



ROLE OF eHEALTH AND mHEALTH IN DISASTER MANAGEMENT

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1. INTRODUCTION

Sri Lanka is prone to several forms of natural disasters resulting in extensive death and property damage. Among these flood, lightening, high wind, and heavy rains are the leading causes of death and property damage. Apart from the above, coastal erosion, fire, drowning, and drought are other causes of men and material damage. Diseases in epidemic proportions may also be regarded as medical disasters. Such epidemics could kill and make people homeless in large numbers. They could also destroy health infrastructure; interrupt public or commercial services. Centre for Research on the Epidemiology of Disasters (CRED) in its 2018 report pointed out with statistics where harshness and ramifications of disasters show worsening trend during last few decades with total of 331 recorded natural disasters blamed for 14,854 deaths while affecting 81,143,283 people and caused an estimated economic loss of US \$130,655,327,000 (Center for Research on the Epidemiology of Disasters, 2009).

e-Health and mHealth are cost-effective, safe ways where ICT is effectively used to support the healthcare sectors. World Health Organization (2016c) highlights the importance of electronic tools in boosting patient welfare and related matters (Malgorzata, 2020). If implemented with a careful plan, mHealth can revolutionise health outcomes.

2. METHODS AND LIMITATIONS

This paper is a literature review that tries to propose a healthcare service delivery framework using eHealth and mHealth to best suit the Island nation of Sri Lanka, whereby assisting to effectively deliver healthcare services to disaster affected communities before, during and after a disaster occurred. Many local and international scholarly articles, concept papers and scientific reports on disaster ehealth and mhealth were studied and evaluated for applicability and adoptability in real-time disaster situations, including in the contemporary Covid-19 pandemic.

This article tries to find proper definition of disaster ehealth (DEH) using available scholarly articles and follows international norms to blend DEH with disaster management as well as the entities of disaster medicine and eHealth. CRED and PubMed Medical Informatics taxonomies were mainly adopted. Nevertheless, we limited our scope to academic and scientific publications, while ignoring grey literature.

3. RESULTS AND DISCUSSION

The generic term “Telehealth” encompasses all remote health services, while “Telemedicine” stands for remote patientcare delivery. Both entities use eHealth and mHealth as integral tools.

Although these two tools are generic on their own, they stand out when uniqueness of each tool during remote service delivery is considered. The former tool uses internet in general and the latter mainly relies on mobile devices. eHealth applies ICT on healthcare service delivery, while mHealth relies on mobile devices for the purpose (WHO, 2021).

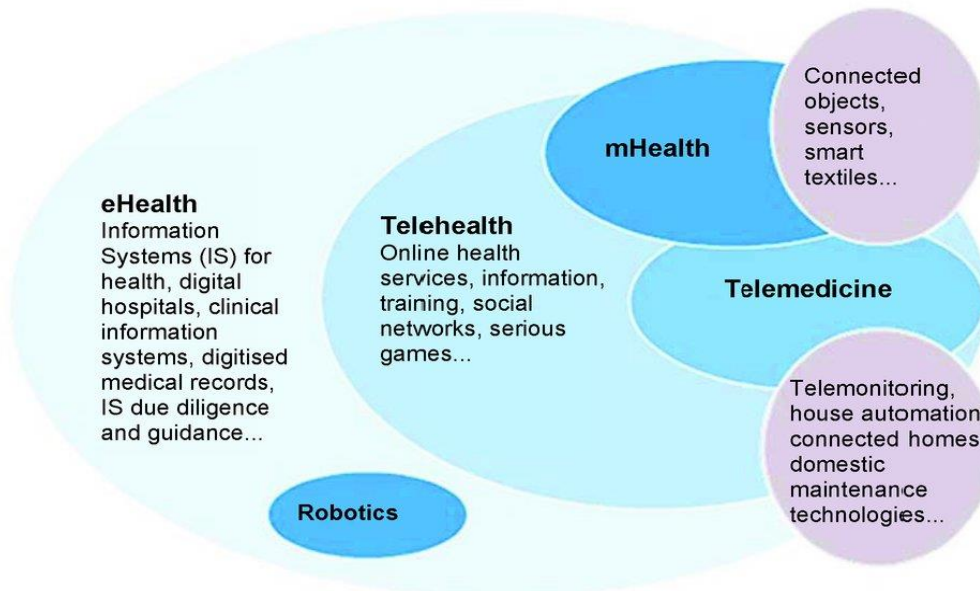


Figure 1. The relationship: ehealth, mhealth, telehealth, telemedicine and robotics.

GSMA study places Sri Lanka as a fast-growing mobile phone market in the South Asian sub-continent with 45-50% mobile ownership by October that year, while South Asia average was 30% and developing world average were 40% (GSMA Intelligence ANALYSIS Country overview: Sri Lanka, 2021).

National Disaster Relief Service Centre under the Ministry of Disaster Management has been monitoring, reporting, and coordinating disaster relief activities in association with other ministries and statutory bodies, including the Ministry of Health which has a disaster management arm. The centre reports that 62 deaths occurred in the year 2020 from various incidents of natural disasters, while 362,399 persons from 101,778 families affected Island wide (Ministry of Disaster Management, 2021).

Table 1: Impact of the human life by disaster from 1980-2020 (Desinventar Database)

Disaster	Deaths	Injured	Missing	Houses Destroyed	Houses Damaged	Affected	Relocated	Evacuated
ACCIDENT	348	340	1	0	5	752	0	0
ANIMAL ATTACK	977	617	2	191	7700	80065	0	59
BOAT CAPSIZE	58	43	23	0	0	73	0	0
CUTTING FAILURE	31	56	1	161	2028	30583	0	0
CYCLONE	12	140	5	11510	88301	898283	0	571
CYCLONE & FLOOD	9	12	0	13178	37371	319128	0	0
DROUGHT	0	0	0	0	0	21415559	0	600
DROWNING	246	21	33	0	0	310	0	0
EARTH SLIP	10	10	7	56	168	3043	0	0
FIRE	102	149	0	2058	1008	15935	0	1040
FLASH FLOOD	6	10	2	82	826	18704	0	0
FLOOD	706	486	113	53807	173833	15242913	4	39421
FOREST FIRE	1	0	0	6	19	98	0	10
GALE	8	21	1	137	1858	11820	0	36
LAND SUBSIDENCE	17	8	0	69	1742	10403	0	401
LANDSLIDE	1001	316	243	2877	12077	292227	348	2357
LIGHTNING	516	461	3	39	753	4745	0	3
ROCK FALL	3	9	0	13	111	1448	0	28
STRONG WIND	217	710	68	7749	105353	735739	16	1339
TSUNAMI	30959	19611	1908	57085	48069	970705	0	0
URBAN FLOOD	0	0	0	0	0	155	0	0
TOTAL	35496	23429	2416	150194	490657	41397027	369	47221



Global Climate Risk Index report of 2020 places Sri Lanka at the 6th position globally as far as natural disasters are concerned (Ministry of Disaster Management, 2021). Tsunami hazard risk of the country also reported as medium, with a greater than 10% chance of a potentially damaging tsunami occurring in the next 50 years. The Boxing Day Indian Ocean tsunami of 2004 was undeniably the worst catastrophe the Sri Lanka has ever encountered in the recorded history leaving more than 30,959 dead, 5,644 people missing, displacing closer to half a million people and destroying almost 100,000 houses (Desinventar).

Sri Lanka recorded in excess of 1,000 combined riverine, urban, and flash flooding floods from 1974 to 2008. The flood risk profile of the country shows upward trend, thanks to the climate change, which is a well-documented cause for increased hydro-meteorological hazards. Sri Lanka suffered many cyclones, including Roanu in 2016 that caused an estimated US\$600 million in damages, and Mora in 2017 that resulted in about US\$415 million in damages. While drought tops the list that costs healthcare service with a lion's share of 78%, floods and droughts in combination projected to incur a whopping US\$52.8 million annually. Contemporary COVID-19 pandemic has been certainly taking a huge toll on every sector of Sri Lanka, and the country is projected to suffer badly in the aftermath of the pandemic and predicted to increase food insecurity and the level of poverty of the nation (Sri Lanka: Disaster Management Reference Handbook, 2021).

Disaster situations, including pandemics, warrant exploitation of advancements in ICT to cope with the health crises arising out of such sudden catastrophes (Muhammad Bilal Janjua et al., 2020). Yarmohammadian et al. (2015) have reviewed literature in 2014 by electronic search on the possibility of adopting mobile health applications in disaster management, and concluded that there are challenges in utilising mHealth during disasters (Yarmohammadian et al., 2015).

Observably, e-health has been applied in an ad-hoc manner as a tool in disaster healthcare (AC Norris et al., 2015). None of these instances cover use other than disaster response phase. E. Topol, 2012 demonstrated the benefits of e-health, while stressing on project failures and barriers to adoption and all concerns that generate resistance to change (E. Topol, 2012). Active participation of healthcare providers and care recipients in designing, development, and evaluation of workflows and the provision of required training pose real challenges in creating a community-friendly disaster e-health framework. (Tony Norris et al, 2018).

Disaster management has not so far been getting along with disaster medicine, thus leaving gaping holes in adaptation of suitable new e-health technologies, examples of which are the electronic health record, telehealth, mobile health (mHealth), big data analytics, etc. Such state-of-the-art technologies are on record for revolutionising non disaster healthcare by improving quality, safety, cost effectiveness, and access to care (David Parry et al., 2018).

Disasters are defined by Baldini and Braun as “destructive events that threaten public health and the environment and disrupt and/or impede normal operations”. Disasters are real burden on healthcare systems (Baldini et al., 2011). Disaster management activities are divided into four phases as mitigation, preparedness, response, and recovery phases for ease of management (Baldini et al., 2009). It is essential that efficient disaster management and emergency medicine are advocated to minimise trauma and effects of disasters (Baldini et al., 2011). Despite the immense growth of ICT adaptation in mainstream healthcare, the same has been proved futile in disaster management and disaster medicine fields (Chronaki et al., 2008). Nonetheless,



systematic adoption and application of eHealth technologies in an integrated manner at all levels of the disaster management cycle (DMC) improves efficacy and effectiveness by many fold during disaster situations. Such an approach may improve disaster health planning also during, and recovery after disasters. Norris et al in 2015 proposed disaster eHealth (DEH) as viable modality to achieve this dream.

ICT has been used as an important tool in managing Covid-19 pandemic in many ways. Integration of technologies may help to improve effectiveness and a framework for technology integration was postulated by Madanian and Parry (2019). Similar framework has been adopted lately to effectively prevent the spread of COVID-19, following suggestion of Adly et al. (2020).

4. CONCLUSION

Governments all over the world invest immensely towards preparedness and planning to reduce damages from natural and man-made disasters. Preparing and planning in advance are two important prerequisites of disaster management and disaster medicine (Maturana C, et al.)⁽²¹⁾. Unsystematic and unconventional adoption of eHealth tools in disaster settings hamper productivity despite wider ad-hoc application (Maturana et al., 2012).

Sieben et al and Norris et al, advocate avenues to improve disaster management outcome by developing suitable ideologies to harmonise with disaster medicine by carefully integrating eHealth technologies. Such systematic approach could be utilised to plan and execute effective measures in future as well as applied to improve overall disaster response and to better react during and after disasters occur.

Recently, COVID-19 pandemic drew interest on eHealth technologies for delivery of effective response, including in Sri Lanka. However, issues with utilisation of such technologies are rampant; systems run-in isolation without integration to healthcare mainstream. Moreover, use and throw approach of eHealth tools during waves of pandemics without sticking to a standardised approach have been abundant in Sri Lanka and other parts of the world. Many such instances of eHealth systems are still running in isolation in Sri Lanka too. On the positive side, the COVID-19 pandemic has opened up hitherto unfamiliar eHealth avenues for exploration and paved way to adopt them for betterment of overall healthcare service delivery in Sri Lanka.

Emergence of DEH lays a strong foundation for improving disaster management and disaster health to get along better in future locally and globally by assisting in designing advanced eHealth tools using available technologies in non-disaster entities. Therefore, it would be possible to work on an appropriate DEH model to help contain a future wave of pandemic in Sri Lanka.

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