digitally, the paper records are sent to archives at a central location, at the organization's headquarters. In addition to the above processes, patient information is also entered on a customized tablet, in the clinic, that conveys relevant data to the Ministry of Health. Table 2 summarizes characterization of observation 1.

Date	Context	NGO contact	Gender	Age	Experience	Duration of observation
14 Dec 2021	Corona virus clinic	Nurse 01A	male	38 years	Over 5 years working with international (and expatriate health staff) and local health NGOs	~ 30 minutes

Table 2. *Characterization's summary of observation 1.*

The second observation was conducted at a Primary Health Clinic (PHC). As in the previous observation site, an informal visit was scheduled with one of the doctors from the organization. In this clinic, the patient journey commences with temperature screen at the entrance before the patient enters the central waiting area. Thereafter, a data clerk opens a specific health record sheet (C) for each patient where details are recorded (name, tent number, date, phone number). Record sheet (C) is then passed to the nurse to register the patient's vital signs and any other relevant observations. Simultaneously, patient's details are registered in a logbook for organizational accountability. The treating doctor then records his notes and prescriptions on the same record sheet (C) which the patient finally takes to the pharmacy to collect their medication. At the end of the working day, the data clerk collects all record sheets from the pharmacy and combines the data onto a central

excel spreadsheet for reporting. The paper records are also archived at the NGO headquarters weekly. Table 3 summarizes characterization of observation 2.

Date	Context	NGO contact	Gender	Age	Experience	Duration of observation
15 Dec 2021	Primary Health Clinic (PHC)	Doctor01B	male	30 years	Over 3 years working with international (and expatriate health staff) and local health NGOs	~ 45 minutes

Table 3. *Characterization's summary of observation 2.*

Last observation was conducted to a mobile Primary Health Clinic (PHC)'s HR system. As it is a vehicle moving from place to place to assist people in need, the set up was very different from the previous. A crowd control guard organizes people for triage, where the attending nurse gets the patient Health Record (HR) sheet (D) (or creates a new one if first time visit). Because of the clinic's nature, people are assigned a **File number**, so the health records can be assessed in next visits. This record sheet (D) contains all clinical information from previous visits, including patient's demographic information. Once vital signs are recorded, the patient is assigned to a specific doctor for consultation, where the doctor register health complaints, diagnosis, and treatment plus the medication prescribed if needed. In this case, a Prescription sheet (E) is opened and sent to Pharmacy, where the pharmacist will check medication and keep the paper (E) in his possession. At the end of the shift, the nurse collects all HR sheets (D and E) to complete the daily report on sheet (F) with statistics of patient's attended, new patients registered, and chief diagnosis. After the process is completed, sheet (F) is scanned and located on the shared NGO's drive. Likewise, the doctor also needs to report on diagnosed Communicable diseases and Referrals made, on report paper (G). When the reporting process is complete, all records are filled according to clinical site and patient file number at the office headquarters, to be available and ready for the next visit to each corresponding clinical site. Table 4 summarizes characterization of observation 3.

Date	Context	NGO contact	Gender	Age	Experience	Duration of observation
18 Feb 2022	Mobile PHC	Pharmacist01C	male	31 years	Over 4 years working with international (and expatriate health staff) and local health NGOs	~ 25 minutes

Table 4. *Characterization's summary of observation 3.*

3.1.3. Ethnographic observations' outcomes

After observing and analyzing the systems present at the three local health clinics, regarding the 7 core workflow phases previously established, some initial conclusions were taken, as shown on Table 5 below:

ADVANTAGES OF THE CURRENT HR SYSTEM'S OBSERVED	DISADVANTAGES OF THE CURRENT HR SYSTEM'S OBSERVED
Presence of a simple and effective patient PBHR system	Small and limited space for clinical information on the PBHR system
Possibility to collect and access individual health records	Duplication on the data entry process, as information is reentered by a data clerk on the electronic system and on additional logbooks
Additional presence of EHR system to add on data collected through the paper-based records	Selection of clinical information by a data clerk with no medical training (onto the electronic database), making it very prone to error
	Access to health records reliant on the single brief electronic entry into the database
	Non standardized reporting system and duplication of the HR system's workflow
	Health professionals don't deal directly with the EHR system
	Hiring of non-medical staff (data clerk) to perform a health professional's duties

Table 5. *Initial conclusions from the Service Safari's ethnographic observations.*

3.2. Paper-based Service Prototyping

To create a baseline for Adventist Help's HR system, and taking the knowledge gained from the initial observations, a paper-based *service prototype* (Saffer, 2010) was developed. The system should eliminate, as much as it could, duplication of information and additional people to complete the task. The aim was to design a structured and recurrent

recording system capable of registering patient's care accurately. To understand the following HR sheets, Figure 2 is presenting the HR system's journey map and its touch points with the record papers essential to complete the workflow of the service.

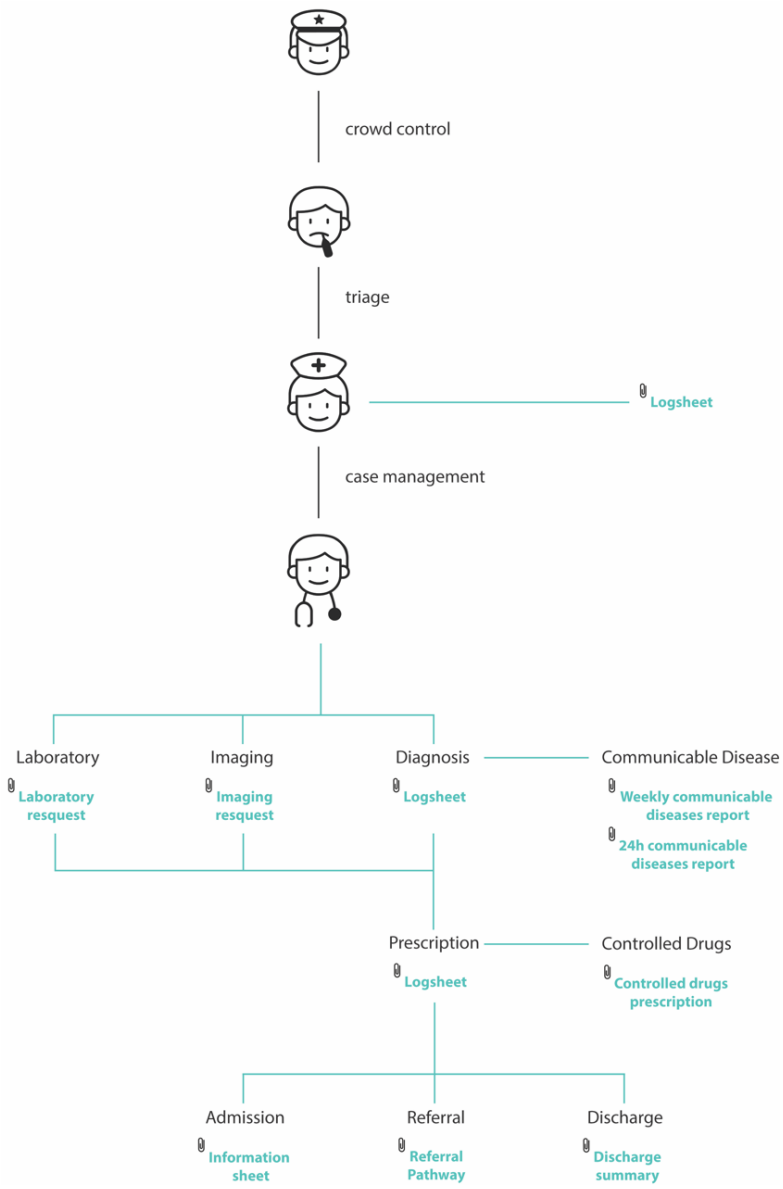
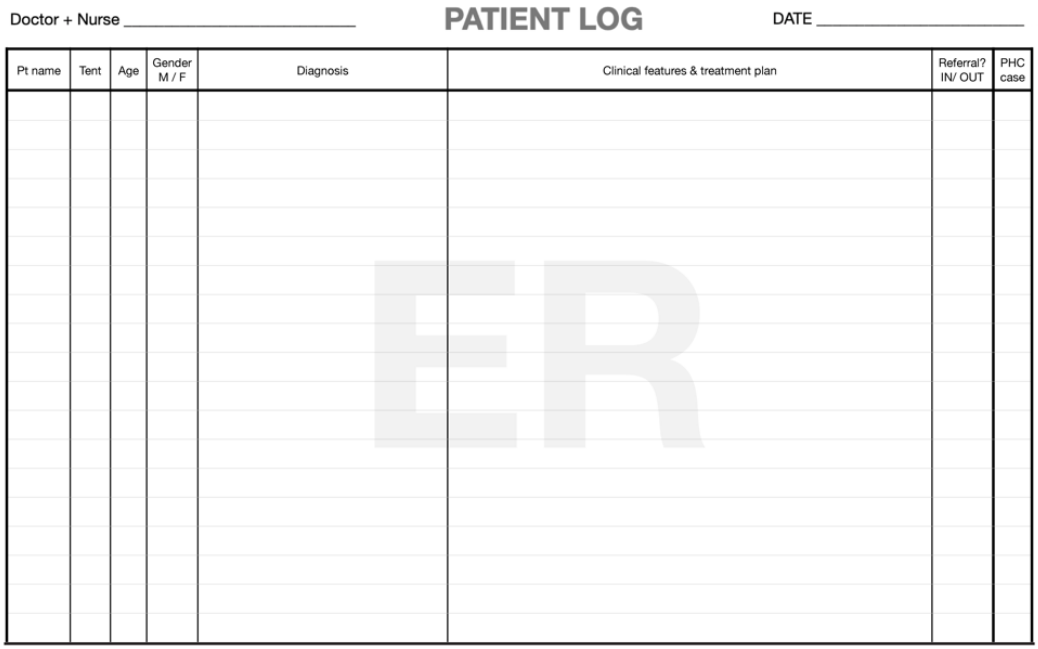


Figure 2. *Adventist Help's HR system journey map.*

This system is composed by a main **Log sheet (3.2.A),** where all patients attended must be registered. This sheet (3.2.A) contains the following information: ethnographic data (name of the patient, tent number, age, gender), diagnosis, clinical features and treatment plan (where doctors and nurses can write important information and care provided to the patient and/or any other clinical aspect relevant to the diagnosis), and a column for Referrals (In/Out,

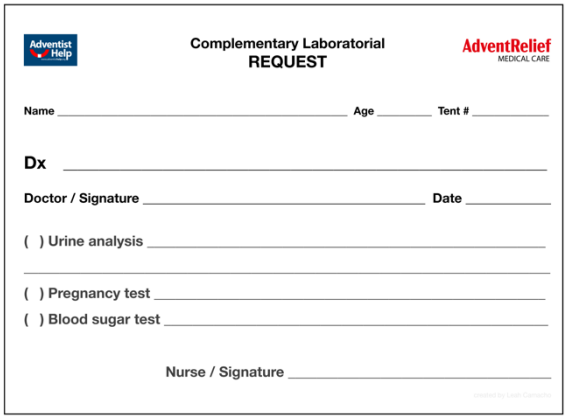
depending if the patient had been referred to this facility by another healthcare provider or stakeholder, or if the patient is being referred outside the hospital facility to receive differentiated care). A last column was added into Log sheet (3.2.A) named PHC case, that is specifically to identify non-emergent cases (cold cases) that were received at the hospital, managed, and advised to see the primary health clinic next door the next day. Doctor and nurses' name plus date is contemplated, to validate the information. An example of Log sheet (3.2.A) is found below in Figure 3.


Doctor + Nurse _____ PATIENT LOG DATE _____

Pt name	Tent	Age	Gender M / F	Diagnosis	Clinical features & treatment plan	Referral? IN/ OUT	PHC case

Figure 3. *Adventist Help's emergency room Log Sheet (3.2.A).*

To support the doctor's diagnose, Laboratory (urine rapid test, random blood sugar and pregnancy tests) and Imaging (Electrocardiogram (ECG), Ultrasound, X-ray) services are available, each with a corresponding **Complementary Laboratorial request sheet (3.2.B)** and **Imaging request sheet (3.2.C)**. Even though the nurse or doctor are the ones performing these additional tests, the paper recording will help in the reporting process. Figures 4 and 5 show the request sheet (3.2.B) and (3.2.C) respectively.



Complementary Laboratorial
REQUEST

AdventRelief
MEDICAL CARE

Name _____ Age _____ Tent # _____

Dx _____

Doctor / Signature _____ Date _____

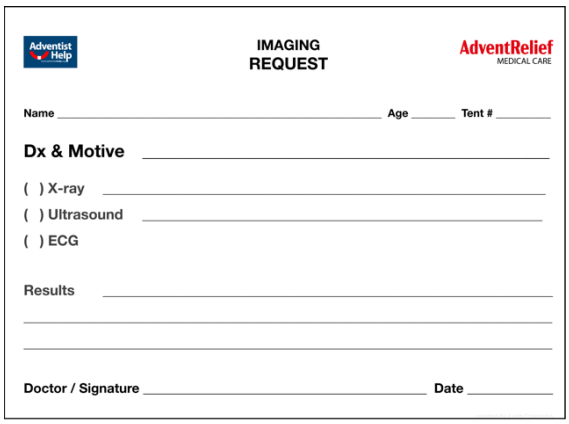
( ) Urine analysis _____

( ) Pregnancy test _____

( ) Blood sugar test _____

Nurse / Signature _____

Figure 4. Complementary Laboratorial request sheet (3.2.B).



IMAGING
REQUEST

AdventRelief
MEDICAL CARE

Name _____ Age _____ Tent # _____

Dx & Motive _____

( ) X-ray _____

( ) Ultrasound _____

( ) ECG

Results _____

Doctor / Signature _____ Date _____

Figure 5. Imaging request sheet (3.2.C).

Upon the diagnosis, if the patient presents any country-listed Communicable Diseases, depending on the severity of the case, a **Weekly Communicable Diseases sheet (3.2.D)** or **24-hour Communicable Diseases sheet (3.2.E)** is completed. The sheets are color coded according to the importance of the reporting (yellow for the weekly communicable diseases and pink for the 24-hour ones), complementing the initial Log sheet (3.2.A) and easing the reporting system and handover to the competent authorities. Figures 6 e 7 represent sheet (3.2.D) and (3.2.E) respectively.

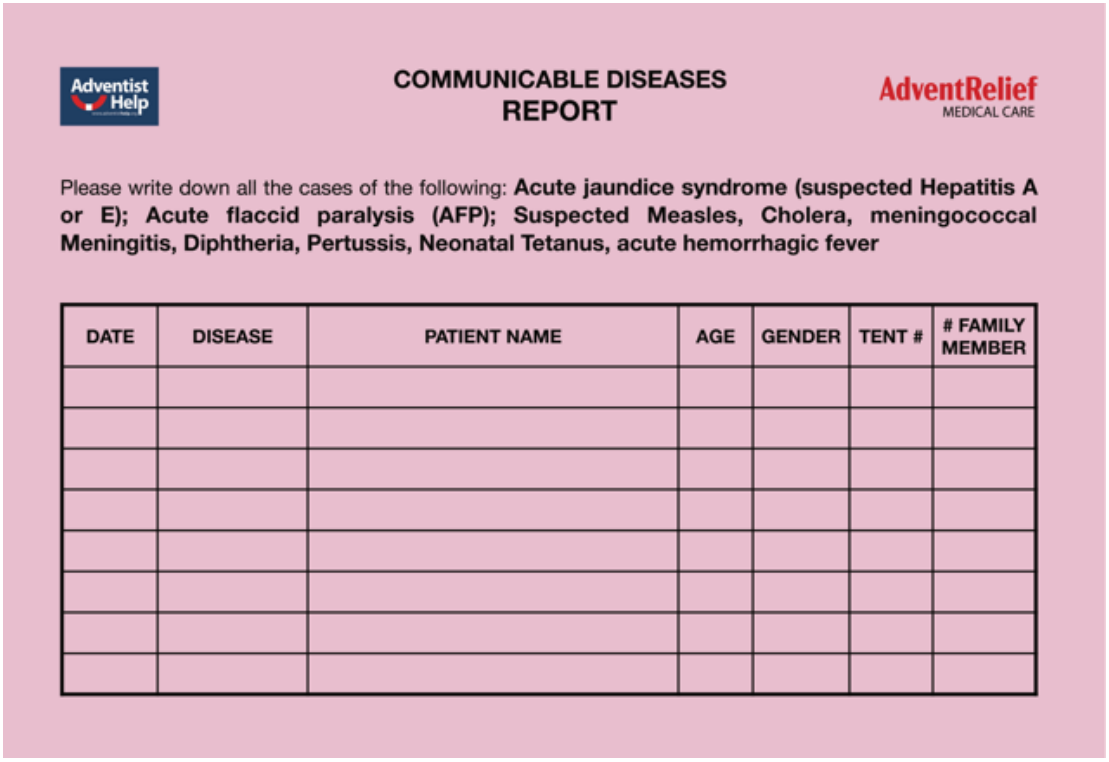
COMMUNICABLE DISEASES
REPORT

AdventRelief
MEDICAL CARE

Please write down all the cases of the following: **Suspected Leishmaniasis; Suspected Chickenpox; Suspected Scabies; Suspected Mumps; Lice**

DATE	DISEASE	PATIENT NAME	AGE	GENDER	TENT #	# FAMILY MEMBER

Figure 6. Weekly communicable diseases' report sheet (3.2.D).



COMMUNICABLE DISEASES REPORT

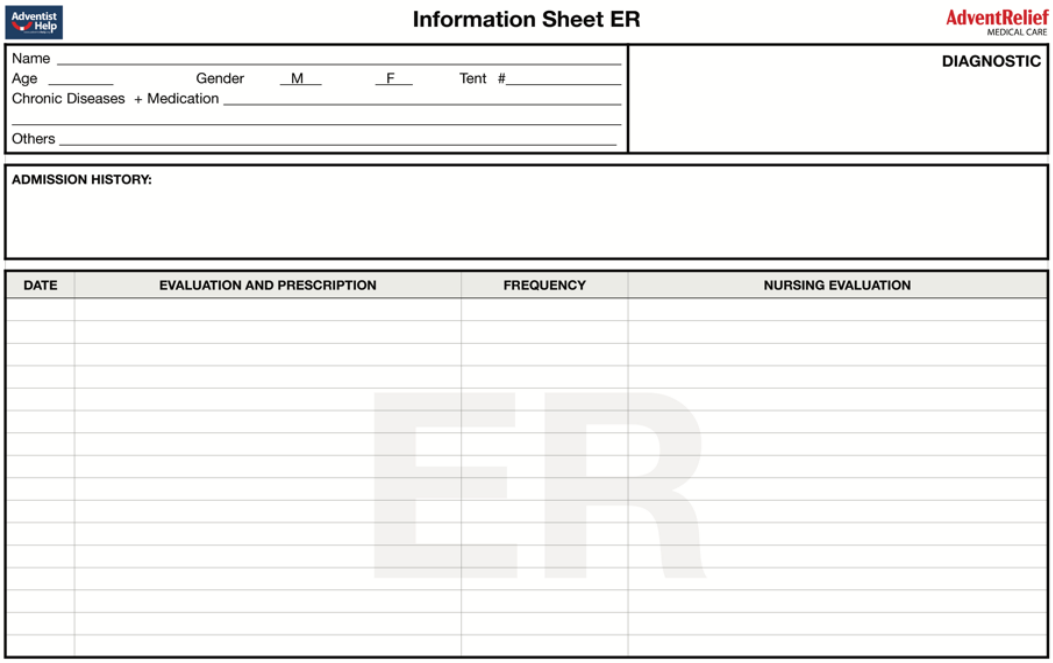
AdventRelief MEDICAL CARE

Please write down all the cases of the following: **Acute jaundice syndrome (suspected Hepatitis A or E); Acute flaccid paralysis (AFP); Suspected Measles, Cholera, meningococcal Meningitis, Diphtheria, Pertussis, Neonatal Tetanus, acute hemorrhagic fever**

DATE	DISEASE	PATIENT NAME	AGE	GENDER	TENT #	# FAMILY MEMBER

Figure 7. *24-hours communicable diseases' report sheet (3.2.E).*

After the patient is diagnosed, there are three possible outcomes: 1- the patient needs admission for observation and continuation of care, **Information sheet (3.2.G)** (figure 8) is opened, to record medical and nursing notes and any relevant clinical information. This is a personal and one time record sheet for a given patient, with enough space to record relevant medical information; 2- the patient needs differentiated care and is referred to another facility, and the doctor on call will write a **Referral pathway sheet (3.2.H)** (figure 9)**,** providing the main reasons for referral and clinical status of the patient; 3- patient is discharged, and the doctor can write down a **Discharge summary sheet (3.2.I)** (figure 10) with pertinent clinical information about treatment given or any other relevant information about the patient's visit to the hospital.



Information Sheet ER

AdventRelief MEDICAL CARE

Name _____

Age _____ Gender __M__ __F__ Tent #_____

Chronic Diseases + Medication _____

_____

Others _____

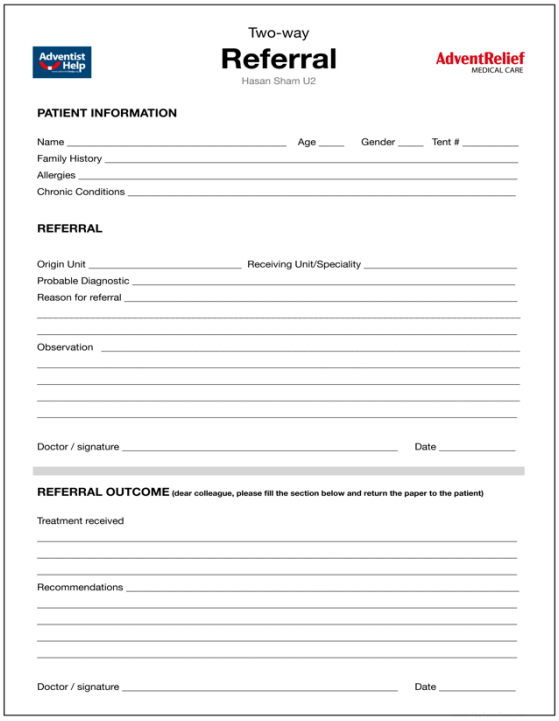
DIAGNOSTIC

ADMISSION HISTORY:

DATE	EVALUATION AND PRESCRIPTION	FREQUENCY	NURSING EVALUATION

ER

Figure 8. *Emergency room admission Information sheet (3.2.G).*



Two-way

Referral

Hasan Sham U2

AdventRelief MEDICAL CARE

PATIENT INFORMATION

Name _____ Age ____ Gender ____ Tent # _____

Family History _____

Allergies _____

Chronic Conditions _____

REFERRAL

Origin Unit _____ Receiving Unit/Speciality _____

Probable Diagnostic _____

Reason for referral _____

Observation _____

Doctor / signature _____ Date _____

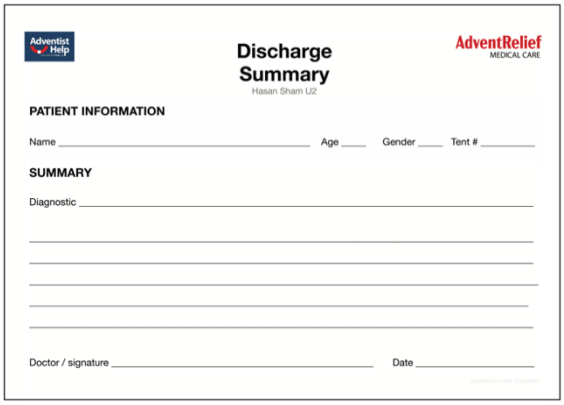
REFERRAL OUTCOME (dear colleague, please fill the section below and return the paper to the patient)

Treatment received

Recommendations _____

Doctor / signature _____ Date _____

Figure 9. *Two-way patient Referral Pathway sheet (3.2.H).*



Discharge Summary

Hasan Sham U2

AdventRelief MEDICAL CARE

PATIENT INFORMATION

Name _____ Age ____ Gender ____ Tent # _____

SUMMARY

Diagnostic _____

Doctor / signature _____ Date _____

Figure 10. *Patient Discharge Summary sheet (3.2.I).*

There is one last record sheet, pertaining to Controlled Drugs, **Controlled Drugs prescription sheet (3.2.J)**, that is used when a patient needs any medication that is "controlled", meaning it can be abused or causing dependence. The medication can only be prescribed and administered if the sheet is correctly completed and in a presence of a witness. This sheet will be attached to the Log sheet (3.2.A) as confirmation of prescription and administration of the medication. Figure 11 exemplifies Controlled Drugs' prescription sheet (3.2.J).


CONTROLLED DRUGS
PRESCRIPTION
AdventRelief
MEDICAL CARE
Name _____ Age _____ Tent # _____
Drug _____ Quantity _____
Purpose _____
Treatment regimen _____
Doctor / Signature _____ Date _____

Figure 11. *Controlled drugs' prescription record sheet (3.2.J).*

3.2.1. Paper-based prototyping outcomes

All paperwork were printed and stored at the hospital site, so it could be always present and used on need. The system was implemented and tested at the hospital for two months, with an induction performed to the staff dealing with those records (doctors and nurses) during 2 weeks. A weekly check on the performance of the recording process was also conducted, with a SWOT analysis performed at the end of the 2 months, to explore the current system, represented in Figure 12.

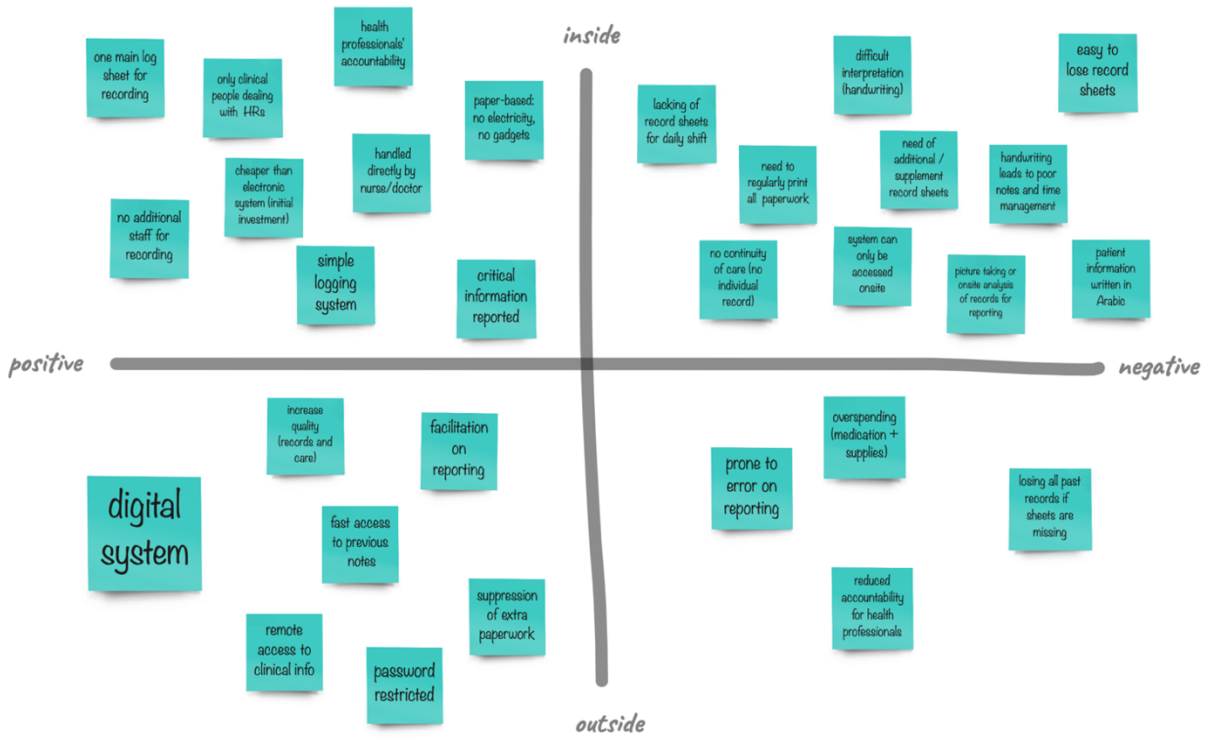


Figure 12. SWOT analysis of Adventist Help's PBHR system.

To complement the initial conclusions regarding the SWOT analysis to the PBHR system prototype, Table 6 summarizes the advantages and disadvantages of the prototype.

Paper-based health record system

ADVANTAGES	DISADVANTAGES
PBHR system capable of keeping account of daily patients and treatment received	(Poor) handwriting on clinical notes, possibly leading to clinical errors and poor quality of care (Zegers et al., 2011)
Clinical information can be recorded on a single daily record sheet (A), with the exception if a patient needs to be admitted for observation	PBHR hinders reporting system as information is in one physical place (a 45-minute drive from the office)
For admissions, record sheet (G) will supplement collected clinical information pertaining that single patient (to sheet (A))	Access to clinical records for reporting is either by going physically on-site or by taking pictures of the information

ADVANTAGES	DISADVANTAGES
For referring a patient, record sheet (H) is used to share important information with receiving health facility	Reporting parameters need to be counted and checked manually (e.g., number of males under 18, number of females over 18, top three recurrent diagnosis, …)
Upon discharge, doctor can send patient away with a treatment summary sheet (I)	Constant need to print all paper records and deliver it on-site
	Need to have additional paperwork to record information (e.g., Laboratory request sheet (B) and Imaging request sheet (C), Weekly Communicable Diseases sheet (D) or 24-hour Communicable Diseases sheet (E)), delaying clinical work

Table 6. Paper-based health record system's advantages and disadvantages.

3.3. Electronic Service Prototyping

PBHR systems where originally designed for record management, but they had proved unsuitable for the high volume of health records resulting from a practice as it becomes difficult to organize and store, reducing clinical and management efficiency and effectiveness (Adetoyi & Raji, 2020; Mbugua, 2013). As the humanitarian health context is an ongoing field study on need for improvement (Daar et al., 2018; Debarre, 2018; El-Khani et al., 2019; Kohrt et al., 2019; Lippeveld et al., 2000; Spiegel, 2017) changes will occur more frequently to meet the demand.

Taking the preliminary conclusions from my PBHR system's implementation phase, and previous experience observing other Health Organizations, where the presence of a digital component was just at the end of the recording journey map, I sought to understand how the system would behave by introducing it at the beginning of the process. I wanted to test if there would be a need to have a designated person (data clerk as the other

NGOs) to record clinical information, how could we have relevant and essential information all at one location for follow up and consultation, if an electronic system would be feasible in a context where electricity and internet connections are not 100% reliable, and above all, if this could evolve for a more professional and standardized level for future locations.

3.3.1. Benchmarking analysis

The first step was to choose an operating system, so the HR could run on. For this intent, a benchmarking analysis (Merriam-Webster, 2022) was conducted to understand and compare HR system's software and the appropriateness for the implementation at the field hospital. Specific elemental features were selected for comparison, such as the cost of the software, in country availability (if the software is available to work in Iraq and rely on custom's support), ability to customize the system to the specific context, immediate demo availability (important to see how it looks and behave at first search), free trial and a user-friendly interface. The system should be as simple as possible and intuitive, so that it will not take valuable time for the staff to swift and learn a completely new system.

A Google search was conducted to understand the current options and main features, and six companies where selected, summarized on Table 7 below. A description of the systems will follow.

Features	kareo	AdvancedMD	CareCloud	ADVANCED DATA SYSTEMS CORPORATION	openEMR	OpenMRS
Free	✗	✗	✗	✗	✗	✓
Operational in Iraq	✗	-	-	-	✓	✓
Customizable	✓	✓	✓	✓	✓	✓
Free trial	✗	✗	✗	✗	✓	✓
Immediate demo availability	✗	✗	✓	✗	-	✓
User-friendly interface	-	✓	✓	✓	✗	✓

Table 7. *Benchmarking analysis to existing EHR systems.*

Kareo is a company that provides EHR systems' options with a cloud-based system, but entering the website there is not much you can learn about besides what you read on the main menu. Pricing information, demo watching, or any additional information requires a log-in and request. After requesting for further information on their software, an automated email was sent to inform that a consultant would get back, with no success. Chatbot assistance is offered and when asked for more information, after a sign up, a message was returned saying that this system only supports US-based practices. Kareo was excluded for a possible HR software. Secondly, **AdvancedMD** was analyzed. As before, demo was only available upon signing in and there was no feedback from the company. The system is customizable (not sure to what extent) and the monthly prices per user are between $429-$729, making it unthinkable of pursuing it. AdvancedMD was excluded for a possible HR software.

CareCloud was among one of the other companies looked up for a clinical EHR software. Like the other companies, for further information a sign up is required, which turns the experience on the website frustrating as you need to keep providing personal details (as email, phone number, name, etc.) to get to know their product. Eventually a demo link was sent through email. There were some interesting features specially with the customized option, but the price per user was set around $674, which makes the system unaffordable and not an option for the field hospital. **Advanced Data Systems Corporation** followed, with the same modus operandi. Very generalized information about the system on the website, and a sign-up request for any additional information or through an international phone number. The demo showed some interesting features, but the lack of easy and accessible information (especially regarding pricing) turned to be an exclusion factor for this system. One of the last companies searched for, **openEMR** sounded attractive at a first glance. The possibility of a free, tailored EHR software arose the interest. However, the software interface seemed old and outdated, not user friendly and the link for trial was not working, leaving many questions unanswered regarding this solution. In any case, this was the best and most promising solution found so far.

For last but not least, **OpenMRS** was explored. For the first time, all questions could be answered straight ahead. The free system operates in multiple platforms, where someone can just run an immediate trial to the software. An experiment on the software was conducted, with very

positive and exciting features and functionalities. It presents a very simple and user-friendly interface, where we can have individual health records with identification possibilities in various ways (by name, date of birth, identification (ID) number), and a summary page with the most recent and elemental clinical information. The free software has a coordinated global community that sustains the platform and works as a forum, an excellent and invaluable tool to get help along the way tailoring the system. For all the features presented, this is the software that presents the ideal qualities for implementation at the field hospital in Iraq.

Money plays a key role in any business, and it's no different among health organizations, where constraints in funding determine the priority of needs (Aly, 2016; Debarre, 2018; Kohrt et al., 2019). This constituted the main reason to reject the HR software's that were not free, leaving two feasible options for implementation whence OpenMRS was the only meeting all features required. Nevertheless, its implementation requires a proper tailoring of the software to the HR system's journey map, which will take some time.

After the benchmarking analysis and initial conclusions, and the need for something that would take less time to implement, it came to my attention a new study of an open-source free HR system specifically created for refugee care named **Hikma Health** (Brotherton et al., 2022). Like OpenMRS, it presents a good option for the implementation at the field hospital in Iraq, even though it was not possible to run a demo. Table 8 shows Hikma Health's benchmarking analysis.

Features	Free	Operational in Iraq	Customizable	Free trial	Immediate demo availability	User-friendly interface
HIKMA HEALTH	✓	✓	✓	-	✗	✓

Table 8. *Hikma Health's benchmarking analysis.*

In both cases, the clinical software identified will require a customization and usability tests before its real implementation, so I decided to simultaneously start an EHR system via Excel sheet, to replace the current paper-record. This first implementation phase

will allow the understanding of gaps and opportunities to better adapt the clinical software (OpenMRS/Hikma Health) for phase two.

3.3.2. Electronic record spreadsheet

An electronic service prototype was initially developed taking into consideration the knowledge obtained from the Service Safari, to test and validate the design choices for the electronic system, replicating the experience of interacting with the service (EHR system) in its original context. The main purpose was to eliminate unnecessary paper records, integrating it into the system and improving legibility and accountability.

For this purpose, a computer was attributed to the hospital site, combining the functionality of a systematic HR system with the advantages of an electronic system. The prototype consists of an Excel sheet, with all relevant clinical information pertaining a patient. As it was a simple system and interface, the design and manipulation of the excel was done internally, relying only on the previous knowledge of the program and not with an IT/ program developer. The idea was to transpose the paper-based record into an electronic version, where health professionals could have access to all the pertaining information on a full screen, without side-scrolling, guaranteeing that they always have 360º visibility to the full record of a patient. The main purpose was to combine all the additional complementary record papers (Weekly Communicable Diseases sheet (3.2.D), 24-hour Communicable Diseases sheet (3.2.E), Complementary Laboratorial request sheet (3.2.B), Imaging request sheet (3.2.C)) on the main Log sheet.

To speed up clinical work, some drop-lists were added into key areas like Imaging and Laboratory request, or medication prescription, displaying the exams, tests and all medication available at the hospital on a single click. Figure 13 shows the electronic health record interface.

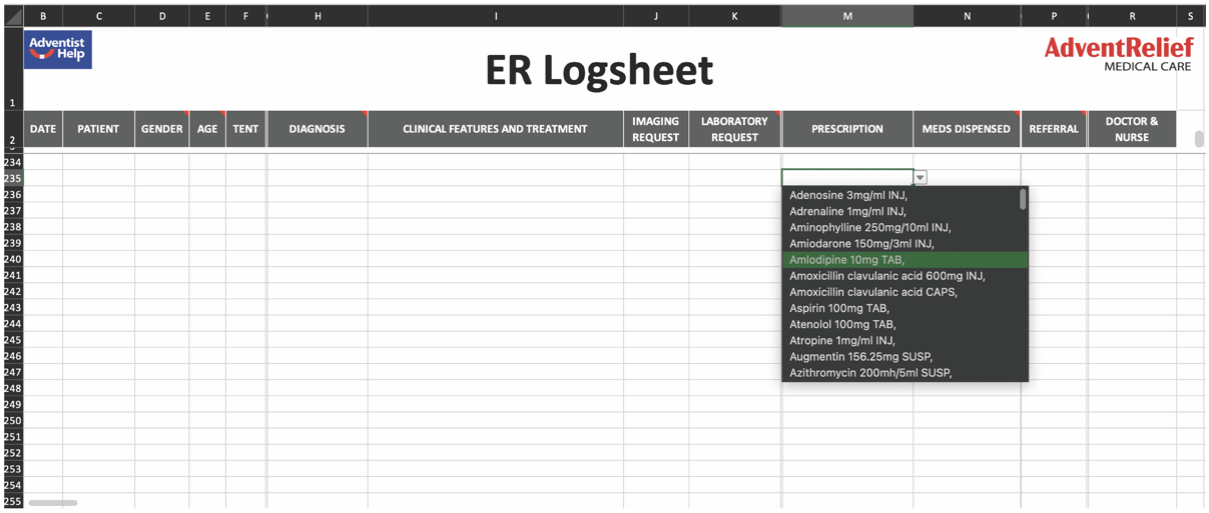


Figure 13. *Adventist Help EHR system's interface, phase one.*

Communicable diseases' record papers were replaced by a conditional word formatting, eliminating the need for a physical record, and stressing the importance of reporting, once again, through a coloring system (as like the paper-based records). The interface is demonstrated on Figures 14 and 15.

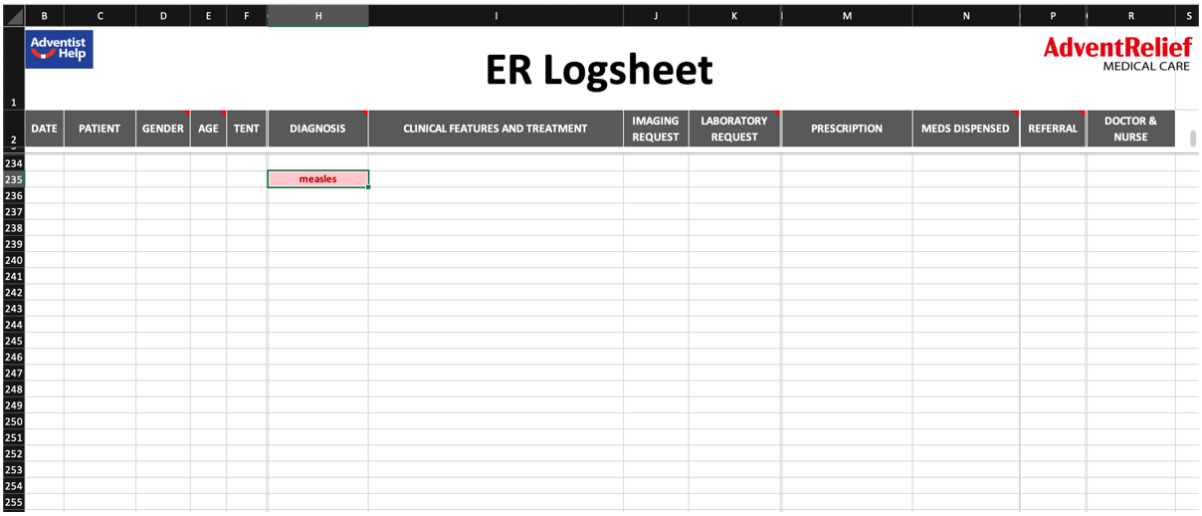


Figure 14. *Conditional word-formatting according to notification requirement: 24-hour reporting in pink.*

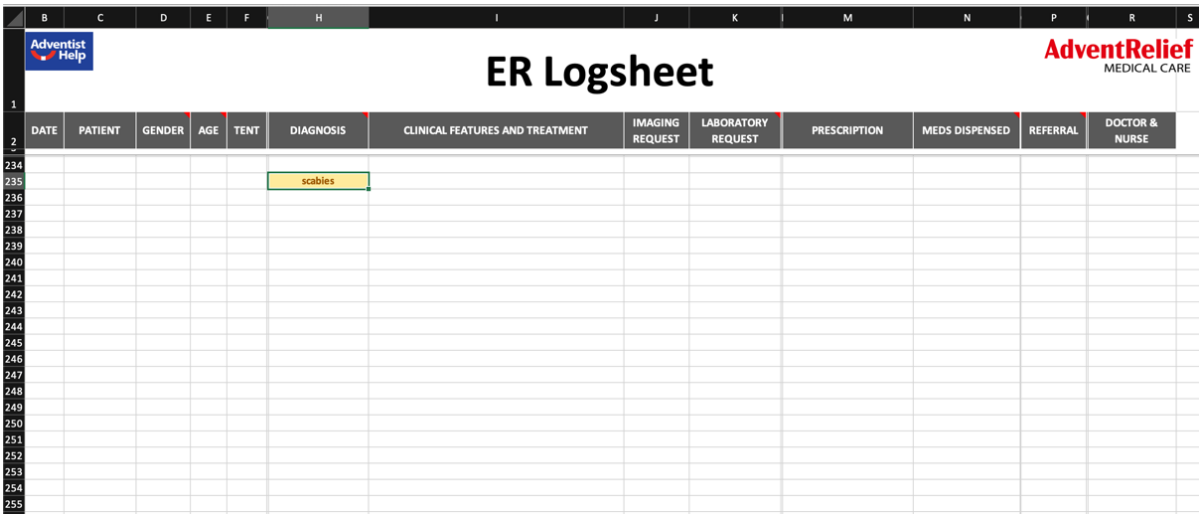


Figure 15. Conditional word-formatting according to notification requirement: weekly report in yellow.

3.3.3. Electronic prototyping implementation outcomes

Phase one was implemented with success for over a month, and it was a smooth transition from the paper-based to the electronic record system. An induction was made on site with all staff so they could be acquainted with the new system. The overall experience was positive, with significant improvements compared with the previous system. The transition from a paper-based to an electronic record was smooth and intuitive, as the system was essentially the paper record template transposed to a digital format. It proved to serve as a systematically collection of patient information and care provided, although with improvement areas to work upon.

Nonetheless, a SWOT analysis (figure 16) was performed to the electronic prototype, in order to determine weaknesses and strengths of the system. Table 9 (below) summarizes the advantages and disadvantages of the EHR prototype.

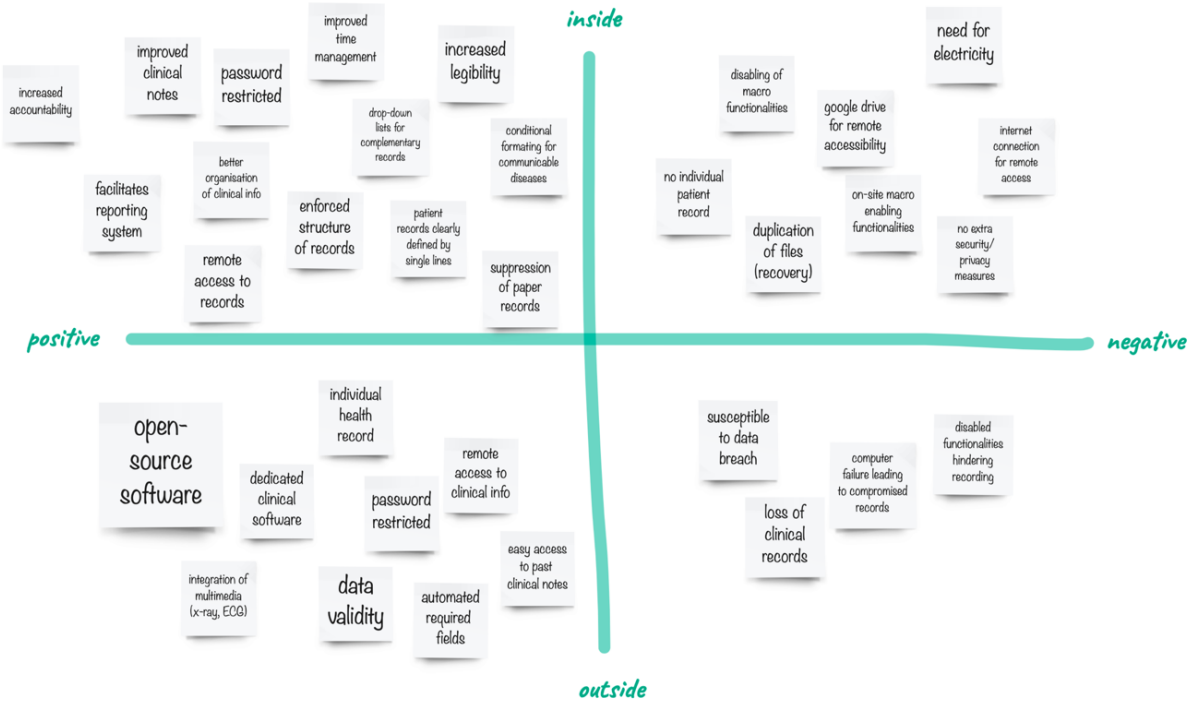


Figure 16. *SWOT analysis to the EHR prototype.*

ADVANTAGES OF THE CURRENT EHR SYSTEM'S OBSERVED	DISADVANTAGES OF THE CURRENT EHR SYSTEM'S OBSERVED
System only requires for a computer and electricity (internet is a bonus, for remote access)	Excel sheet cannot create an individual record per patient (as it's a spreadsheet and not a database)
Paper records are only for referrals, discharge notes and prescription (if medication is not provided at the hospital)	Disabling of cell functionalities (e.g., multiple selection of items on drop-down lists, automated date) when on recovery file mode
Excel sheet suppressed supplementary paperwork with drop-down lists and conditional formatting	Macro functionalities (e.g., multiple selection on drop-down lists) can only be done on site
Excel cells “auto-fit” functionality enables the record to be clearly horizontally divided and organized	Remote accessibility is only possible through an exclusive shared google drive, only relying on Google’s security and privacy policies
Clinical notes are more legible Remote access is possible, facilitating timely reporting	

Table 9. *Summary of the EHR spreadsheet's implementation.*

This digital prototype contributed with some initial and critical conclusions, central to the development and improvement of the system. The main issues to be addressed are pertaining to the simplicity of the program used, as it is not a clinical software (Asi & Williams, 2018; Brotherton et al., 2022; Camacho, Penedos-Santiago, & Ferreira, 2022; Saffer, 2010), thus not presenting some expected functionalities of an EHR system (e.g., individual patient health record). Legibility and accountability were greatly improved, however it still needs a more structured and mandatory data cells filling (e.g., if a doctor prescribes X number of a certain medication, the system should require that the 'medication dispensed' cell is filled with the Y number of medications given to the patient).

3.4. Speed consulting workshop

Over a month of the implementation of the electronic prototype, and in order to help improve end users' experience with the service (health professionals using the current HR system), a *Speed Consulting* workshop (The Health Foundation & NHS Improvement, 2020) was developed, to rapidly collect ideas and/or solutions to main problems/ issues regarding the EHR system in place. After the implementation of the electronic system and analysis of the positives and negatives of the system, a list of issues were compiled. Three problems stood out, that most implicated the system and need action taken. The workshop was developed to work under these problems and explore future possibilities for improvement. Figure 17 exemplifies the actions taken regarding the selected problems.

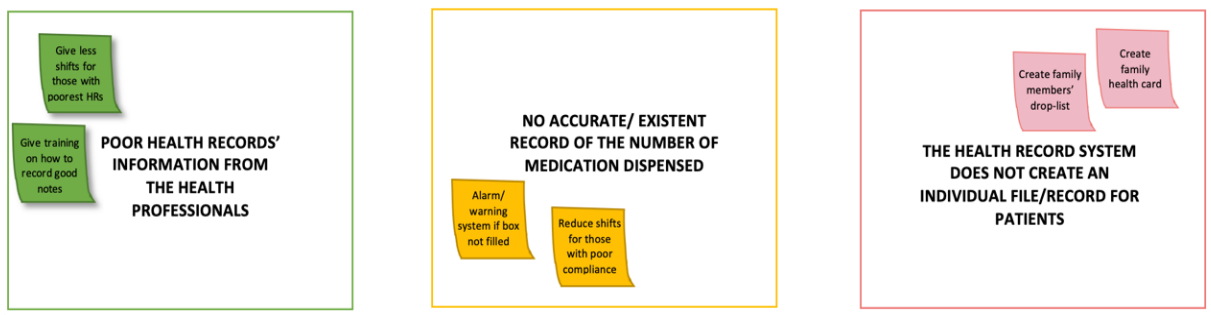


***Figure 17**.EHR system's problems and possible solutions/ideas to explore during the workshop.*

The workshop was conducted at the field hospital in a period of one week, divided into 3 sessions so a different team of national and international doctors (4), nurses (4) and a microbiologist – Laboratory assistant (1) could participate, with a duration of 35-45 minutes each session. It consisted in 3 phases: 1) **introduction** *(5 minutes)* for welcome and explanation of the purpose and workshop phases; 2) **breakdown** *(30 minutes)* in 3 separate areas/tables with problems/issues regarding the current EHR system. The group had 10 minutes to discuss and write on sticky notes as many ideas as possible and/or solutions to meet the problem. When time's up, they rotate and moved to another problem to repeat the process; 3) **discussion and conclusion** *(5-10 minutes)* so the team could provide feedback about the exercise and ideas given. Figure 18 demonstrates the speed consulting workshop progress.

Figure 18. *Speed consulting workshop with national and international health professionals.*

3.4.1. Speed consulting workshop outcomes

Workshop outputs were analyzed and grouped by area of interest resulting in 3 main themes, recurrent to all three problems, represented by different colored-coding. Also, an alpha-numeric code was given to each participant to preserve their privacy and anonymity. Table 10 summarizes the workshop analysis done.

PROBLEMATIC	Poor health records' information from the health professionals	No accurate/ existent record of the number of medications dispensed	The health record system does not create an individual file/ record for patients
THEMATIC COLORS	**Paper record**		*Any idea or solution that will involve a paper-based record system*
	Accountability		*Any idea or solution that involves any kind of participant's responsibility, either by themselves or through a third party, training, or a consequence/ warning system*
	Electronic record upgrade		*Any idea or solution that involves an upgrade of the current EHR, a software change, modification, or improvement*
CODE	Coding representation of the health professionals involved in the workshop		

Table 10. *Summary of speed consulting workshop's analysis.*

A total of 70 ideas and possible solutions were collected from the three EHR system's challenged problems with the most recurrent solution being accountability (53%), immediately followed by an Electronic record upgrade (34%), represented by figure 19. Even though the electronic system has been proven to have increased efficiency, legibility, and the advantage of accessing it remotely, a paper-based solution still emerged as a problem-solving to the electronic version of the current HR, despite these solutions doubling the documentation process and increasing to the current prototype's issue. Concerning the ideas/solutions under the theme 'Accountability', the most recurrent solution was by imparting most of the responsibility to the service users or through a punishment/reward system. Figures 20 to 22 represent the analysis to the speed consulting workshop.

Figure 19. *Speed consulting workshop results.*

PROBLEM 1	IDEAS AND SOLUTIONS	CODE	THEME
Poor health records' information from the health professionals (leading to malpractice and patient safety issues)	*"writing all information of the patient in a paper if there was no time, then transfer to the computer"*	02B	Paper record
	"not having time is a big problem so charging someone to write it on computer"	02B	Accountability
	"getting proper history and examination of the patient to get the diagnosis"	02B	Accountability
	"the doctor or the nurse will get a warning if the spaces not filled properly"	02B	Electronic record upgrade
	"someone to check on the records/info (doctor supervisor) so they can learn and do it well"	03B	Accountability
	"give a class to the staff to write a good clinical history (so you can justify diagnosis and prescription)"	03B	Accountability
	"put the whole physic exam to fill in the clinical history table (or the most important aspects) or also an extra line (excel) to put the reason of the treatment or diagnosis"	03B	Electronic record upgrade
	"make the system not working if you don't fill the whole vital signs"	03B	Electronic record upgrade
	"the system won't let you prescribe or put the right medication if you don't have a right diagnosis"	03B	Electronic record upgrade
	"the doctor after check the patient should write the diagnosis"	02A	Accountability
	"for the old patient must check vital signs and write in our system"	02A	Accountability *
	"we should diagnose and write on our system which patients have chronic diseases"	02A	Accountability *
	"it's better for all patients to check vital signs"	02A	Accountability *
	"making separate rows (on the excel system)"	04B	Electronic record upgrade
	"giving warning to all. If they not obey by giving 3 stages of warning and its consequences"	04B	Accountability
	"if the software could give suggestions according with the chief complaint"	03A	Electronic record upgrade
	"the system doesn't allow you to continue for prescription if the clinical features' box is not complete"	03A	Electronic record upgrade
	"giving training to staff (so everyone knows what to write"	03A	Accountability
	"giving warning to all"	04A	Accountability
	"penalty"	05B	Accountability
	"surveillance. Taking random sample from health care records"	05B	Accountability
	"laboratory patients' records (paper based)"	01D	Paper records
	"dedicated software for medical records"	01D	Electronic record upgrade
	"job description. Training"	05A	Accountability
	"if you did your duties I will give you a reward"	05A	Accountability
	"someone special for recording data"	05A	Accountability

Although categorized into 'Accountability' THEME does not present any idea and/or solution to solve the problem.

***Figure 20**. Speed consulting workshop - problem 1 health professionals' quotes and analysis.*

PROBLEM 2	IDEAS AND SOLUTIONS	CODE	THEME
No accurate / existent record of the number of medications dispensed (accountability and stock management)	*"educate or make a presentation to clarify the system"*	02B	Accountability
	"write down the number of drugs on a paper before putting into the computer"	02B	Paper record
	"have a pharmacist to manage it"	02B	Accountability
	"an alarm making if the medication dispensed is not filled"	02B	Electronic record upgrade
	"if the system doesn't work so we can write it on a paper and then solve the informatic issue"	03B	Paper record
	"have a system that will not let you go to write the info for the next patient if you don't complete the last one"	03B	Electronic record upgrade
	"because sometimes come a little of crowd in the emergency room, you have to wait until you finish to go to another (and write everything)"	03B	**
	"all medicine dispensed should account for"	02A	Accountability *
	"fill the medication place which can be empty and cheating"	02A	Accountability *
	"check the medication every day with the stock"	02A	Accountability
	"making a clinical software"	04B	Electronic record upgrade
	"create hospital ID for patients"	03A	Electronic record upgrade
	"create a file system using tent # + family members"	03A	Electronic record upgrade
	"buy a clinical software"	04A	Electronic record upgrade
	"return to have a paper-based system"	04A	Paper record
	"dedicated software (for medical records) that also supports amount of medication prescribed"	01D	Electronic record upgrade
	"holding the physicians accountable for the lack of information (unrecord)"	01D	Accountability
	"here we need a pharmacist"	05A	Accountability
	"recording on the paper"	05A	Paper record
	"each of us are in charge of the daily records"	05A	Accountability
	"not dispensing more than 1 tablet for medication"	05B	Accountability
	"cancel of contract"	05B	Accountability
	"daily checkup of all medication"	05B	Accountability

***** This was not considered into a THEME as it's a problem within the given problem.***
Although categorized into 'Accountability' THEME does not present any idea and/or solution to solve the problem.

***Figure 21.** Speed consulting workshop - problem 2 health professional's quotes and analysis.*

PROBLEM 3	IDEAS AND SOLUTIONS	CODE	THEME
The health record system does not create an individual file/record for patients (each time they come in, it will be as the "first" time)	*"we can write his name linked with tent number (ex, Sara C-122)"*	02B	Accountability
	"we can ask the patient if he knows how to spell his name"	02B	Accountability
	"we can write the 3 or 4 second names of the patient"	02B	Accountability
	"we can try different spells for 1 name or ask who wrote this particular name"	02B	Accountability
	"create a new system to get the ID/tent or proper name include the photo on it (even to share with other organizations)"	03B	Electronic record upgrade
	"give a record to the patient so he can have his clinic history (and he can go to everywhere with it)"	03B	Paper record
	"make a finger detector with clinical history"	03B	Electronic record upgrade
	"tell the patient if he doesn't bring the ID can't be attended"	03B	Accountability
	"the system gives us the patient file"	02A	Electronic record upgrade
	"all the patients that visit our ER they need to bring ID tent number"	02A	Accountability
	"we can make a system in our computer that we can write a number so the computer can get the patient file"	02A	Electronic record upgrade
	"paper and medication to account"	04A	Paper record
	"hire a pharmacist"	04A	Accountability
	"give warning to all. If not solved or they do not obey give a personal warning. If happens again give a punishment by taking half salary, if happen again do not give shifts"	04B	Accountability
	"give a warning to the team. If problem continues no shifts for that staff"	03A	Accountability
	"create a warning system on the computer if field not filled"	03A	Electronic record upgrade
	"make nurses responsible to check if doctor is writing on the system"	03A	Accountability
	"having your special note"	05A	Paper record
	"tent nº (instead of looking up patients by name)"	05B	Electronic record upgrade
	"take a picture for the record system (with a webcam)"	01D	Electronic record upgrade
	"dedicated medical software"	01D	Electronic record upgrade
	"make a barcode (hospital ID) for each patient"	01D	Electronic record upgrade

Figure 22. *Speed consulting workshop - problem 3 health professional's quotes and analysis.*

3.5. Service Blueprint

To get a more comprehensive understanding of the current HR system, a service blueprint was mapped. As Shostack (1984) once said, "A service blueprint allows a company to explore all the issues inherent in creating or managing a service" (Shostack, 1984, p.134). In this specific case, the purpose of mapping the blueprint was to have a visual understanding of the relationship between the HRS's processes, people involved and the physical/digital props, representing its flow of actions (Gibbons, 2017; Service Design Tools, n.d.). It allows to have a two-dimensional picture of the process, by laying out the user actions in a chronological axis (horizontally) and its different action areas on a vertical axis (Fließ & Kleinaltenkamp, 2004). This method was also chosen for its ability to generate ideas and improving the existing one (Polaine et al., 2013) by enhancing our creative thinking and facilitating problem solving.

The blueprint represents the 3 phases of the user journey (a doctor): before engagement with the service (health record); during and after engagement with the service. Figure 23 represents the HR system's service blueprint.

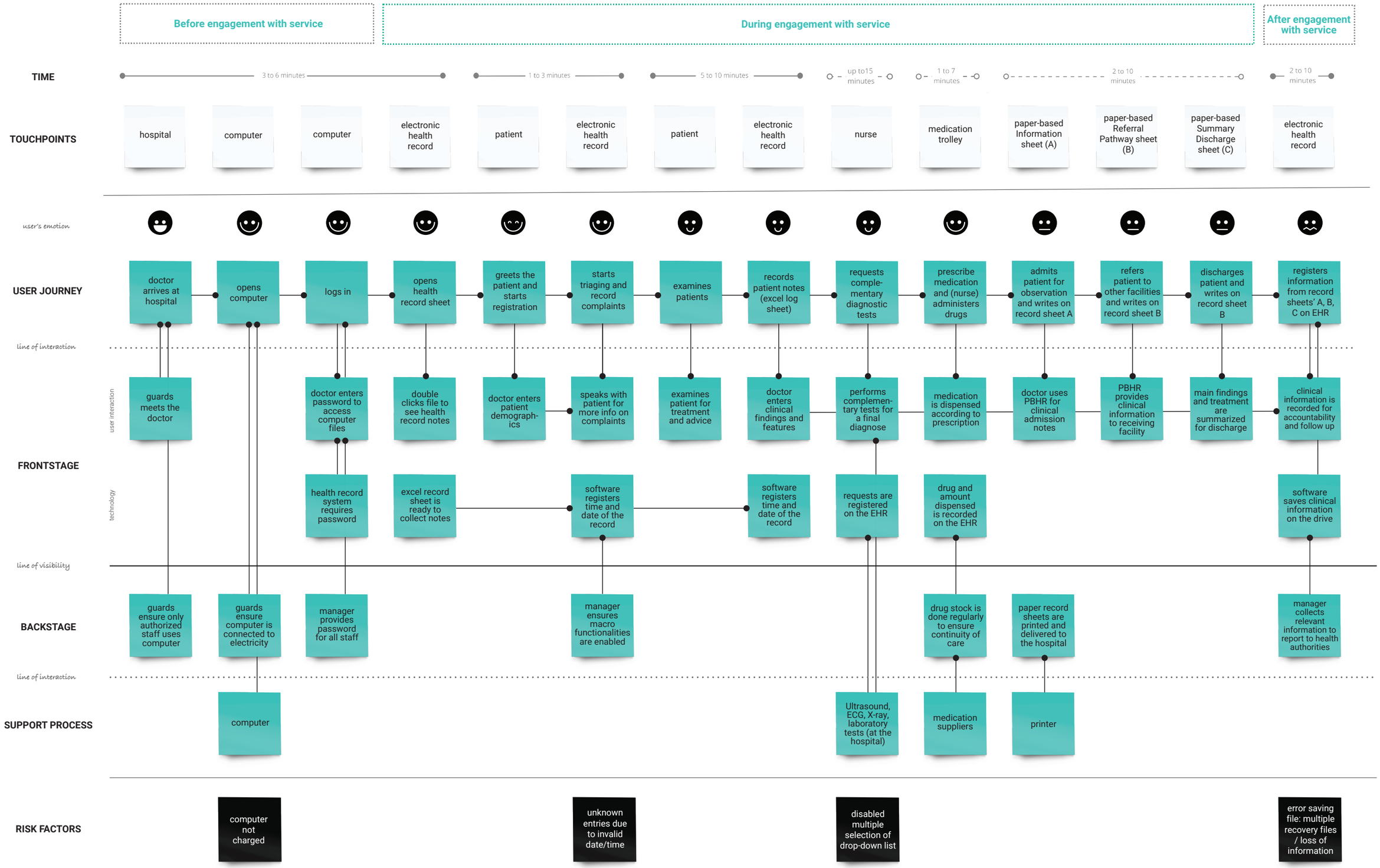


Figure 23. *EHRS' service blueprint.*

3.5.1. User journey and touch points

As the doctor will be the one primarily interacting with the HR system, the blueprint was mapped according to the doctor's journey while interacting with the system and its correspondent touchpoints. The following steps were identified as the user journey's activities:

1. Doctor arrives at the hospital 2. Opens computer 3. Logs in	**Before engagement with service**
4. Opens record log sheet 5. Doctor greets the patient and starts triaging 6. Registers patient (onto log sheet) 7. Doctor examines patient 8. Writes patient (onto log sheet) 9. Requests complementary diagnostic tests 10. Nurse gets prescribed medication from trolley 11. Patient is admitted for observation, and doctor opens record sheet (3.2.A) - Information sheet 12. Patient is referred to another health facility, and doctor register clinical information on record sheet (3.2.B) - Referral Pathway 13. Patient is discharged from the hospital, and doctor record clinical information on record sheet (3.2.C) - Summary Discharge	**During engagement with service**
14. Doctor registers all information pertinent to record sheets 3.2.A, 3.2.B and 3.2.C for future account and follow up	**After engagement with service**

During the journey, the identified **touchpoints** were:

- Hospital
- Computer
- Health record
- Patient
- Nurse
- Medication trolley
- Paper record sheet A
- Paper record sheet B
- Paper record sheet C

The estimated time since a doctor engages with the system until its finished can take between 10 to 30 minutes, depending on the complexity of the case.

Regarding the emotions the user fells throughout the journey, there is a clear disappointment/dissatisfaction with the system along the way, as the doctor will have to move from the electronic system to the paper-based intermittently, thus duplicating clinical notes and slowing down the process.

3.5.2. Physical evidence

Doctors will see and interact with the system to make it work, and this happens in two levels concurrently: the user interaction with the service in firsthand and all the steps taken to use the system, and the technology they will need to use to operate it (computer and a software).

a. Doctor gets to the hospital and greets guard.

Figure 24. *Doctor greeting guard at the hospital.*

b. Doctors opens record sheet and records patient's demographics

Figure 25. *Doctor recording patient's demographics onto the EHR system.*

c. Nurse dispenses medication according to doctor's prescription.

Figure 26. *Nurse dispensing medication from trolley.*

d. Doctor writes down (on paper-based records) clinical information pertinent

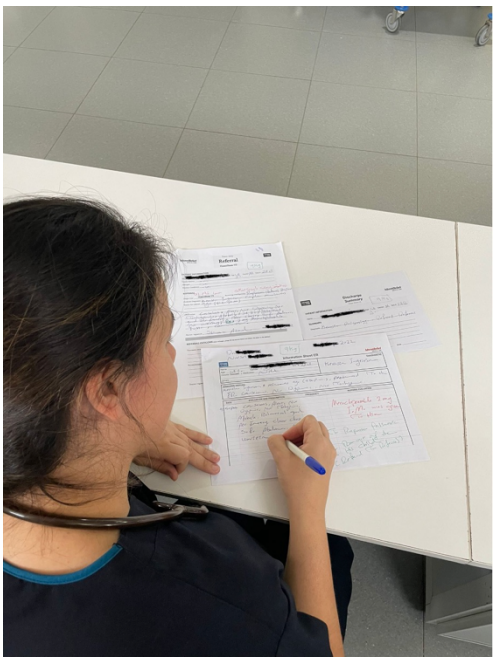


Figure 27. *Paper-based record sheets for patient transfer.*

3.5.3. Backstage and Support processes

Finally, we come to the "invisible" and final stage of the service, but central to its execution. This actions are the Organization's responsibility, as will directly impact the user journey and experience with the service.

People and activities beyond line of visibility (**Backstage**):

- *Guard*: assures only authorized personal enters the hospital and that the computer is always connected to the electricity;
- *Management team*: gives IDs to all clinical staff working with the HR system;
- *Manager*: ensures HR system is working with its functionalities enabled, that there are enough stock of medication and paper-records for the shift and collects relevant information for reporting purposes to health authorities.

As for the **Support processes**, to ensure an optimized functioning of the system, it was identified:

- *Computer*: to run the health record system software;
- *Medical machines/equipment*: such as X-ray, ultrasound, laboratory exams to assist the doctor in the diagnosis;
- *Medication suppliers*: to ensure medication is always available to treat patients;
- *Printer*: to print all the paper-based records necessary (to complement clinical care).

3.5.4. Risk Factors

Also called *fail points* (Shostack, 1984), the last horizontal axis of Risk factors represent pain points throughout the system that can hinder its performance, leaving continuity of patient care vulnerable and are the main threats to the present system in place.

A. *Computer is not charged*. This is a situation that can be solved in a couple of minutes, but, if there is already many patients waiting to be seen by the doctor, that means patient information might need to be written in a paper, while the computer and HR system is opening. Once the computer is plugged in and operating again, clinical information will need to be re-written on the system, duplicating work and time-consuming.

B. *Unknown entries due to invalid date/time*. Since the record system is running on a simple excel sheet, many functionalities are based on formulas and conditional formatting. For this reason, everyone accessing the document can easily disable cell functionalities, resulting in clinical data to be "lost" on time and date which can affect patient care continuity.

C. *Disabling drop-down lists' multiple selection*. Similar to the previous factor, touching the wrong button or editing a cell can present a major problem to the doctor's work. When a diagnose depends on the doctor's request for more than one complementary test, if the health record cannot document multiple requests, not only the doctor will have to manually write it on the patient's notes (instead of a single click), or not record it at all and just perform the test, hindering the report

system as the information will be “missing” from its appropriate place and it will be presumed to have not happened.

D. *Error while saving the excel health record sheet data*. This situation brings two very negative and distressing results: 1) all clinical information is lost after the last file auto-saving, and as there is no back-up to the system, data is permanently lost; 2) the computer creates recovery files, scattering clinical information throughout multiples documents, making it difficult to access all data at once and the chance of different health professionals to choose a different file to record information on.

4

CASE STUDIES AND USABILITY TESTS

OPENMRS CASE

HIKMA HEALTH CASE

Upon the study and identification of the service needs and the possible clinical software (OpenMRS) to use, a usability test was conducted. The main purpose was to start getting to tailor the system and see how it would adapt to the required features and hospital's journey. To start its customization, a list of some vital features that this new system should have in its core functionalities were laid out:

1. A free clinical software capable of being tailored to the present setting;
2. The possibility of having multiple accounts/users logged into the system;
3. Distinctive privileges according to each user (e.g., doctor can see entire patient's record while pharmacist can only access doctor's diagnosis and prescription);
4. Individual health record files for patients attending the hospital;
5. Complementary diagnostic tests can be prescribed automatically by the system and the results to be saved on the patient's notes/file;
6. When referring, discharging or admitting a patient, adequate paperwork is now requested on the system rather than on paper-based sheets;
7. Capability of the system to work on-line and off-line;
8. Auto-save mode or similar to assure that clinical information is not lost (e.g., in a power shortage or software's crushing);
9. User session's expiration time during shift;
10. Patient attendance information to be generated automatically to facilitate reporting system.

4.1. OpenMRS case

The ability to tailor a system to its real workflow and need is a vital characteristic for a smooth implementation and upgrading of the current system. Figure 28 displays the software areas in which one can customize and tailor to its needs, and the reason to pursue this clinical software as an option for implementation at the field hospital in Iraq.

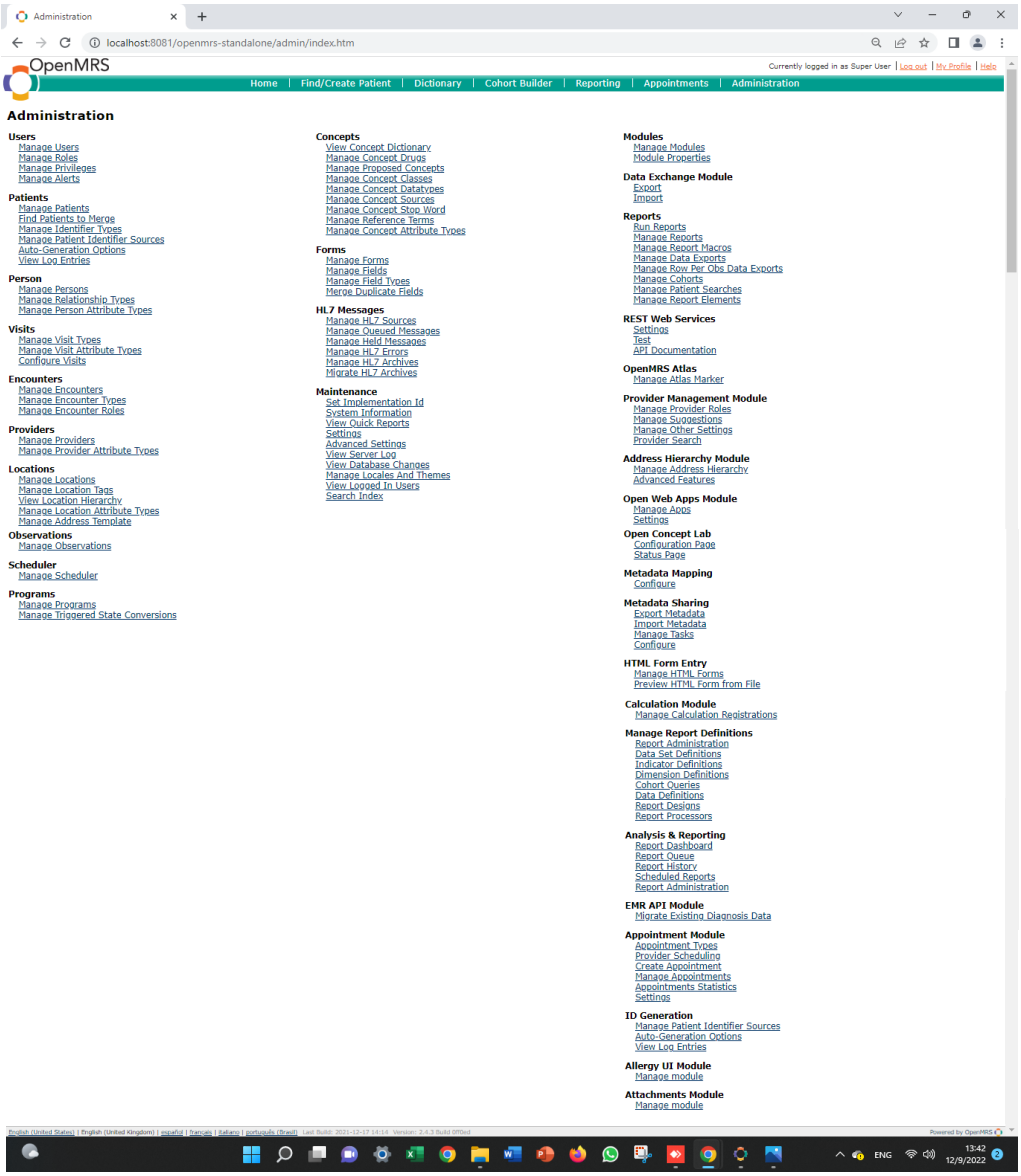


Figure 28. *OpenMRS fields, subject to users' customization.*

Upon software's installation, a two-phase start-up is always required (Figure 29). The first step is to open the software, so the system can connect to its data base, and once its running, we can then open the software's interface through Google Chrome (with a correspondent link). The system's database should be stopped every time we close the software and re-opened to enter and use the system.

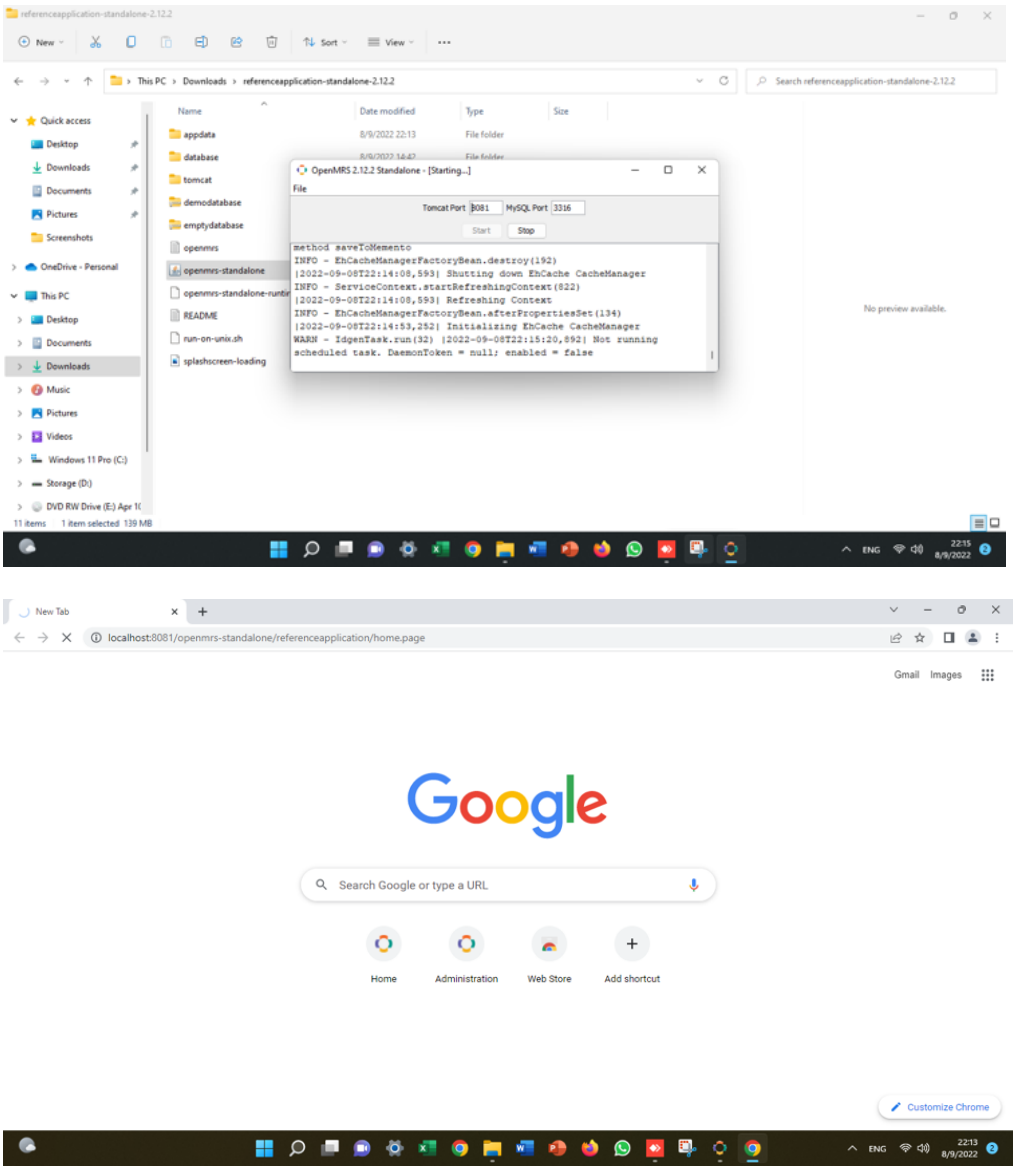


Figure 29.
Two-step opening of the OpenMRS software.

4.1.1. Log in and users

When the page is loaded, we are finally into the interface's main page, where we can now proceed with the Log in. Each user will have its own *username* and *password*, and they will be attributed to their own area of work (for demonstration purposes, the selection on figure 30 will be the *Inpatient Ward*).

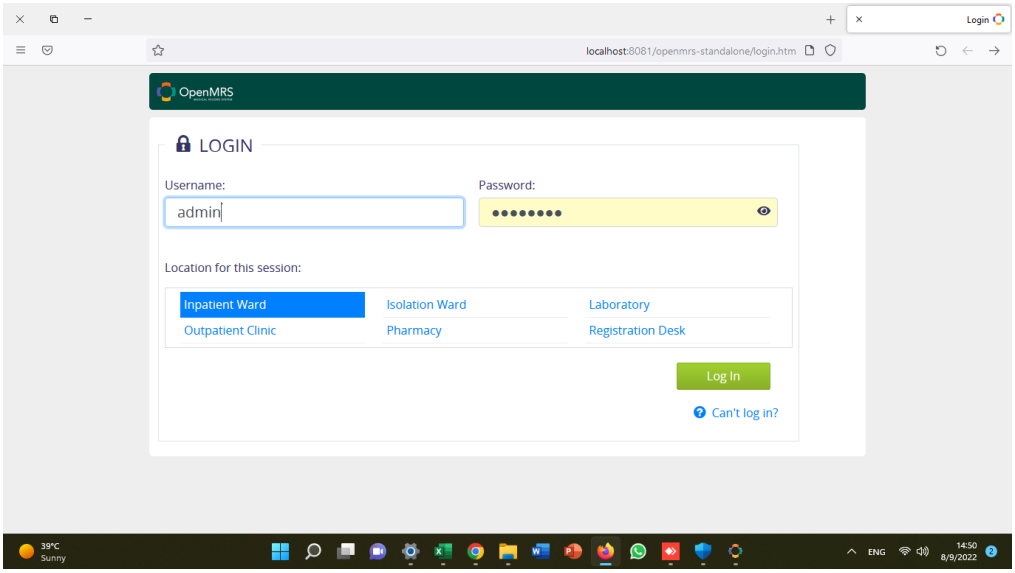


Figure 30.
User log in and location for the session.

User ID for staff can be created and edited as seen on Figure 31. Roles and privileges will be attributed to each one, according to their position (Figure 32), which will affect the access to different menus access on the main screen. Figure 33 illustrates the menu seen by the manager while figures 34 and 35 presents the doctor's menu.

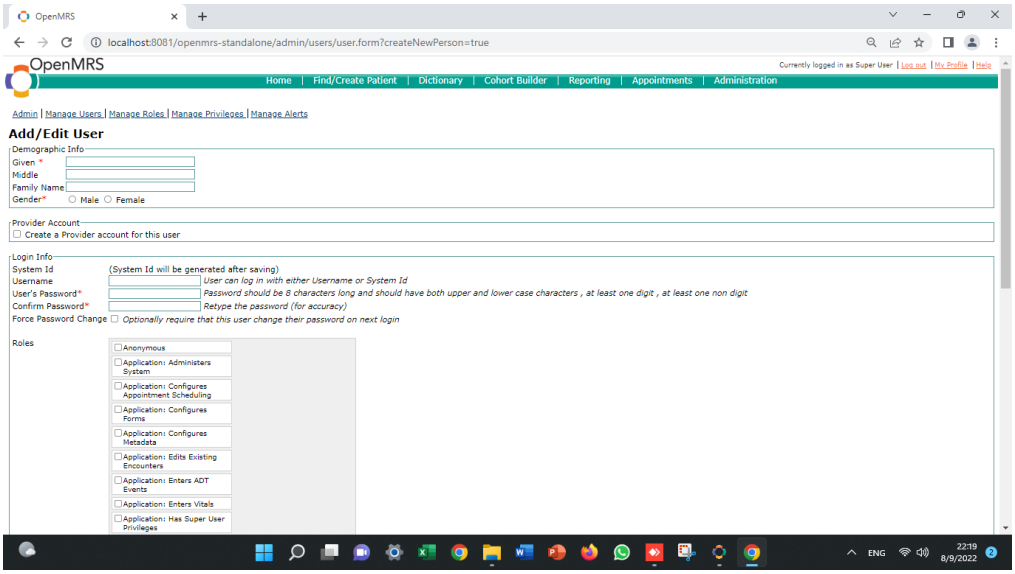


Figure 31.
Users' adding and editing menu.

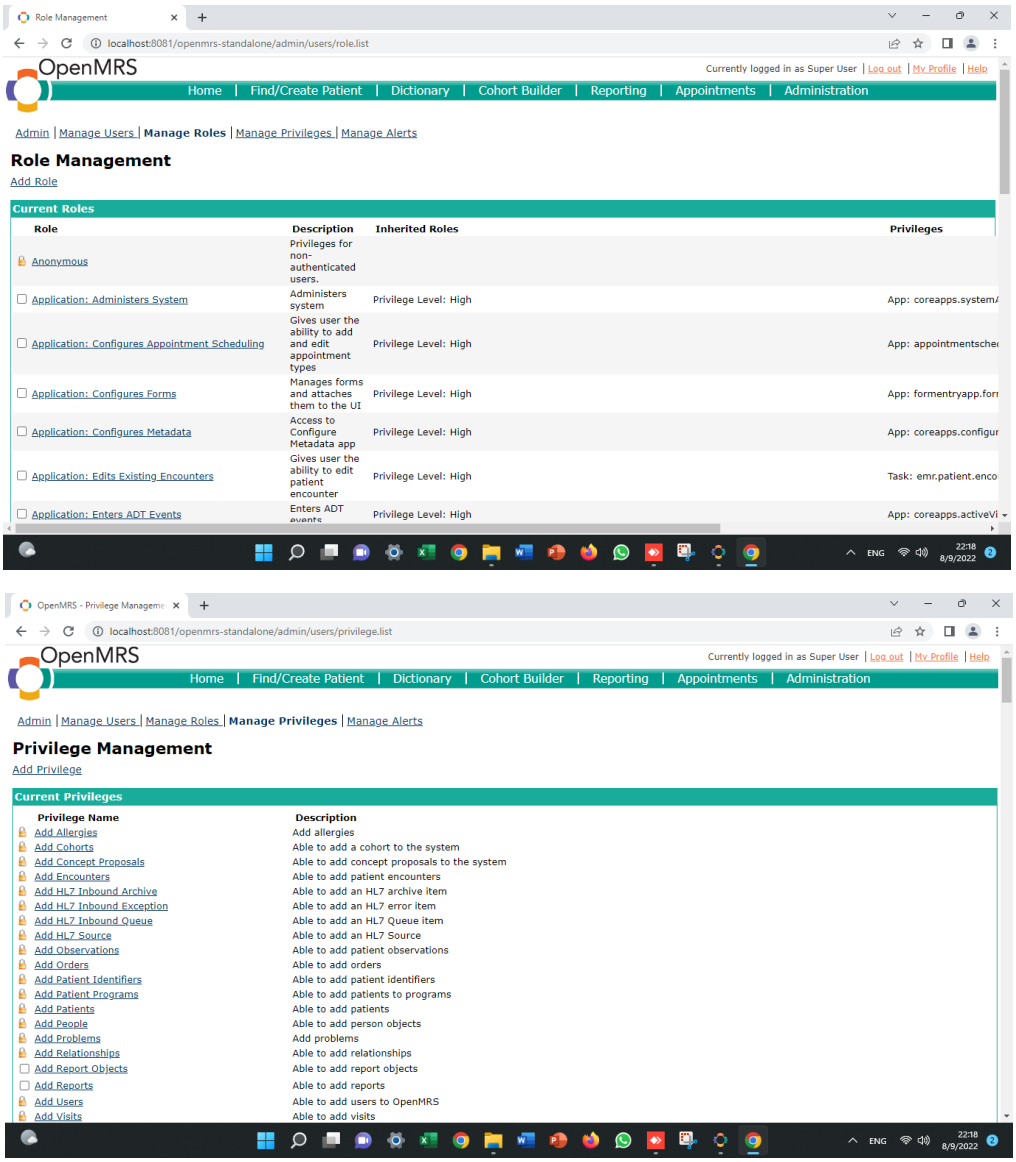


***Figure 32**. Customization of users' roles and privileges.*

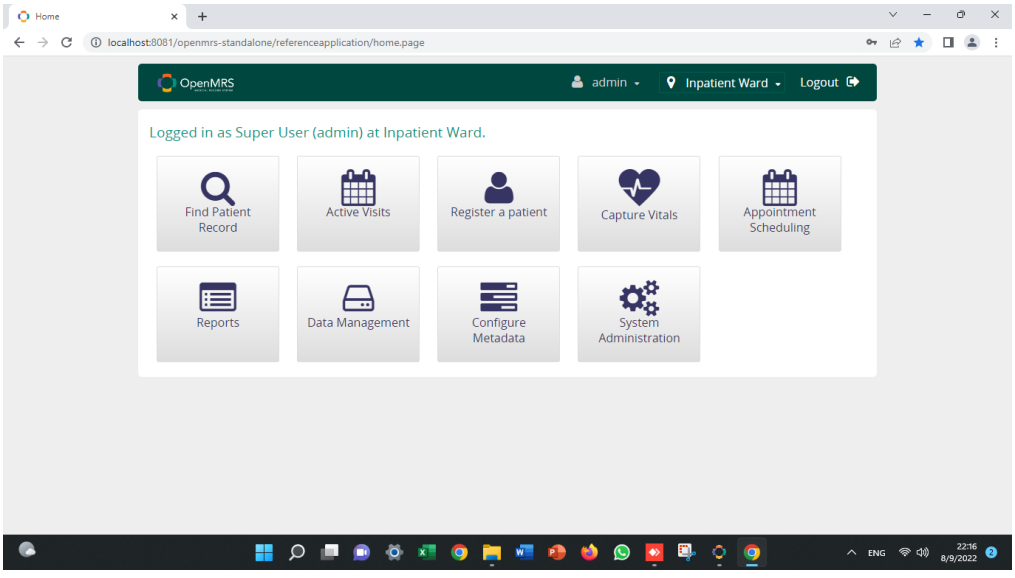


***Figure 33**. Manager's interface (Super User) showing multiple menu options.*

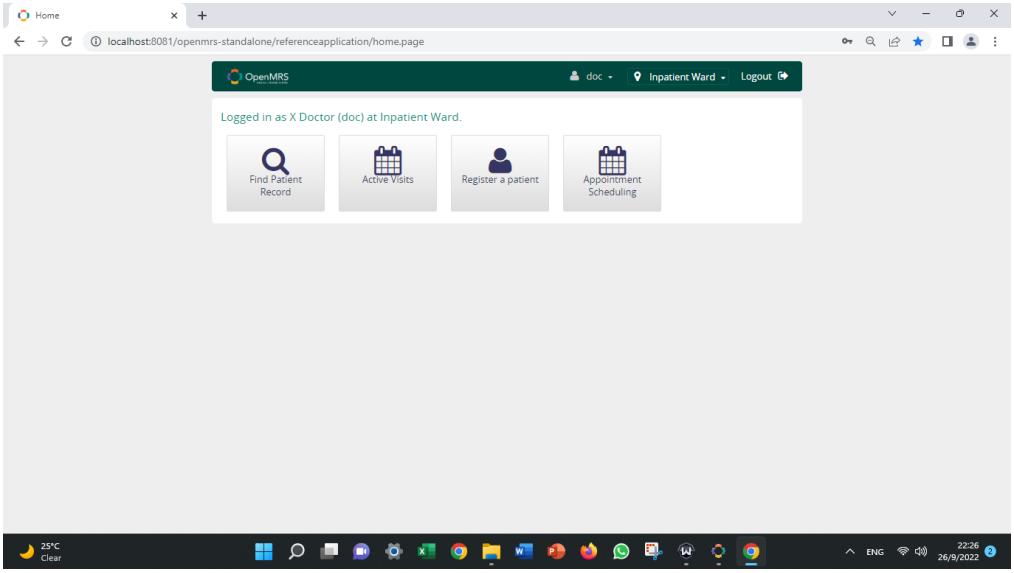


Figure 34. *Doctor's interface with reduced menu options.*

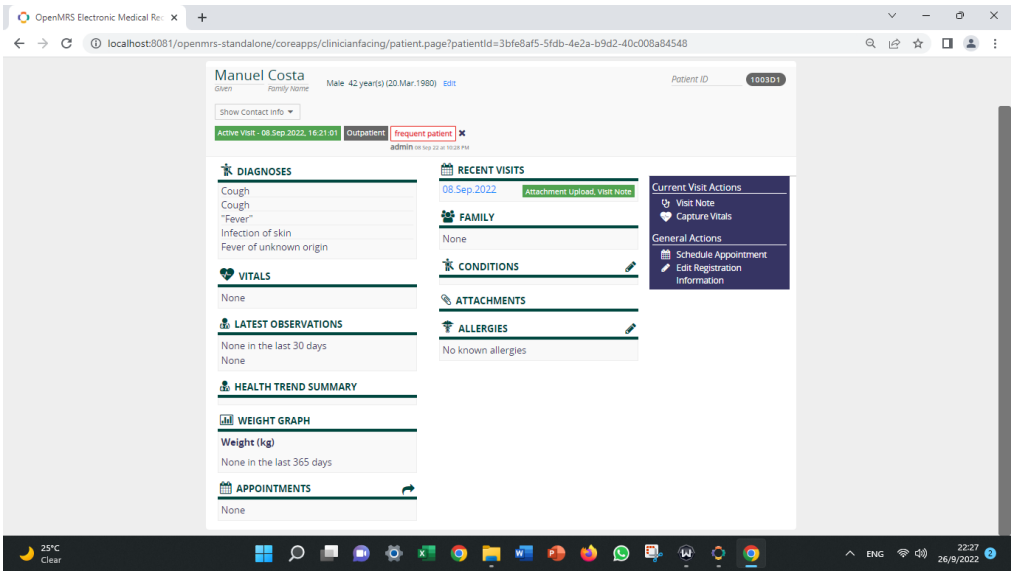


Figure 35. *Doctor's interface when accessing a patient record.*

4.1.2. Patient's registration and individual health record file

The next step is to register patients. Demographics, contact information and household information can be entered, creating a single ID for each patient (Figure 36).

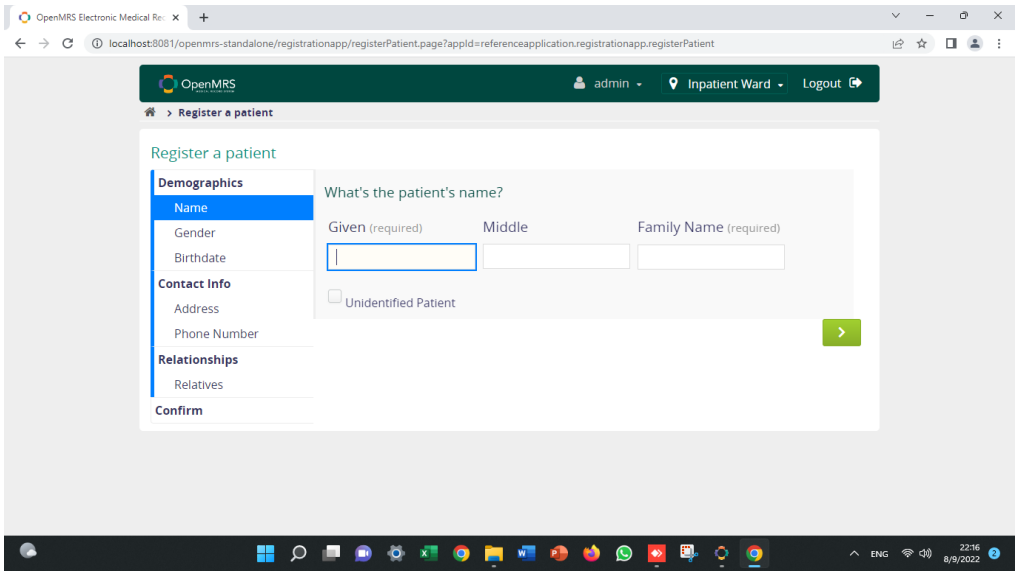


Figure 36.
Patients' details registration into the system.

A general patient menu is available for information collection (figure 37). A visit note will be opened each time a patient goes to the hospital, where a full history of visits can be accessed (figure 38).

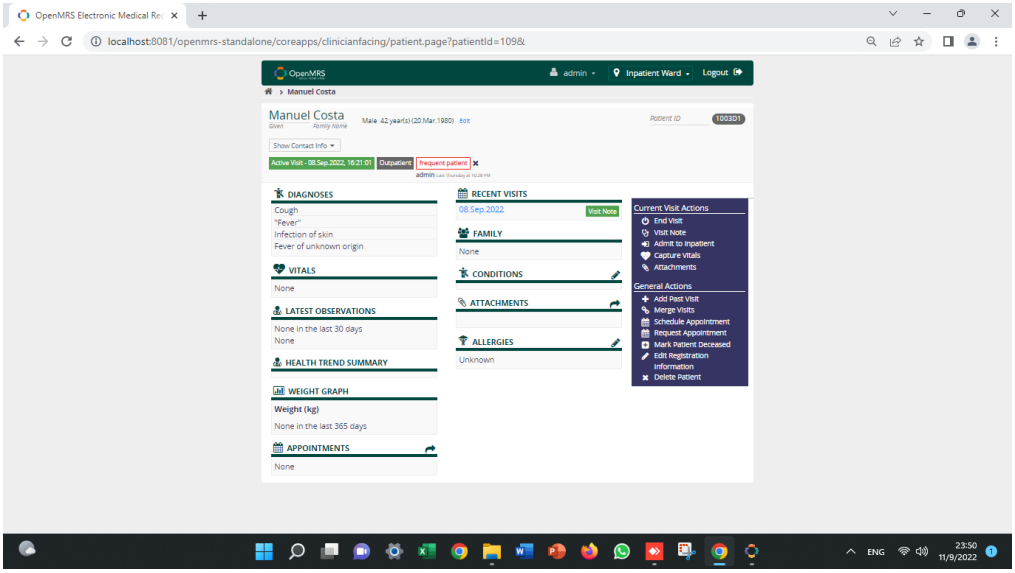


Figure 37.
Patient's individual health record interface.

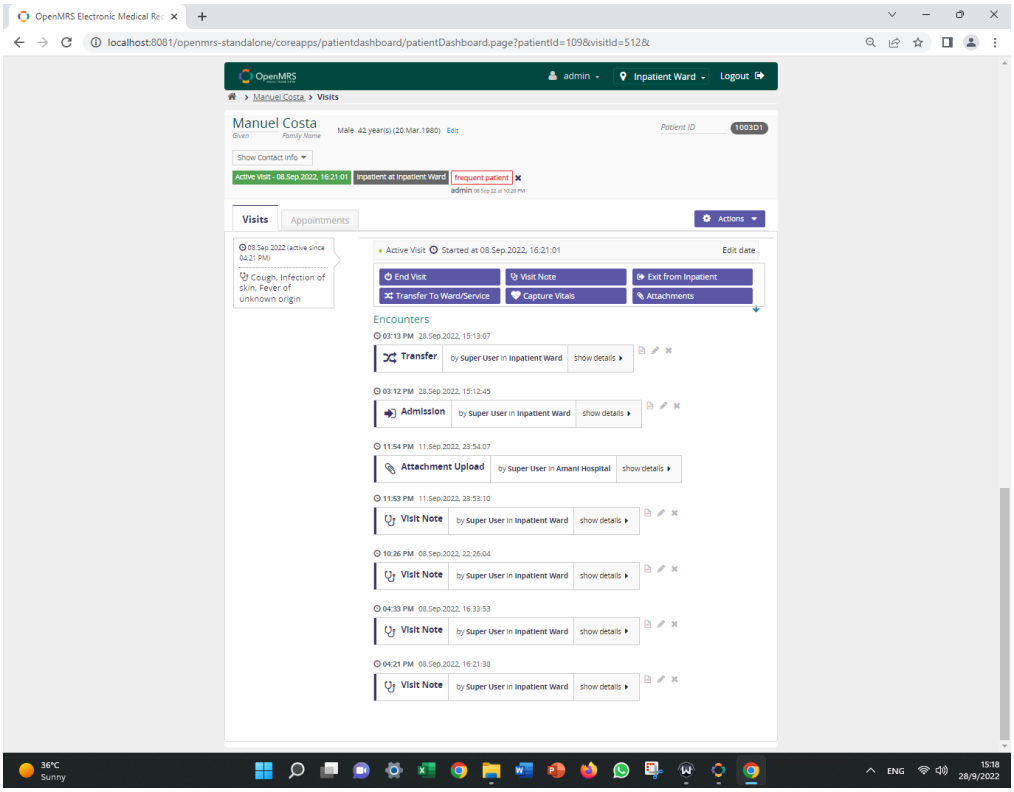


Figure 38. *Patient's visit history.*

Another important aspect is the fact that *Attachments* can be made directly to the patient's health record, as shown in Figure 39. Complementary diagnostic tests such as X-rays or ECG results can be added to the file with an explanatory clinical note. With this feature, exam results can always be found as they are enclosed to the electronic file.

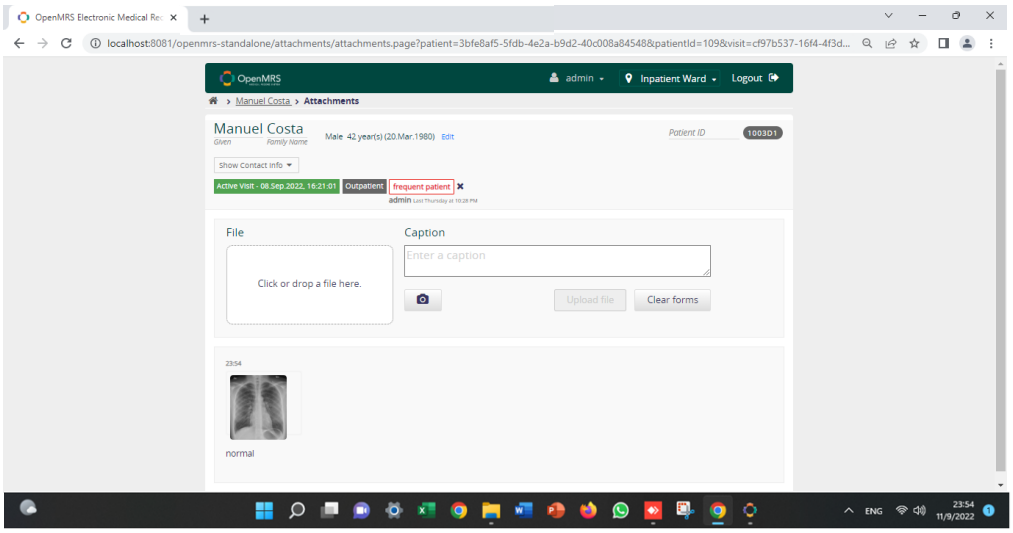


Figure 39. *Attachment of an x-ray to a patient's health record file.*

4.1.3. Stats and reporting system

As for the reporting system, one of the main concerns was the practicality of information to be shared with the designated stakeholders. When first using the paper-based records at the end of the sheet, the log sheet would be collected and manually counted all attendances. Once the electronic version was implemented through the excel record sheet, date and time were automatically generated upon patient entry to the document, facilitating greatly the reporting system. With OpenMRS, a simple patient's attendance list is also possible, as shown in Figure 40.

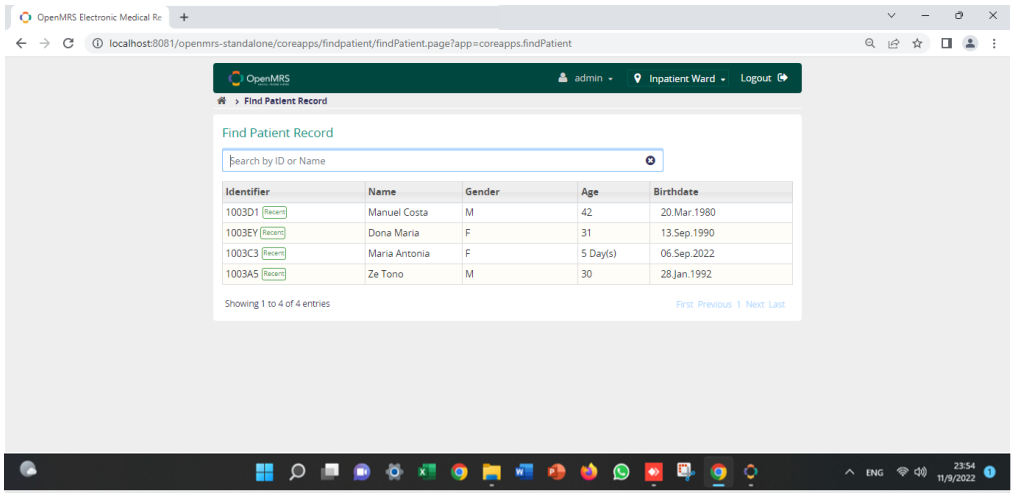


Figure 40. *System's patient entry menu according to recent visits to the hospital.*

Figure 41 presents OpenMRS tracking system of patients that are still "active", meaning they are still under doctor's observation/consultation. These entries are independent from those on Figure 40.

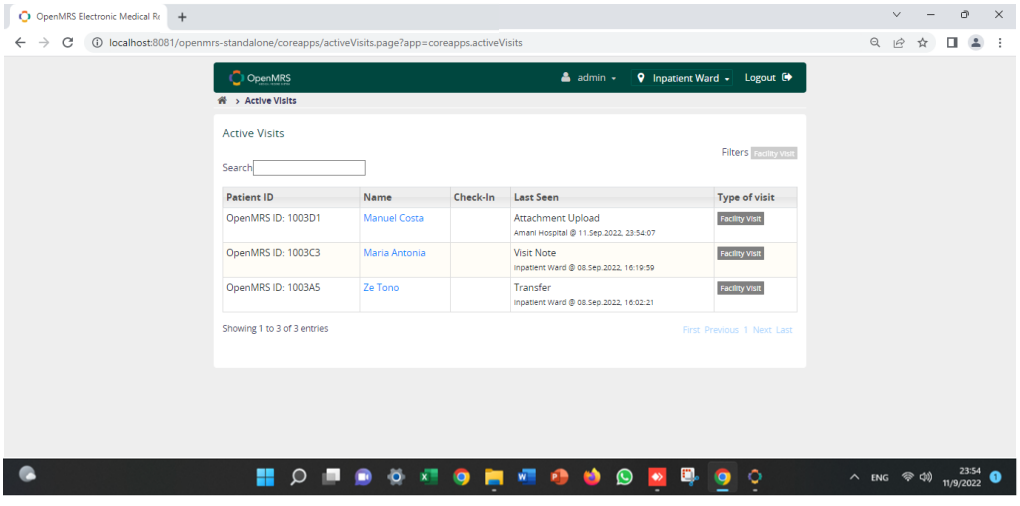


Figure 41. *OpenMRS active patient's visit menu.*

Notwithstanding, the software also allows the search and extraction of a reporting analysis generated by the system according to various parameters, as demonstrated in Figure 42.

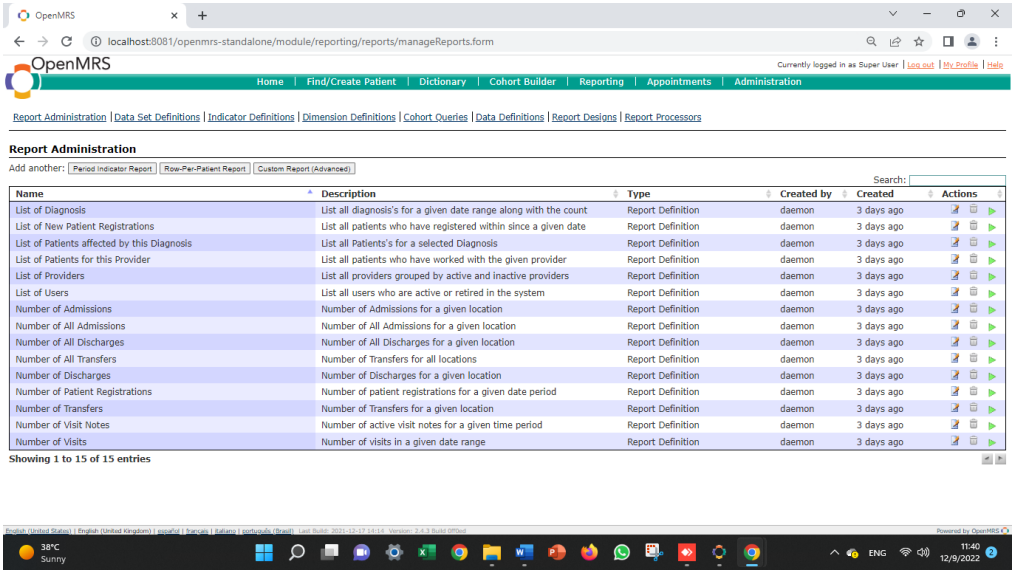


Figure 42. *Automated software's reporting system.*

Upon selection of a parameter to analyze, the system will open a Report editor option where we can specify a certain specification and, in the case of '*new patient registrations*' a filter by dates can also be applied, as demonstrated by figures 43 and 44.

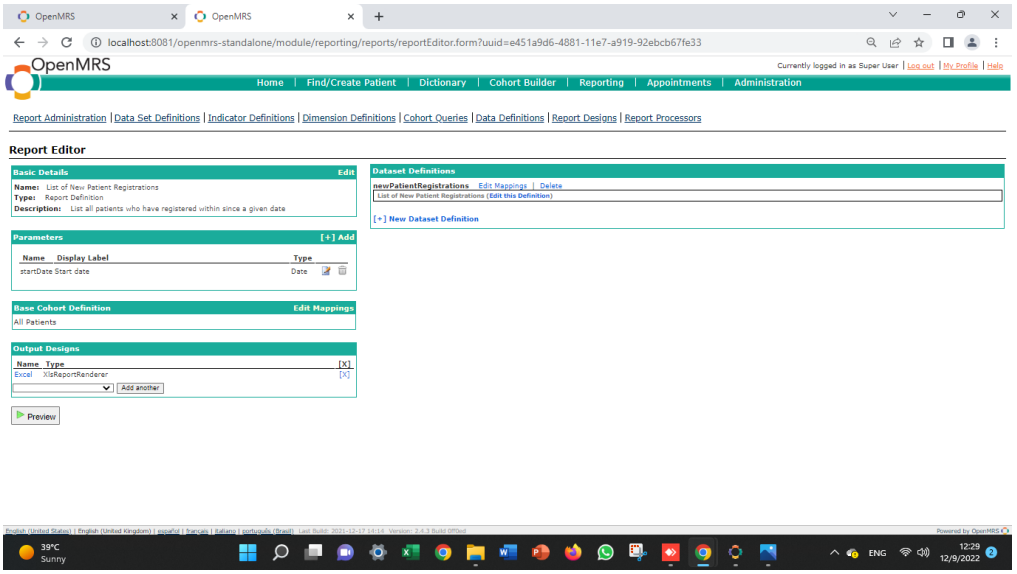


Figure 43. *Reporting system: selection of New Patient Registration according to date.*

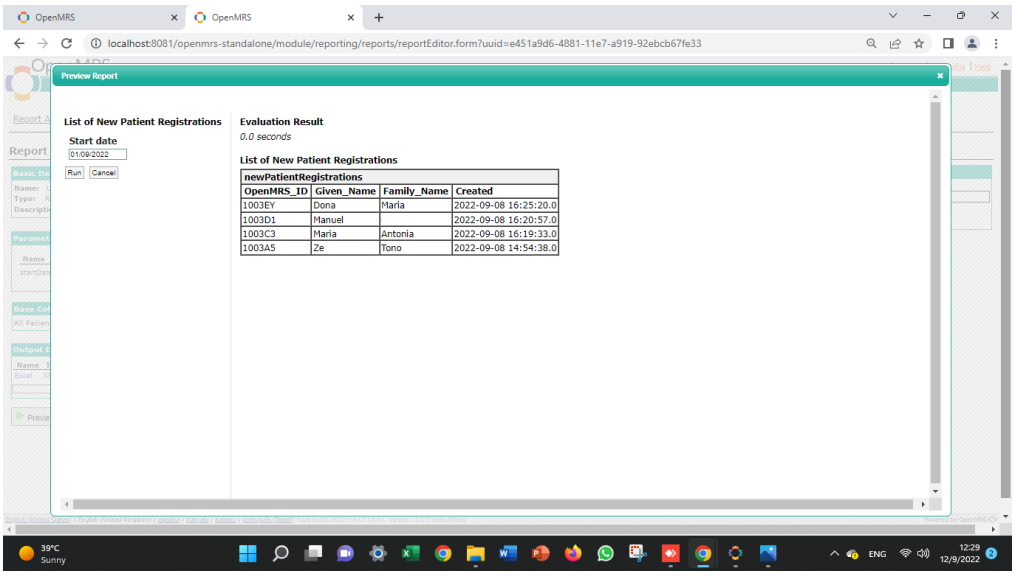


Figure 44. *Report visualization for New Patient Registration.*

4.1.4. Usability test outcomes

At the beginning of this chapter, some core features were delineated for the running and tailoring of the clinical software (OpenMRS) for a future re-design of the present EHR system at the field hospital in Iraq. Table 11 summarizes the pros and cons of the usability test performed with the software.

EHR system's software

ADVANTAGES	DISADVANTAGES
Free and capable of customization	Not having a “double click” launching system
Works on-line and off-line	Lack of step-by-step guidance
Multiple users working in the system	Need to stop the server to save information and avoid crashing
Different user’s roles and privileges	Some errors are continuing to appear even since when they were first reported (year 2016, 2019)
Creating and accessing to individual HR files	Very difficult to understand trouble-shooting treads (on the forum)

ADVANTAGES	DISADVANTAGES
Complementary diagnostic tests included into patient record	Pharmacy menu not available hindering doctor's prescription and recording
Paper-based records inserted into software	No Laboratory menu available, even though it's present on the software
Auto-save mode	The system cannot end a patient's visit, keeping it always "active" (patient is never discharged)
System's user session expires after a while (if not constantly in use)	Requires a good knowledge of computer science and coding
System generates reporting parameters	

Table 11. *OpenMRS core features' summary.*

4.2. Hikma Health case

Working in a very particular environment as a field hospital, inside an IDP camp, where limited resources and a constant need of flexibility, it's elemental that the clinical software involves the least amount of money (desirably free), with minimal physical resources (digital technology), and easy to use. Hikme Health seems to meet all the requirements, and it has been tested in the field already. Figure 45 exemplifies the app interface.

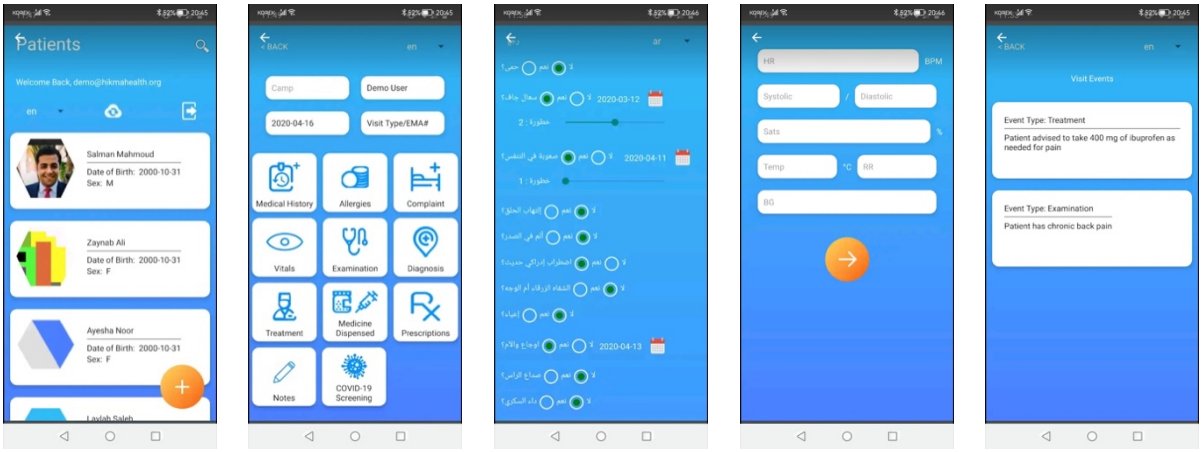


Figure 45. *Hikma Health EHR system's interface.*

One of my primary concerns was the fact that it was 1) an app, 2) for android. Having a software that only works with a smartphone/tablet and with one specific operating system it's a hurdle as it requires the user to have one of those electronic devices (even for the usability test) for that specific operating system. The second setback was that the app doesn't work immediately after download (even for a demo version). There is no way to create a new user, what led me to the next obstacle, that was how to make it run. On the Google Play, there is no kind of feedback, rating, comment of the app, that can help or elucidate regarding its use as shown in Figure 46.

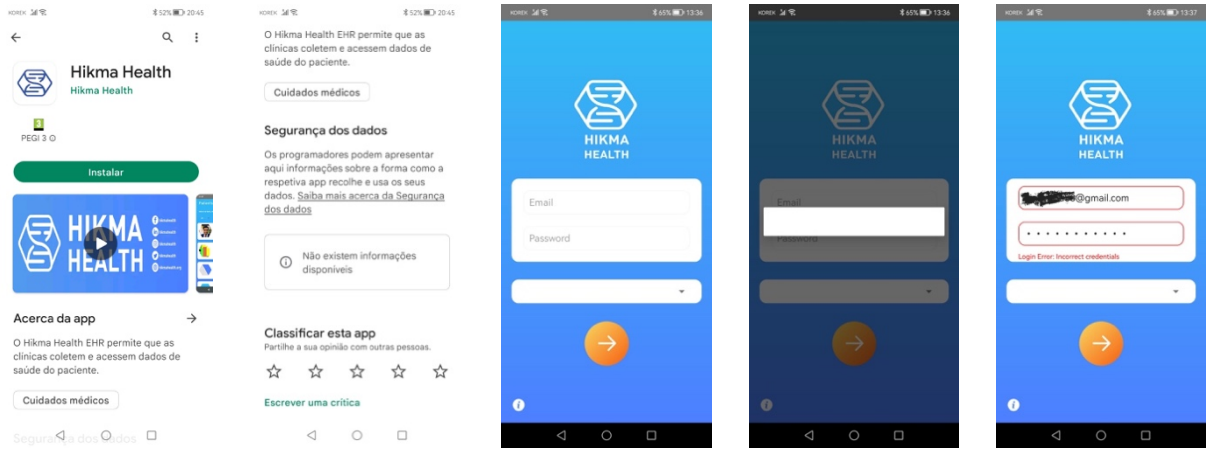


Figure 46. *Hikma Health app on Google Play and its log in interface.*

On their website, I'm taken to a GitHub page, which is the platform used for the developers to work on the open-source software. Once again, I'm facing a scenario that requires an advanced knowledge in computer science (and coding) just to initiate the software. When entering the GitHub page, an initial software information is given, with the first steps to set up the system. Figure 47 below shows the information and steps to do it.

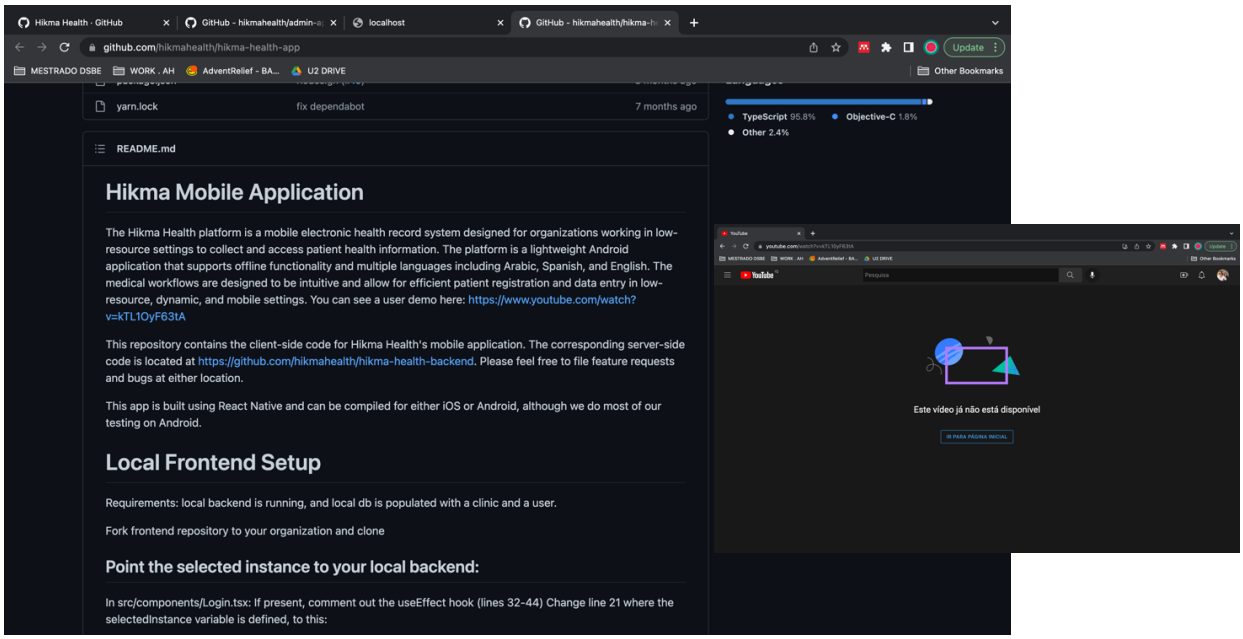


Figure 47. Hikma Health's GitHub page.

Once again, the information provided is very complex and foreign to someone nonrelated with the field. The usability test will not proceed from this point on, has it will require that I have someone with web development skills to assist me. Figure 48 shows some initial information for the setting up of the software/app.

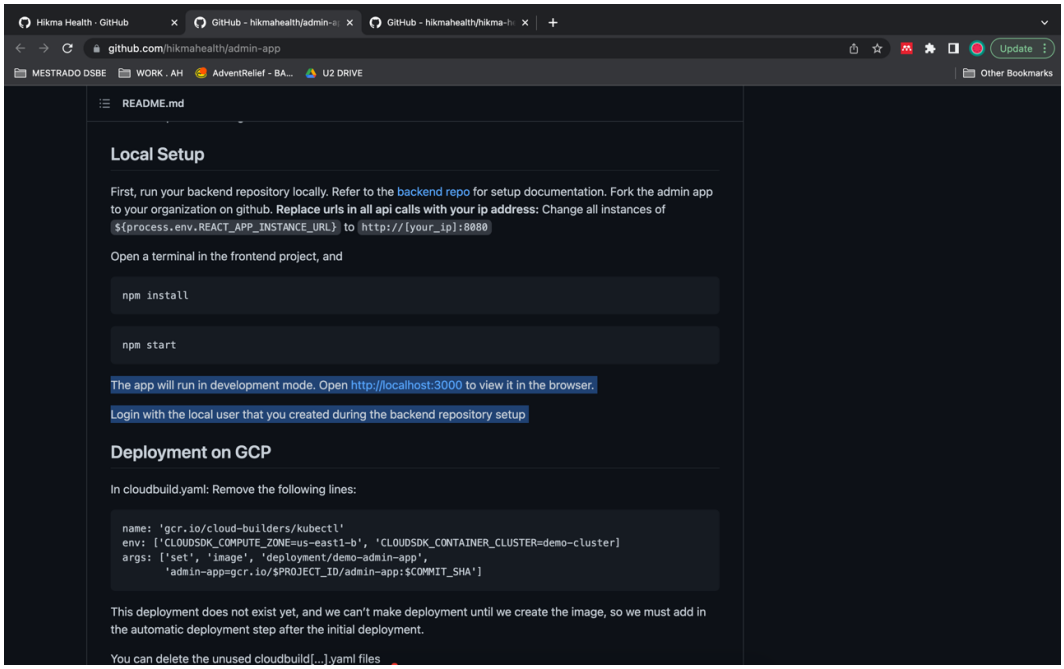


Figure 48. Hikma Health GitHub page with local setup for the EHR system's app.

5

USER EXPERIENCE FLOW CHART

The usability test described in chapter four demonstrated that OpenMRS possesses many of the core features for a suitable and practical record keeping tool. However, the fact that the system could not be completely tailored to the need and required an advanced level of computer science knowledge to overcome some steps thorough the process made the software to be a "dead end" at this point of research.

To lay down the way for a re-designed and customized EHR system, suitable for the work of health organizations in refugees or IDP camps working with limited resources and funding, a user experience *flowchart* (Martin & Hanington, 2012) was created to demonstrate the processes and actions of the different users with the system (EHR). This diagram serves to communicate the sequence of events necessary for the interaction of the users (doctor and nurses) with the system, represented by Figure 49 below. Doctor and nurse hold different privileges while interacting with the system, whereas the doctor can possibly go through all the steps within his account (without the nurse being logged in). Manager's actions are also represented, and for the nature of his actions, the process is represented independently of other users.

Figure 50 is also added to represent the actions of a new user (Dentist) to the system. The nature of his/her work within the emergency field hospital grants him/her the same privileges as a medical doctor, without a mandatory interaction with the nurse and/or doctor. In this case, he/she can start his/her interaction with the record system through checking the scheduled appointments or initiating a consultation by starting a new patient visit.

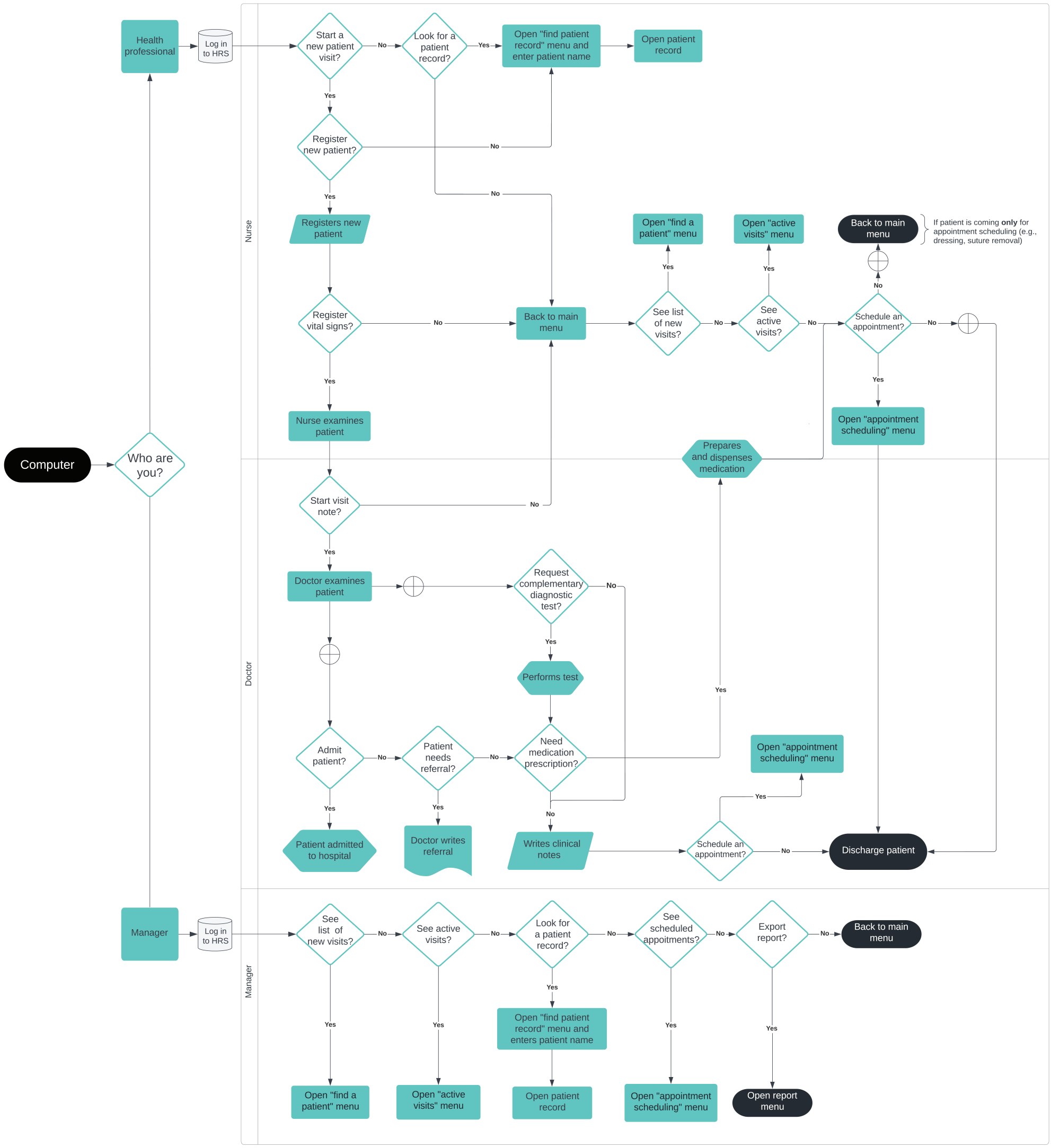


Figure 49. *EHRS's user experience flowchart.*

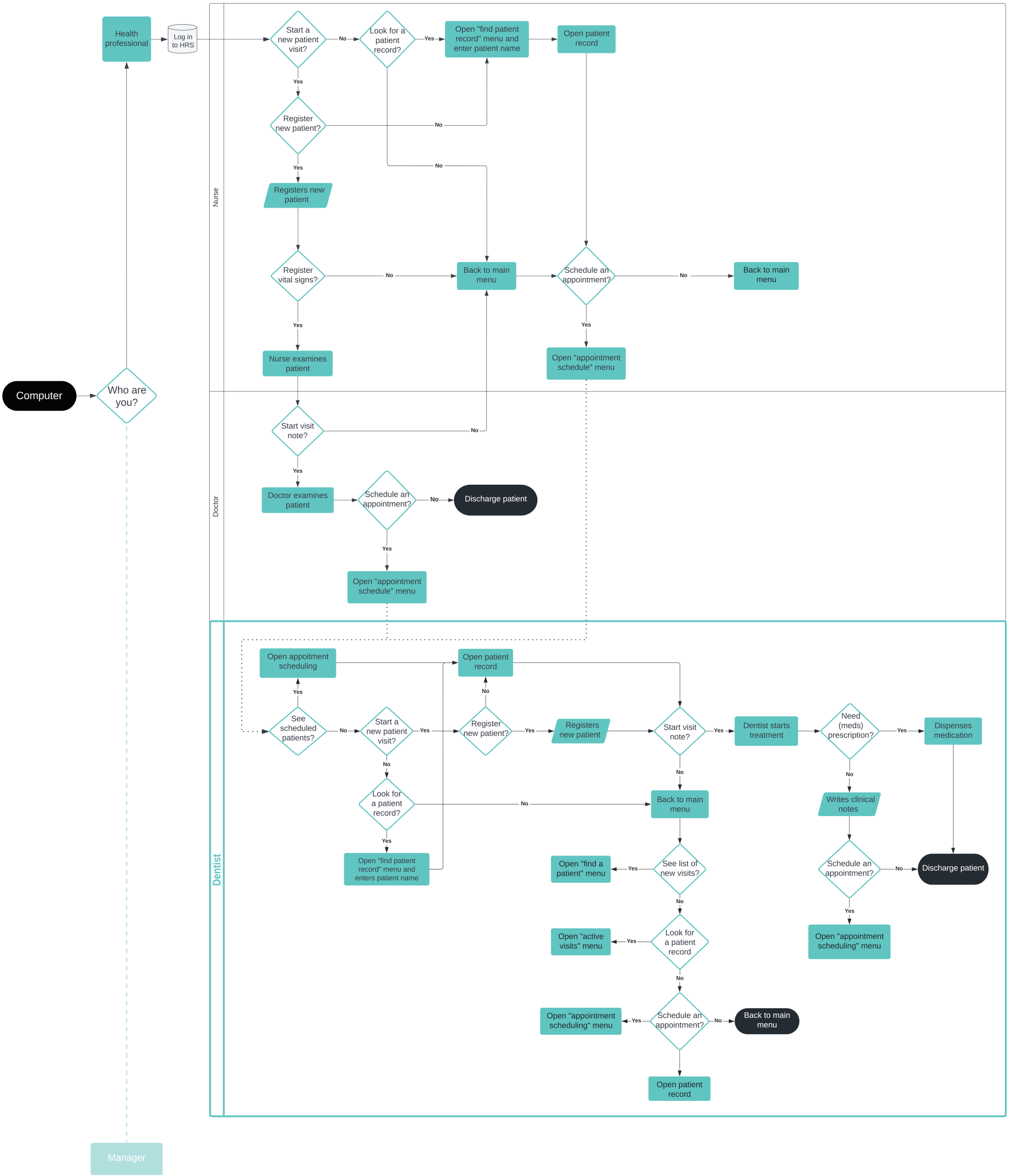


***Figure 50**. Dentist EHRS's user experience flowchart*

6

CONCLUSION AND DISCUSSION

Working in the field, within a setting that represents multiple and daily challenges and setbacks, this study aimed to understand the current state of the art of the HR systems within health NGOs working in refugee/IDP camps in Erbil, Iraq for a future re-design. It was a very personal and exciting investigation on both clinical and design areas, as a student, a nurse, and a health manager.

With respect to the initial research questions, this thesis focused on the analysis and investigation of a clinical HR system, to understand where it stands, current problems and possible solutions. The mapping of its service blueprint, where a two-dimensional picture of the process when a user is interacting with the service, laying the user actions and the different action areas, and the risk factors to the service was essential to run the usability tests with the clinical software. Even though the usability tests turned out, at this point of research, a dead end for the implementation of a clinical software at the hospital for lack of customization to the specific environment setting, it laid down valuable insights of the capabilities a clinical software has for this specific environment. For this reason, at the moment of the conclusion of this dissertation, the field hospital is still using the electronic prototype previously developed.

As the usability tests came to a dead end at this point of research, the creation of a user experience flowchart, where all the core processes and actions that different users with specific privileges will take while interacting with the service laid down a diagram for a customization of a clinical electronic software to run in this kind of settings, can be fully operational, keeping it simple enough to its users and efficiently for its purpose.

Service Design, with its many methods and tools made possible to understand and experience the service both focused on the end user, but also including the needs of the managers, organization, and the health system in place. Its human-centered approach enabled the mapping of a service that is useful, efficient, and effective capable of generating a systematic and iterative process.

Overall, the results offered us some valuable findings, with the main problems identified regarding the clinical software's available, and with the potential solution for its customization and implementation.

6.1. Limitations

Regarding the clinical software, both Hikma Health and OpenMRS presented some limitations to the research as the software needed a greater level of customization, with OpenMRS presenting a further level of tailoring to the specific context, nevertheless insufficient to be accurately tested at the hospital site, as the modifications require the assistance of a more proficient and knowledgeable person in computer science. The open-source model was able to provide a closer feel of what a clinical software can be in comparison with the actual HR, but it entails more self-sufficiency from the user point of view, hindering its full testing.

6.2. Future research and final words

This is the first time a Service Blueprint is used in the context of a field hospital inside an IDP camp and demonstrated to have given a clearer picture of the next steps. Research showed that there have been some developments on free-open-source clinical electronic record keeping tools, albeit with no system that is tailored to the point of being immediately used by humanitarian health organizations.

I believe that with this initial research, adequate R&D funding in the future, can open doors for the release of a clinical EHRS capable of serving the needs and constraints of such a setting that is working in the humanitarian sector. Furthermore, this clinical software proven to be an easy, accessible, and essential tool for health workers, that can be distributed and implemented free of charge to any health organization yearning to have a more efficient and effective clinical recording instrument.

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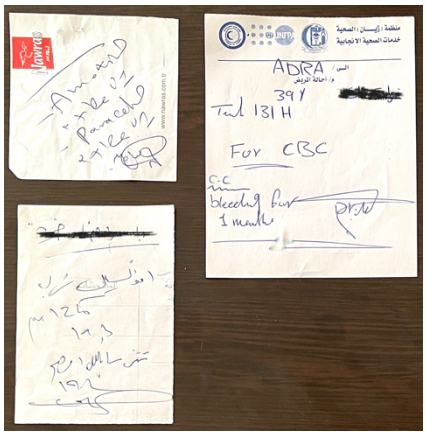
GLOSSARY

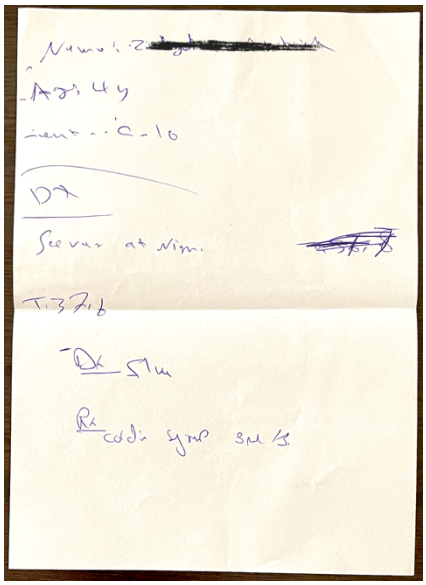
Coding	the action of making computers do things
Cold case (patient or illness)	non-urgent conditions/cases (e.g. common colds, old wound change)
Communicable disease	an infectious or transmissible disease, that can spread to others
Computer science	(a discipline) to study what computers can do
Da'esh	arabic name to refer to the radical (Sunni) Muslim organization ISIS/ISIL
Developer	a person who builds and creates software and apps
Field hospital	a temporary hospital that is set up to provide emergent care
Health Information Systems	a system to manage healthcare data as it collects, stores, and manages information to be then transmitted
Humanitarian assistance/aid	the immediate assistance given to save lives and relieve suffering
SDG #3 - Good Health and Wellbeing	one of UN's objectives, to prevent diseases and needless deaths so people can have a healthier life

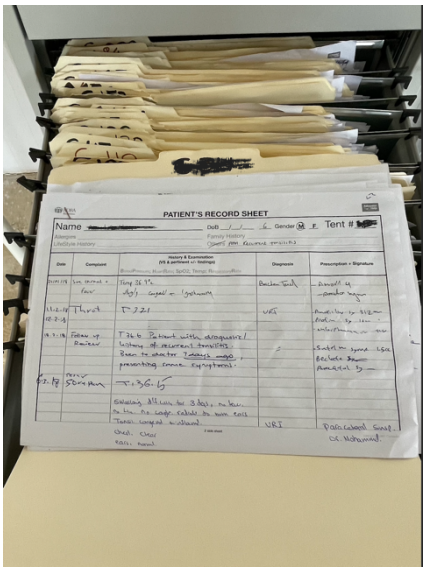
APPENDICES

APPENDICE 1 . Examples of HR system's in the health humanitarian sector work



	Date	MdM #	DoB	Gender	Origin	Firstname Name	???	???	ICPC2	Meds	Referral to
	2/21/17	[redacted]	2/10/17	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΙΚΤΕΡΟΣ/ ΠΑΡΑΚΟΛΟΥΘΗΣΗ	D13		
	2/21/17	[redacted]	1/1/15	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	augmentin, aerolyn, atroven, pulmicort	
	2/21/17	[redacted]	1/1/76	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΑΔΥΝΑΜΙΑ, ΚΑΤΑΒΟΛΗ	A04, S02	benzyl, vitamins	BLOOD TEST
	2/21/17	[redacted]	1/1/15	M	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	aerolyn, augmentin	
	2/21/17	[redacted]	10/6/16	M	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	amoxil, atroven, pulmicort, soldesanil	
	2/21/17	[redacted]	9/11/12	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΣΤΑΦΥΛΟΚΟΚΚΙΚΗ ΔΕΡΜΑΤΙΤΙΔΑ	S76	augmentin, tombrex	
	2/21/17	[redacted]	1/1/00	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΣΥΖΗΤΗΣΗ ΑΙΤΗΜΑΤΟΣ	C48		
	2/21/17	[redacted]	1/1/66	F	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΣΥΖΗΤΗΣΗ ΑΙΤΗΜΑΤΟΣ	C48		
	2/21/17	[redacted]	1/1/90	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΒΗΧΑΣ- ΦΑΡΥΓΓΑΛΓΙΑ	R21, R05	trachisan	
	2/21/17	[redacted]	12/12/77	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΑΙΣΘΗΜΑ ΚΑΤΑΒΟΛΗΣ ΜΕΤΑ ΑΠΤΟ ΔΗΜΗ ΨΥΧΙΑΤΡΙΚΟΝ ΦΑΡΜΑΚΩΝ	A04	lexotanil (κατόπιν συννενόησης με τον Ψυχίατρο από BABEA)	
	2/21/17	[redacted]	1/1/89	F	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΚΑΤΑΡΡΟΗ,ΦΑΡΥΓΓΑΛΓΙΑ, ΠΥΡΕΤΟΣ	A03, R07, R21	trachisan, depon, otrivin	
	2/21/17	[redacted]	12/16/97	F	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΟΣΦΥΑΛΓΙΑ, ΠΥΡΕΤΟΣ, ΦΑΡΥΓΓΑΛΓΙΑ	L03,A03	brufen, trachisan, ciprovix	
	2/21/17	[redacted]	1/1/56	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΚΕΦΑΛΑΛΓΙΑ, ΑΔΥΝΑΜΙΑ, ΦΑΡΥΓΓΑΛΓΙΑ	N01, U01, A04	pradif	NEUROLOGIST
	2/21/17	[redacted]	1/1/95	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΒΗΧΑΣ, ΚΑΤΑΡΡΟΗ, ΦΑΡΥΓΓΑΛΓΙΑ	R05, R07, R21		
	2/21/17	[redacted]	2/10/17	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΙΚΤΕΡΙΚΗ ΧΡΟΙΑ	D13		
	2/21/17	[redacted]	1/7/17	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΕΞΕΤΑΣΗ	C31	pampers, benzyl, d3	
	2/21/17	[redacted]	1/1/13	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΠΥΩΔΗΣ ΡΙΝΙΤΙΔΑ	R21	amoxil, trebon	
	2/21/17	[redacted]	1/1/15	M	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΠΥΩΔΗΣ ΡΙΝΙΤΙΔΑ	R21	amoxil, trebon	
	2/21/17	[redacted]	1/1/14	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	amoxil, soldesanil	
	2/21/17	[redacted]	1/1/12	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	augmentine, trebon	
	2/21/17	[redacted]	12/24/86	M	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΚΡΥΟΛΟΓΗΜΑ	R07	ortivin, depon	
	2/21/17	[redacted]	1/1/93	F	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΑΔΥΝΑΜΙΑ ΚΑΤΑΒΟΛΗ	A04	depon	
	2/21/17	[redacted]	5/21/15	M	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	aerolyn, soldesanil	
	2/21/17	[redacted]	1/25/17	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΣΥΖΗΤΗΣΗ ΑΙΤΗΜΑΤΟΣ	C48		
	2/21/17	[redacted]	1/1/13	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	augmentine, aerolyn	
	2/21/17	[redacted]	1/1/95	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΚΕΦΑΛΑΛΓΙΑ, ΦΑΡΥΓΓΑΛΓΙΑ, ΒΗΧΑΣ	N01, R07, R21	brufen, trachisan, lordin	
	2/21/17	[redacted]	1/1/53	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΣΥΖΗΤΗΣΗ ΑΙΤΗΜΑΤΟΣ	C48		CARDIOLOGIST
	2/21/17	[redacted]	1/11/71	F	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΜΕΤΡΗΣΗ ΑΥ	F15, K86		
	2/21/17	[redacted]	1/1/12	M	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΛΟΙΜΩΞΗ ΑΝΩΤΕΡΟΥ ΑΝΑΠΝΕΥΣΤΙΚΟΥ	R74	augmentine, soldesanil	
	2/21/17	[redacted]	1/1/85	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΓΕΝΙΚΕΥΜΕΝΑ ΑΛΓΗ	A01, S02	brufen, travocort	
	2/21/17	[redacted]	1/1/00	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΣΥΖΗΤΗΣΗ ΑΙΤΗΜΑΤΟΣ	C48		
	2/21/17	[redacted]	1/1/86	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΑΛΛΕΡΓΙΑ, ΡΙΝΙΤΙΔΑ, ΚΕΦΑΛΑΛΓΙΑ	N01, R07	zirtek, depon	
	2/21/17	[redacted]	1/1/99	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΙΔΡΑΔΕΝΙΤΙΔΑ	S06		
	2/21/17	[redacted]	1/1/15	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΒΡΟΓΧΙΤΙΣ, ΟΤΙΤΙΔΑ ΕΔΩΘΗ ΠΑΡΑΠΕΜΠΤΙΚΟ	H01, R78	amoxil, trebon, aerolyn	
	2/21/17	[redacted]	8/24/15	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΙΩΣΗ ΡΙΝΙΤΗΣ ΒΗΧΑΣ	R.07	ορους μυτη mucosolvan	
	2/21/17	[redacted]	1/1/90	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΟΙΔΗΜΑ ΚΑΤΩ ΑΚΡΩΝ ΑΔΥΝΑΜΙΑ	A.04 K.07	δοθηκαν οδηγιες για mitrotan	
	2/21/17	[redacted]	1/18/00	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΚΡΥΟΛΟΓΗΜΑ ΔΥΣΠΝΟΙΑ ΑΛΓΟΣ ΔΕ ΑΚΡΑ ΧΕΙΡΑ	L12 R.02 R.07	otrivi trachisan aerolyn	RO AKPA XEIPA
	2/21/17	[redacted]	1/1/92	F	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΣΥΖΗΤΗΣΗ ΑΙΤΗΜΑΤΟΣ	C.48		
	2/21/17	[redacted]	1/1/86	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΚΕΦΑΛΑΛΓΙΑ ΑΛΕΡΓΙΚΗ ΡΙΝΙΤΗΣ	N01, R07	zirtek depon	
	2/21/17	[redacted]	1/1/11	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΕΔΩΘΗ ΠΑΡΑΠΕΜΠΤΙΚΟ ΓΙΑ ΔΕΡΜΑΤΟΛΟΓΟ	-48		
	2/21/17	[redacted]	6/24/06	F	AFG	[redacted]	ΠΑΙΔΙΑΤΡΟΣ	ΙΩΣΗ ΚΑΥΣΟΣ ΟΦΘΑΛΜΟΥ ΒΗΧΑΣ	R.07	trebon zirtek	
	2/21/17	[redacted]	1/1/95	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΚΡΥΟΛΟΓΗΜΑ	R.07 L.14	otrivin	
	2/21/17	[redacted]	1/1/84	M	AFG	[redacted]	ΠΑΘΟΛΟΓΟΣ	ΣΥΖΗΤΗΣΗ ΑΙΤΗΜΑΤΟΣ	C.48		ΟΥΡΟΛΟΓΟ





Country	Gender	First Name	Last Name	Age	R/S/T No.	Date seen	Time Seen	Complaint	Complaint 2	Complaint 3	Diagnosis	Diagnosis 2	Medication 1	Medication 2	Medication 3	Medication 4
Afghanistan	F	[redacted]		10	R92	10/01/2017	16:11:05	Head Ache			Vision Problem		Paracetemol x 500mg		Paracetemol x 500mg (1/2 tab	
Afghanistan	M	[redacted]		55	R105	10/01/2017	16:44:58	Cold	Body Ache		Viral Laringitis		comtrex cold	Ibuprofen x 400mg		
Afghanistan	M	[redacted]		67	R8	10/01/2017	17:16:08	Eye Problem			poor vision left eye		Paracetemol x 500mg		Paracetemol x 500mg TID, dec	
Afghanistan	M	[redacted]		17	R99	10/01/2017	17:32:40	Sore Throat	Body Ache		Viral infection		cough syrup			
Afghanistan	M	[redacted]		19	S10	10/01/2017	18:14:03	Sore Throat	Body Ache	Runny nose	Viral infection		comtrex cold	cough syrup		
Afghanistan	F	[redacted]		15	R17	10/01/2017	18:41:35	Dizziness			Viral infection	BL Leg Pain	Cough syrup	Paracetemol x 500mg	Trachisan Lozenges	
Afghanistan	M	[redacted]		16	S10	10/01/2017	18:58:17	Fever	Sore Throat		Strepthroat		Amoxicillin 500mg	Paracetemol x 500mg	Trachisan Lozenges	
Pakistan	M	[redacted]		17	R88	10/01/2017	19:17:08	Cough			Allergy	Viral infection	Cetirizine Syrup	Paracetemol x 500mg	Trachisan Lozenges	
Afghanistan	F	[redacted]		30	R32	10/01/2017	19:34:35	Burn			Wound Care					
Afghanistan	M	[redacted]		37	R32	10/01/2017	19:49:37	Sore Throat	Cough	Body Ache	Pneumonia	Viral Pharyngitis	Cough Syrup	Azithromycin 500mg	Paracetemol x 500mg	
Afghanistan	F	[redacted]		1	R32	10/01/2017	19:49:59	Runny nose			Cold (URI)		Mucosolvan			
Afghanistan	M	[redacted]		1	R20	10/01/2017	21:06:05	Cold	Fever		Ear infection	Neonatal seizures	Amoxicillin Suspension 250mg/5t	Paracetemol (liquid)		
Afghanistan	F	[redacted]		4	R20	10/01/2017	21:06:54	Cough	Ear Ache		Ear infection	Febrile seizures	Amoxicillin Suspension 250mg/5t			
Afghanistan	M	[redacted]		42	R34	10/01/2017	21:31:52	Sore Throat	Body Ache		Strep Pharyngitis		Paracetemol x 500mg	Amoxicillin 1g		
Afghanistan	F	[redacted]		30	R92	10/01/2017	21:35:11	Head Ache	Pregnant	Stress	Pregnant	Anxiety	Paracetemol x 500mg			
Afghanistan	F	[redacted]		8	R92	10/01/2017	21:35:41	Eye Problem			Seasonal Allergy	Vision problem	Cetirizine 10mg			
Iran	F	[redacted]		35	R91	11/01/2017	16:30:51	Stress	Diabetes		Uncontrolled diabetes	Stress				
Afghanistan	F	[redacted]		30	R33	11/01/2017	16:41:03	Sore Throat	Cold	Pregnant	Viral Pharyngitis	Viral infection	Paracetemol x 500mg	Lozenges	Vicks	
Afghanistan	F	[redacted]		24	R83	11/01/2017	17:17:47	Pregnant			Pregnant		Prenatal Vitamin			
Afghanistan	F	[redacted]		50	R80	11/01/2017	17:22:28	Back Pain	Lump on head	Head Ache	Back Pain	Cystic lesion	Multivitamin	Iron 65mg	Paracetemol x 500mg	
Afghanistan	M	[redacted]		15	S10	11/01/2017	18:03:01	Sore Throat			Streptococcus infection		Paracetemol x 500mg	Amoxicillin 500mg		
Afghanistan	F	[redacted]		28	R82	11/01/2017	18:08:16	Cough	sore throat	body pain	Pneumonia	viral faringitis	amoxicilin 500mg	ibuprofen 400mg		
Afghanistan	F	[redacted]		27	R57	11/01/2017	18:21:05	Tooth Ache	Dizziness	Head Ache	Dental		Paracetemol x 500mg	Prenatal Vitamin		
Afghanistan	F	[redacted]		9	R57	11/01/2017	18:21:36	Sore Throat	Cough	Head Ache	Streptococcus infection	Viral infection	Amoxicillin 500mg	Paracetemol x 500mg	mucosolvan	
Afghanistan	M	[redacted]				11/01/2017	19:21:40	Cough	Sore Throat		Streptococcus infection		Amoxicillin 500mg	Paracetemol x 500mg		
Afghanistan	F	[redacted]		24	R	11/01/2017	19:27:09	No periods			Yeast infection	Amenorrhea	Fluconazole 150mg	Paracetemol x 500mg	Amoxicillin 500mg	
Afghanistan	F	[redacted]		36	R101	11/01/2017	20:22:28	Back Pain	Rash		Herpes Zoster	scabies (treated)	Paracetemol x 500mg			
Afghanistan	F	[redacted]		9	S34	12/01/2017	15:39:54	Rash			Eczema		Ibuprofen x 200mg			
Afghanistan	F	[redacted]		25	R74	12/01/2017	16:05:22	Pregnant			Pregnant		Prenatal Vitamin			
Iran	M	[redacted]		37	T42	12/01/2017	16:17:53	Kidney pain			Back Pain	Renal colic (?)	Buscopan 10mg			
Afghanistan	F	[redacted]		1 month	R24	12/01/2017	16:41:54	Skin Complaint			Healthy baby	TNPM				
Afghanistan	F	[redacted]		22	R24	12/01/2017	17:11:38	Dizziness			HA		Paracetemol x 500mg	Multivitamin (with iron)		
Afghanistan	M	[redacted]		13	R75	12/01/2017	17:37:16	Cold	Sore Throat	Runny nose	Viral infection	Seasonal Allergy	Cough syrup	Paracetemol x 500mg	Lozenges	
Afghanistan	F	[redacted]		61	105	12/01/2017	17:58:42	Body Ache	Ear Ache	Cough	Strep throat		Amoxicillin 500mg			
Afghanistan	M	[redacted]		31	R68	12/01/2017	18:14:02	Chest Pain			Chest Pain	SP Lobectomy	Paracetemol x 500mg	Voltaren		
Afghanistan	M	[redacted]		17	S11	12/01/2017	18:35:08	Skin Complaint	Itchy		Scabies		Scabies medication			
Afghanistan	M	[redacted]		52	R102	12/01/2017	19:05:11	Cough			Cold		Mucosolvan	Comtrex		
Afghanistan	M	[redacted]		17	R22	12/01/2017	19:17:13	Dr. Noal Christopher			Ear infection		Amoxicillin 500mg	Ear Drops		
Afghanistan	M	[redacted]			R87	14/01/2017	12:30:00	Head injury			Stitches					

APPENDICE 2 . Service Safari observational sheets

OBSERVATION 1

OBSERVATION (service safari + user shadowing + informal interviews)

December 14

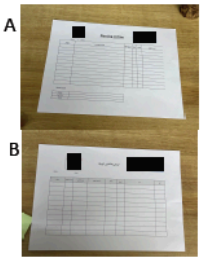
CONTEXT OF THE SERVICE: Corona virus clinic (diagnostic and isolation)

PEOPLE INVOLVED IN DELIVERING THE SERVICE: Nurse, doctor, data clerk

Before (engaging with service)

If a suspected case is reported, the patient is tested in a tent where they could also stay for quarantine. Patient information is collected in a paper HRS to be entered in the medical notes.

During (my engagement with service)



There are two health record sheets to be filled by the nurse. Record sheet A is the nursing notes, that records the actions and care provided to the patients, as well as test result and patient's information. However, this paper is NOT for one specific patient, but to record all patients attended that day. Record sheet B it's a "list of corona tests", where all patients are registered there with information about their name, age, tent, camp, etc.).

After (my engagement with service)

After the medical staff register the information on the paper HRS, a data clerk (which is non-medical staff) enters all the information on a excel sheet (demographic information, results, etc.). There is also a tablet (provided by WHO) used for reporting, that needs to be filled and sent online with daily stats (number of patients seen, demographics, etc.) by the doctor.

OBSERVATION (service safari + user shadowing + informal interviews)

TOUCHPOINTS:

- Nurse
- Tent (for testing)
- Paperwork (health record system)
- ☹ Office (data clerk)
- ☺ Computer
- ☹ Tablet

OPPORTUNITIES / PAINPOINTS:

⊖

- too many touchpoints for dealing with the same information.
- duplication of information (paper and digital)
- hiring a data clerk just to enter data (bringing more costs to the organization, and clinically not relevant)
- duplication of information: patient register on the computer system + recorded in the attendance daily sheet
- data entry in 3 different systems (paper, computer, tablet)

⊕

+ having a digital system helps when looking for patient attendance history much faster than with the paper system
+ since there is a digital system, the nurse could also enter the data digitally (instead on paper sheets)

OBSERVATION 2

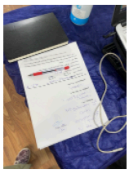
OBSERVATION (service safari + user shadowing + informal interviews)

December 15

CONTEXT OF THE SERVICE: Primary Health Clinic

PEOPLE INVOLVED IN DELIVERING THE SERVICE: (primary) Nurse, doctor, data clerk (secondary) gate person, pharmacist

Before (engaging with service)

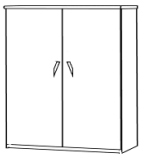


Patients is checked for temperature at the gate. After that, he gets to a "waiting room" where the data clerk will open a new health record sheet with the patient's name, tent number, date, gender, and phone number while the nurse is triaging the patient. Before the patient leaves, his name gets into a big logbook where all the patients are register and recorded.

During (my engagement with service)

The nurse will write the patients' name, tent number and vital signs. After the record sheet is opened, the patient can move now to an outdoor waiting area, to be seen by the doctor. He keeps his record with him. Once he gets inside the doctor's office, he will have a full diagnosis and prescription if needed. In that case the patient goes to the pharmacy with the health record to collect the medication. The record paper stays with the pharmacist and the patient goes home.

After (my engagement with service)



Once the shift is coming to an end, the data clerk collects all the health records from the pharmacist to introduce the data on an excel form for reporting (name, age, tent, diagnosis, and medication prescribed). Finally, the health record sheet is filled in a binder that will be sent to headquarters every week.

OBSERVATION (service safari + user shadowing + informal interviews)

TOUCHPOINTS:

☹ - entrance temperature check person
- waiting room + triage
☹ - data clerk
- Nurse
- outdoor waiting room
- examination room

☺ - doctor
- pharmacy
☺ - digital system
☹ - binders (for filling health records)

OPPORTUNITIES / PAINPOINTS:

⊖

- duplication of information (paper and digital)
- hiring a data clerk just to enter data (bringing more costs to the organization, and clinically not relevant)
- duplication of information: patient registered on the computer system + recorded in the attendance logbook
- no complete patient's health history (the digital entrance only records ONE diagnosis, meaning if the patient has more than 1 it will not show on the computer)

⊕

+ having a digital system helps when looking for patient attendance history much faster than with the paper system
+ record sheet in English and Arabic

OBSERVATION 3

OBSERVATION (service safari + user shadowing + informal interviews)

February 17

CONTEXT OF THE SERVICE: Mobile Clinic

PEOPLE INVOLVED IN DELIVERING THE SERVICE: Nurse, doctor, pharmacist, guard (for crowd control)

Before (engaging with service)

Crowd control guard organizes people for triage. Because it's a mobile clinic, people are assigned a FILE NUMBER, so the records can be assessed in next visits. The patient goes to triage nurse. At triage, the nurse gets the patient HR sheet E (or creates a new one if first time visit). This sheet contains all health information from previous visit

During (my engagement with service)

Patient's demographic information is collected, and Vital Signs registered by the nurse, that assigns the patient to a specific doctor. The patient takes sheet E to doctor's consultation room. Doctor writes complaint, diagnosis, and treatment + medication given. If medication needed, Prescription sheet F is opened and sent to Pharmacy.

After (my engagement with service)

At the end of the shift, nurse collects all HR sheets to complete the report on sheet G with statistics of patient's seen, new patients and diagnosis. After this is done, sheet G is scanned and placed on the shared drive for the ONG. Also, the doctor needs to report on Communicable diseases and referrals made, on a report paper H. When the reporting is complete, all HRs are filled according to site and file number at the office, for the next visit to the site.

OBSERVATION (service safari + user shadowing + informal interviews)

TOUCHPOINTS:

☺
- crowd control
- triage desk
- record sheet E
- Nurse
- doctor
- record sheet F
- pharmacy

☹
- reporting paper sheet G
- scan of reporting paper G
- reporting sheet H
- filling of HR papers

OPPORTUNITIES / PAINPOINTS:

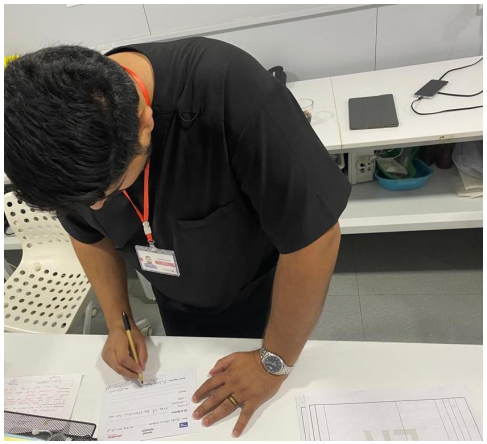
⊖

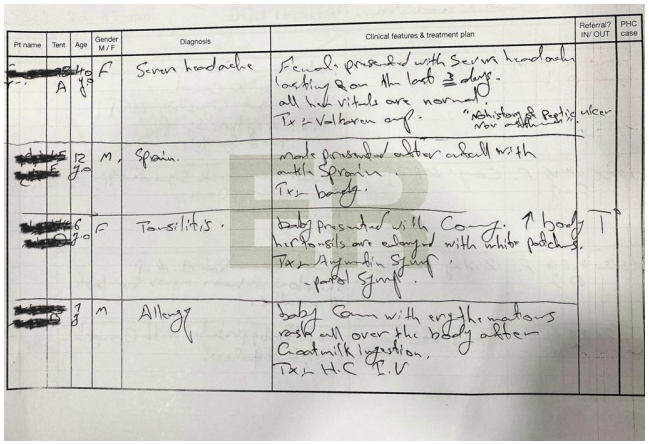
- reporting process needs to be in 2 different papers (sheet G and H)
- there could be only one paper with two different sections: one for nurse and another for doctors
- duplication of work with the scanning of the report. If the template was on the computer, could be automatically saved and sent to respective stakeholders

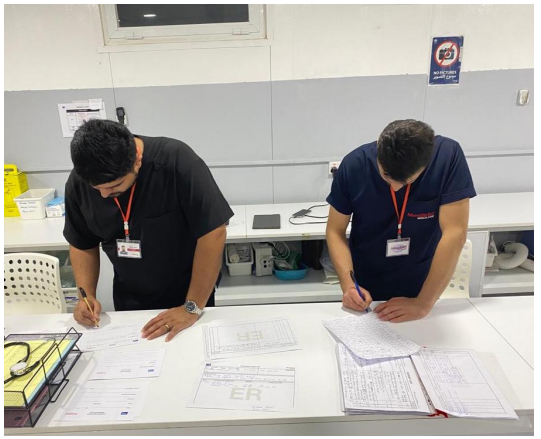
⊕

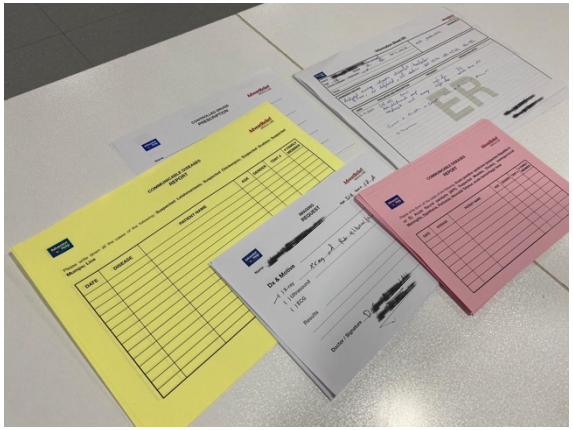
+ one HR paper (sheet E) for both doctor and nurse
+ separate prescription paper (sheet F), and only accessible to doctor at his room
+ patients have FILE NUMBER so it's easier to track the patient HR

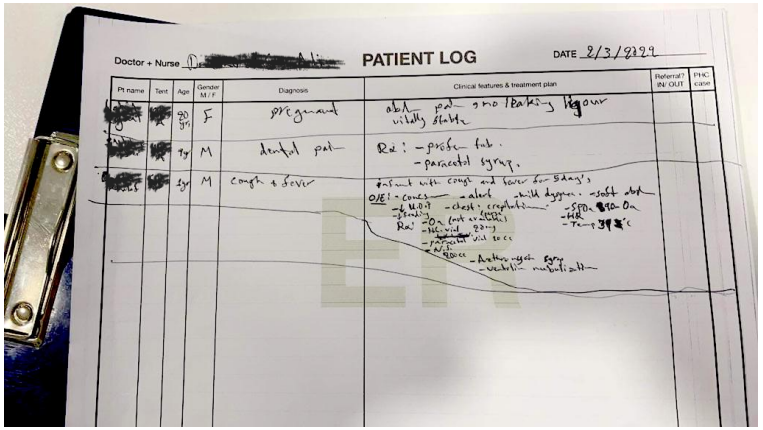
APPENDICE 3 . Paper-based health record systems' implementation

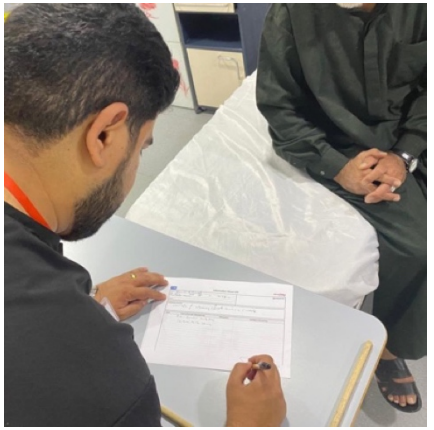




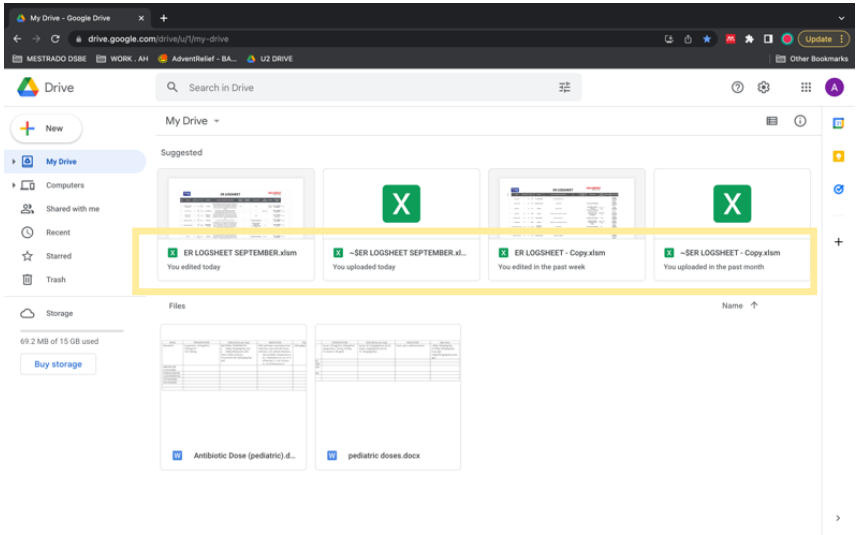


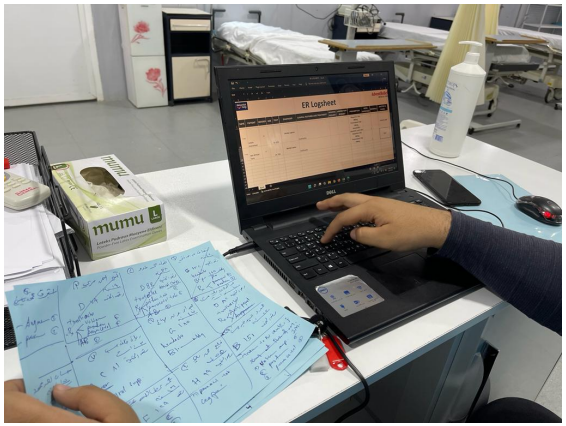


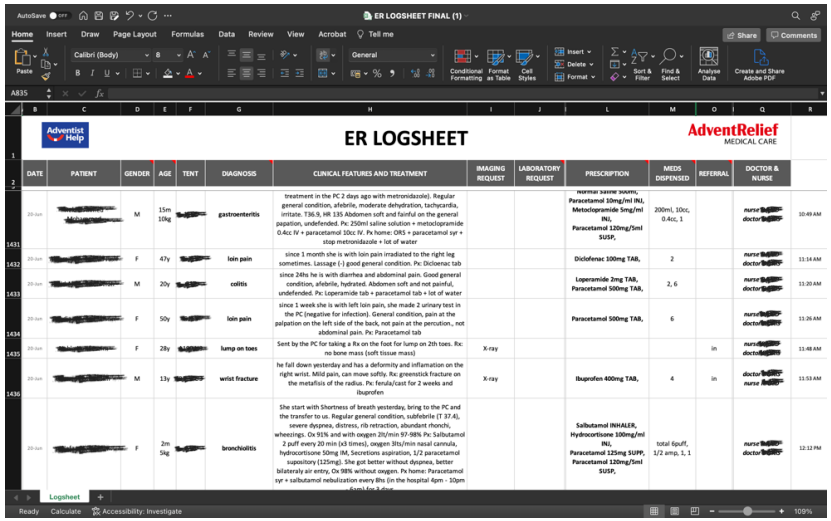


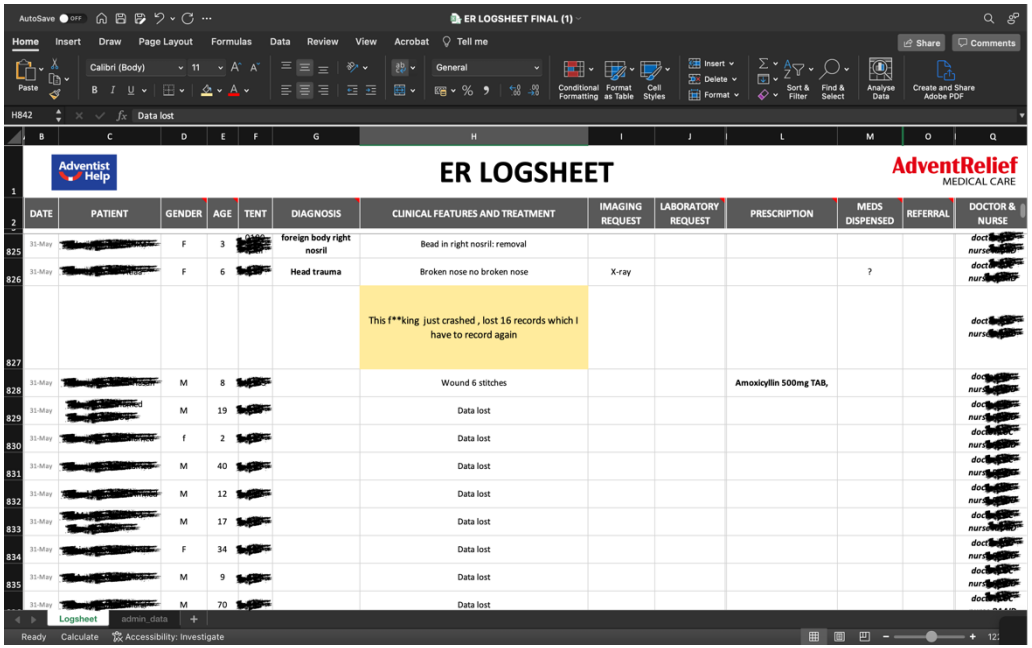


APPENDICE 4 . Electronic health record systems' implementation

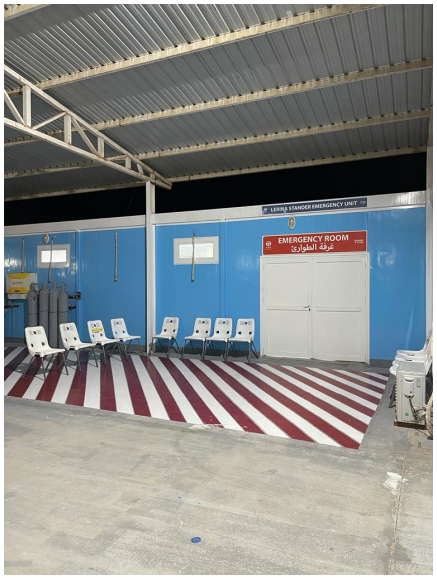








APPENDICE 5 . Adventist Help Field Hospital, Iraq



APPENDICE 6 . Ethical approvals and Informed consents

ADVENTIST HELP
EXECUTIVE COMMITTEE

Submission Form for the Executive's Committee consideration to a Research Study

Date 01 / 12 / 2021

The present investigation is to be conducted at the Adventist Help Emergency Field Hospital in Kurdistan, Iraq. The scope of the study is to achieve a master's degree in Design for Health and Wellbeing, by the Polytechnic of Leiria, Portugal.

Title of the study:
Health and Design at service of a refugee camp in Iraq

Researcher's identification and team members:
Lea Camacho Eliana Santiago, PhD (supervisor) Estêvão dos Santos, MD (co-supervisor)

Scientific foundation for the study
This project arises from the need to counteract a scenario of danger and unpredictability in the care provided to patients, which originates from a poor or a non-existent health record system. My experience over the past 4 years with the organization has revealed a precarious and yet scarce presence of such a system throughout the health partners. The lack of practicality, an easy understanding and access to health partners proved to be an obstacle in the provision of excellency in care. The literature shows that a functional

Adventist Help
Schosshaldenstrasse 17
3006, Bern, Switzerland
president@adventisthelp.org
info@adventisthelp.org

Adventist Help

Place(s) where the study will take place:

Health organizations working inside refugee/IDP camps or on behalf of that community and Adventist Help's emergency field Hospital in Hasan-Sham, Iraq

Guarantee of participants consent and autonomy:

There will be handed out an Informed Consent Form to each participant, that they will need to read and sign if agreed, to participate in the research. The form will be attached to this document in Annex.

Procedures for ensuring confidentiality:

The organization and/or person's name will be replaced with a numeric code, making this data anonymous so that anyone can identify them. The data collected in the course of this study will be kept in secure files with restricted access, whether electronic or physical, and all persons or entities with access to that personal data are subject to professional secrecy.

Adventist Help
Non-Commercial Legal Society
Fiscal Number: CHE411743194
Schosshaldenstrasse 17
3006, Bern, Switzland
www.adventisthelp.org
info@adventisthelp.org
Emergency Medical Support

Adventist Help
Schosshaldenstrasse 17
3006, Bern, Switzerland

president@adventisthelp.org
info@adventisthelp.org

ANNEXES

Term of Responsibility

I hereby, as lead researcher, declare on my honor that the information provided in this form is true. Furthermore, I declare that, during the study, the recommendations contained in the Declarations of Helsinki, the World Health Organization and the European Community will be respected.

Date: 01.12.2021

Researcher:

(Handwritten signature)

Adventist Help
Schosshaldenstrasse 17
3006, Bern, Switzerland

president@adventisthelp.org
info@adventisthelp.org

Health and Design at service of a refugee camp in Iraq

Participant Information and Informed Consent Form for the study

December 2021

THIS DOCUMENT IS COMPOSED BY 05 PAGES AND ITS DUPLICATED: ONE DOCUMENT GOES TO THE RESEARCHER; ANOTHER GOES TO THE PERSON WHO IS CONSENTING TO THE STUDY.

WHY AM I READING THIS DOCUMENT

You're being invited to voluntary participate in a study with the main goal of mapping a clinical record system in a context of a health organization working in the humanitarian sector, conducted by a Nurse, a Doctor and a Designer.

This document serves the purpose to provide you with all the details about the study for which you're being invited to collaborate. Please carefully read the information and discuss it with whom you wish. In case of any question please refer to one of the team's constituents.

By voluntary participating in the study means that

- You're free to decide to participate, or not;
- You can stop any activity related with the study at any time, without justifying why.

THE STUDIES' PURPOSE

Working in the humanitarian sector for the past 4 years as a nurse in a health NGO, my experience has demonstrated that the lack and/or poor quality of a health record system is a very pertinent and even harmful situation ultimately to the patients but also for the health workers. Many studies have demonstrated that a key component for the management, delivery and safety of quality health care is through a good health record system (digital or not), and so I propose to map a simple yet effective health record system under the NGO I'm currently working with. This study will take place in Kurdistan, Iraq as part of my master's degree Program in Design for Health and Wellbeing at the Polytechnic of Leiria, Portugal.

The study will be conducted during the next 10 months; however, you will only be approached once, during one day for some information collection (regarding your health record system, existing or not). The visit will take approximately 45 minutes.

WHAT WILL HAPPEN IF I PARTICIPATE?

First, you will need to sign the informed consent document. After, all the data collected will be kept confidential and with restricted access exclusively by the research team, that are obliged to maintain the anonymity and confidentiality of the data collected.

You can quit your participation in the study at any time, without explanation. You can also decide that you don't want the data collected to be processed, and we will acknowledge as you withdraw you consent.

The research team will replace your name with a numeric code, except your age and gender, nationality, professional category, years of experience (within and without health NGOs), making this data anonymous so that no one can identify you. The data collected during this study will be completely destroyed after the completion of the study.

The data that directly identifies you is maintained only by study researcher in a safe place and only she can have access to your identity. Your identity will not be revealed in any reports or publications resulting from the study. All persons or entities with access to your personal data are subject to professional secrecy.

If you have any other question about the study, please feel free to contact:

Lea Camacho *(researcher)*

Adventist Help
Phone: (+964) 0751 8329009
E-mail:
leahdebrando@gmail.com

Title: Health and Design at service of a refugee camp in Iraq

Adventist Help

I, [redacted] agree to participate in the "Health and Design at service of a refugee camp in Iraq" study.

I have read this document, and the researcher has explained its content and clarified all questions. I understood the purpose of this study and what involves my participation in it. I voluntarily agree to participate, knowing that at any time I can refuse to participate, without any kind of consequence. I confirm that I have received a signed copy of the following document.

By signing this document, I authorize the use of the data collected, which I voluntarily provided, with guarantees of confidentiality and anonymity given to me by the researcher.

This consent is valid except and until it is revoked by me.

Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LEA CAMACHO
Signature	Signature
Date 14th December, 2021	Date 14TH DECEMBER 2021

Adventist Help

Consent to conduct additional investigations with personal data

During the study or after its completion, Polytechnic of Leiria, Portugal, would like to be able to use the data collected for additional medical and/or scientific research projects, when previously authorized by a competent Ethics Committee. Personal data includes age and gender, nationality, professional category, years of experience (within and without health NGOs), that will be encrypted by a numeric code that identifies you. These additional research projects may include studies to gain more knowledge related to health record systems in the humanitarian crises.

The decision to accept your personal data for further investigation is not mandatory, and you can always change your decision at any time. If you decide that you no longer want to allow Polytechnic of Leiria to use your data for further research, you can do so without having to change your initial participatory consent. If that's the case, please inform at least one member of the study's research team.

By signing this consent, I agree to the use of my personal data in further investigations as described above.

This consent is valid except and until it is revoked by me.

Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LEA CAMACHO
Signature	Signature
Date 14th December, 2021	Date 14TH DECEMBER 2021

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This consent is valid except and until it is revoked by me.

Participant

Name (in capitals) [redacted]

Signature

Date 10th DECEMBER 2021

Researcher

Name (in capitals) LEA CAMACHO

Signature

Date 10th DECEMBER 2021

Consent to conduct additional investigations with personal data

Adventist Help

During the study or after its completion, Polytechnic of Leiria, Portugal, would like to be able to use the data collected for additional medical and/or scientific research projects, when previously authorized by a competent Ethics Committee. Personal data includes age and gender, nationality, professional category, years of experience (within and without health NGOs), that will be encrypted by a numeric code that identifies you. These additional research projects may include studies to gain more knowledge related to health record systems in the humanitarian crises.

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This consent is valid except and until it is revoked by me.

Participant

Name (in capitals) [redacted]

Signature

Date 10TH DECEMBER 2021

Researcher

Name (in capitals) LEA CANACHO

Signature

Date 10TH DECEMBER 2021

Adventist Help

During the study or after its completion, Polytechnic of Leiria, Portugal, would like to be able to use the data collected for additional medical and/or scientific research projects, when previously authorized by a competent Ethics Committee. Personal data includes age and gender, nationality, professional category, years of experience (within and without health NGOs), that will be encrypted by a numeric code that identifies you. These additional research projects may include studies to gain more knowledge related to health record systems in the humanitarian crises.

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This consent is valid except and until it is revoked by me.

Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LEA CAMACHO
Signature	Signature
Date 18. Feb. 2022	Date 18th FEBRUARY 2022

I, [redacted] agree to participate in the "Health and Design at service of a refugee camp in Iraq" study.

I have read this document, and the researcher has explained its content and clarified all questions. I understood the purpose of this study and what involves my participation in it. I voluntarily agree to participate, knowing that at any time I can refuse to participate, without any kind of consequence. I confirm that I have received a signed copy of the following document.

By signing this document, I authorize the use of the data collected, which I voluntarily provided, with guarantees of confidentiality and anonymity given to me by the researcher.

This consent is valid except and until it is revoked by me.

Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LISA CAMACHO
Signature	Signature
Date 16th ~~March~~ APRIL 2022	Date 16TH APRIL 2022

Consent to conduct additional investigations with personal data

During the study or after its completion, Polytechnic of Leiria, Portugal, would like to be able to use the data collected for additional medical and/or scientific research projects, when previously authorized by a competent Ethics Committee. Personal data includes age and gender, nationality, professional category, years of experience (within and without health NGOs), that will be encrypted by a numeric code that identifies you. These additional research projects may include studies to gain more knowledge related to health record systems in the humanitarian crises.

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By signing this consent, I agree to the use of my personal data in further investigations as described above.

This consent is valid except and until it is revoked by me.

Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LEA CAMACHO
Signature	Signature
Date 16th [redacted] 2022 APRIL	Date 16TH APRIL 2022

Adventist Help

I, [redacted] agree to participate in the "Health and Design at service of a refugee camp in Iraq" study.

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By signing this document, I authorize the use of the data collected, which I voluntarily provided, with guarantees of confidentiality and anonymity given to me by the researcher.

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Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LEA CAMACHO
Signature	Signature
Date 16th April 2022	Date 16th APRIL 2022

Consent to conduct additional investigations with personal data

Consent to conduct additional investigations with personal data

During the study or after its completion, Polytechnic of Leiria, Portugal, would like to be able to use the data collected for additional medical and/or scientific research projects, when previously authorized by a competent Ethics Committee. Personal data includes age and gender, nationality, professional category, years of experience (within and without health NGOs), that will be encrypted by a numeric code that identifies you. These additional research projects may include studies to gain more knowledge related to health record systems in the humanitarian crises.

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By signing this consent, I agree to the use of my personal data in further investigations as described above.

This consent is valid except and until it is revoked by me.

Participant

Name (in capitals) [redacted]

Signature

Date 16th April 2022

Researcher

Name (in capitals) LEA CAMACHO

Signature

Date 16TH APRIL 2022

Consent to conduct additional investigations with personal data

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Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LEA CAMACHO
Signature	Signature
Date 16 /April/ 2022	Date 16th APRIL 2022

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Adventist Help

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Signature Allen	Signature Lea Camacho
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Participant	**Researcher**
Name (in capitals) [redacted]	Name (in capitals) LEA CAMACHO
Signature Sara Barbosa Pinto	Signature
Date 02.09.2022	Date 2.9.2022

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Participant

Name (in capitals) [redacted]

Signature

Date April 16, 2022

Researcher

Name (in capitals) Lea Camacho

Signature

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Name (in capitals) [redacted]	Name (in capitals) Lea Camacho
Signature	Signature
Date 16/04/2022	Date April 16, 2022

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