

Social Determinants of Health Equity: Does mHealth Matter for Human Development?

Completed Research

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Abstract

Health equity is the absence of systematic disparities in health or the major social determinants of health between social groups (Braveman & Guskin, 2003). This implies that ideally, everyone should be able to access the healthcare they need to be able to lead the lives they chose to live. This means that people do not need universal access to health care, but they do need the care that is specific to their circumstances. Current trends in the use of mobile applications for accessing health information and healthcare providers, appear to address the social determinants of health inequities in some cases. The evidence is anecdotal at best, and few studies have been carried out to investigate this relationship. This paper investigates the effects of social determinants of health on health equity in relation to mHealth use at a global level. It also considers this relationship with human development and the ability of people to lead the lives they choose to live. The findings show correlations among the indicators at the global level. To understand the implications of these findings, we triangulate these findings with qualitative data from a focus group sessions. The contribution of this paper is in understanding the role of mHealth in addressing health equity and human development.

Keywords

Health Equity, mHealth, IT for Development, Human Development.

Introduction

Equity in healthcare represents both physical and mental wellbeing in which key social determinants include household living conditions, conditions in communities and workplaces and access to healthcare (Braveman & Gruskin, 2003). Equitable access to healthcare involves addressing the disparate needs of people while not necessarily offering universal public access to healthcare. Health indicators, such as health worker density and distribution and births attended by skilled health personnel, and universal health coverage are important when assessing health equity. Countries, such as Vietnam, Mexico, and China have all experienced gains in health equity since the implementation of universal health coverage. In addition, these countries have experienced a decline in infant mortality (Lin, 2012; Knaul, 2012).

The ethical dimension of equitable healthcare provision means that everyone should not necessarily have the same access to healthcare, but that people should be able to access the care that they require and live the lives that they value (Sen, 2002). This means that equitable access to health care depends upon the socio-economic conditions in which people find themselves. The importance of human capital in enabling people to lead the lives they choose is captured in the Human Development Index. The United Nations Human Development Index (HDI) was developed to "examine the progress of the conditions of human living – the ability of people to lead the kind of life they have reason to value" (Anand & Sen, 2000, p84).

The social determinants of health (SDOH) are especially important. While there are differences in gender, education, financial resources and race/ethnic inequalities that affect the ability of people to be able to access care, the supply of quality care may also be limited. In the United States, for example, a similar health condition exists between low-income men and high-income men in their sixties (Costa-Font & Herná'ndezQuevedo 2012, p. 195). Health equity affects education outcomes and income rates; people who suffered a chronic illness in childhood are adversely affected compared to their peers (Case et al., 2005). It

is also known that neighborhood gardens placed in the low-income neighborhood provide healthy food to those living in that neighborhood. Therefore, it is vital to understand the health disparities in both health and non-health sectors to improve health equity globally.

There is evidence to suggest that the human condition is improved through the use of internet-enabled mobile applications to support health care access, information and patient-centered care (Cliff, 2012; Gabriel & Normand, 2012; Boulos et al., 2011; Payne et al., 2012). Uses of mobile health applications give people more choices as to how they may go about leading healthier lives. Kahn et al. (2010) argues that mHealth may also have a non-health benefit: fostering local economic development beyond health care.

There are as yet few if any studies that evaluate the success of mHealth in offering equitable healthcare to individuals and communities in need. In this paper, we investigate the research question: what are the key social determinants of health equity and human development? Once we have discovered the nature of this relationship, we investigate: What is the role of mHealth in addressing health equity and human development? The following sections describe the investigation.

Theoretical background

Health Equity

The concept of health equity arose from the belief that differences in social and economic backgrounds of people lead to differences in their ability to access health care. In other words, groups of people who are already socially disadvantaged due to their poverty, gender, racial, ethnic or religious backgrounds are further disadvantaged with respect to their health (Qureshi, 2016). Braveman and Gruskin (2003) offer a conceptual definition that they operationalize as follows: “equity in health is the absence of systematic disparities in health (or in the major social determinants of health) between groups with different levels of underlying social advantage/disadvantage—that is, wealth, power, or prestige.... health is essential to wellbeing and to overcoming other effects of social disadvantage.” (Braveman & Gruskin 2003, p.254).

Equity in healthcare represents both physical and mental wellbeing in which key social determinants include household living conditions, conditions in communities and workplaces and access to healthcare (Braveman & Gruskin, 2003). Health indicators, such as health worker density and distribution and births attended by skilled health personnel, and universal health coverage are important when assessing health equity. Countries, such as Vietnam, Mexico, and China have all experienced gains in health equity since the implementation of universal health coverage. In addition, these countries have experienced a decline in infant mortality (Lin, 2012; Knaul, 2012).

In order to measure health equity, we draw upon the **Health Equity Index (HEI)**. This index is derived from the World Health Organization which measures Health Equity through a Health Equity Monitor, which is an index of composite coverage defined as follows “composite coverage index is a weighted score reflecting coverage of eight RMNCH interventions along the continuum of care: demand for family planning satisfied (modern methods); antenatal care coverage (at least four visits); births attended by skilled health personnel; BCG immunization coverage among one-year-olds; measles immunization coverage among one-year-olds; DTP3 immunization coverage among one-year-olds; children aged less than five years with diarrhoea receiving oral rehydration therapy and continued feeding; and children aged less than five years with pneumonia symptoms taken to a health facility. This indicator is based on aggregate estimates.” (WHO, 2019) From the Health Equity index (HEI) we use Health Equity And Financial Protection Indicators (HEFPI) where the key indicator is Physicians (per 1,000 people)

Social Determinants of Health (SDOH)

Poor living conditions are a social determinant of health. Living conditions in which the quality of air, water, and sanitation are low will mean that people living in these conditions will have lower health outcomes and more significant needs for health care. More people live in cities than ever before and health inequality is growing (Corburn, 2017). Slums in cities with little or no sanitation or recourse to fresh air or drinking water will compound the health disparities that may exist. This is important for policymakers from the local to the global economy. Poverty limits access to quality foods and a safe place to live. Besides, communities with poor SDOH are plagued with low income, unsafe housing, and substandard education. Utilizing and

applying the data from SDOH, health both locally and globally will be improved as well as progressing health equity (CDC.gov, 2018).

According to the World Health Organization (WHO), “the social determinants of health are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power, and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between countries.” (World Health Organization, 2018). Social environment/living conditions, such as drinking water, clean cities, and sanitation are equally crucial to population health. Several researchers have documented that exposure to things, such as air pollution and proximity to toxic sites, increases the risk of cardiovascular and respiratory mortality (Brook et al., 2010; Laumbach & Kipen, 2012; Mustafić et al., 2012; Tzivian, 2011). In this paper we draw upon one of the WHO’s Social Determinants of Health indicators used for this analysis are the Adult mortality rate (probability of dying between 15 and 60 years per 1000 population).

Human Development

Human development is often understood in Amartya Sen’s terms to be the process of expanding the real freedoms that people enjoy to lead the lives they value (Sen, 2002). Anand and Sen (2000) contend that an understanding of development has to take place with appropriate acceptance of the pervasive role of human capital. Human Development is conceptualized as the enhancement of human lives and freedoms. They state that it is important to recognize the central part that the productive roles of human beings play in the promotion of economic and social development. In other words, human development is needed to achieve social and economic development. This means that development efforts that understanding the key indicators leading to human development will be effective in bringing about social and economic development through interventions that support human development. Kleine et al. (2012) argue that human individuals as using their agency to navigate social structures, which have in turn been co-created by individuals are central to the process of development s using their agency to navigate social structures, which have in turn been co-created by individuals.

In order to measure human capital in enabling people to lead the lives they choose we draw upon the **Human Development Index (HDI)**. The HDI was created to define how economic growth should be measured in terms of human development or the ability of people to lead the lives they choose to live. The HDI “is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions” (UNDP, 2018). HDI indicates that the development of a country should be based on people and their capabilities (HDI, 2018). This is important because a healthy population has a lower cost of medical care and more workers available for the workforce (Braveman et al., 2011).

Mobile Health (mHealth)

mHealth is defined as the use of portable electronic devices for mobile voice or data communication over a cellular or other wireless network of base stations to provide health information (Kahn, Yang, & Kahn, 2010). An area in which mobile healthcare provision is becoming more equitable is in enabling care to become more patient-centered. Studies have shown that the outcomes of patient-centered care have reported better recovery from their discomfort and concern, better emotional health, and fewer diagnostic tests and referrals (Cliff, 2012; Gabriel & Normand, 2012). Additional studies have also shown that the use of mHealth applications for patient centered care reduce the cost of care significantly (Boulos et al., 2011; Payne et al., 2012).

Evidence suggests that motivated patients can achieve significant improvements in their health outcomes when they use mobile applications (García-Gómez et al., 2014). Internet-enabled mobile applications allow active patient participation in decisions affecting their health status, health information, linking people and information through multiple digital devices to allow for person-to-person communication, and participating in support groups (Boulos et al., 2011). The use of such mobile applications is transforming the relationship between physicians and patients offering more significant equity in outcomes. While the

successful cases of mHealth offer hope to those in need of primary healthcare, it is not clear if at all they can be sustained, scaled up, or even replicated globally.

Mobile applications and internet access continue to transform healthcare by offering patients greater knowledge about their condition and the ability to actively participate in health-related decisions that affect them (Ventola, 2014; Anderson et al., 2003; Boulos et al., 2011). Physicians and medical students are also increasing their usage to support their education and clinical practice (Payne et al., 2012; Ventola, 2014). The increased popularity of smartphones has led more patients to proactively manage their care while on the go using specific mobile applications containing functionalities such as GPS tracker for Alzheimer's patients, not available on desktop computers.

Location-based mHealth applications can further assist the independent living of persons with disabilities and/or multiple chronic conditions and in epidemiology/public health surveillance, community data collection and remote monitoring of patients. (Boulos et al., 2011; Mosa et al., 2012). Disease diagnosis, drug reference, and medical calculator applications were reported as most useful by healthcare professionals and medical or nursing students (Mosa et al., 2012). Their reliability for making clinical decisions, protection of patient data concerning privacy; impact on the doctor-patient relationship; and proper integration into the workplace remains limited (Ventola, 2014; Boulos et al., 2011; Mosa et al., 2012).

While the successful cases of mHealth offer hope to those in need to primary healthcare, it is not clear if at all they can be sustained, scaled up, or even replicated in communities around the world. There are as yet few if any studies that evaluate the success of mHealth in offering equitable healthcare to individuals and communities in need. In order to measure mHealth at the global level, Qureshi and Xiong (2019) created a mHealth Index. The mHealth index comprised of Mobile Phone Subscriptions per 100 population (World Bank, 2017), Internet Usage per 100 population (World Bank, 2017) and the Health Index (UNDP, 2017). Qureshi and Xiong (2019) found a very strong positive correlation between their mHealth index (MPSIUHI), Inequality-adjusted life expectancy mobile phone index (LEMPSI), Inequality-adjusted education mobile phone index (EIMPSI), and the Human Development Index (HDI). In this paper the mHealth index will be used to answer the following hypotheses:

H1: mHealth usage will lead to an increase in health equity

H2: the higher the Social Determinant of Health measured in terms of Adult Mortality rate, the lower the level of health equity

H3: Social Determinants of Health and mHealth have a positive effect on Health Equity by reducing the negative effect of the social determinants

H4: Social Determinants of Health, and mHealth and have a positive effect on Human Development Equity by reducing the negative effect of the social determinants

Methodology

Data for this study is gathered from the World Health Organization, World Bank and UNDP. Health equity data was collected from the Health Equity Monitor database. Multiple regression was carried out of a sample of 175 countries for which data was complete for all the variables described above. The following sections outline variables in the model:

MPSIUHI: In order to assess the effects of mHealth adoption on the HDI, we created an index comprising of Mobile Phone Subscriptions per 100 population (Individuals, 2018), Internet Usage per 100 population (Individuals, 2018) and the Health Index (HDI, 2018). This index we abbreviate as MPSIUHI, which measures mHealth in this study.

Health Equity index (HEI): In order to access the health equity information, we utilize Health Equity and Financial Protection Indicators (HEFPI), available from the World Bank¹. One key indicator, physicians per 1,000 people is selected for this research.

¹ <https://datacatalog.worldbank.org/dataset/hefpi>

Social Determinants of Health indicators (SDOH): In order to access the Social Determinants of Health, we utilize adult mortality rate (probability of dying between 15 and 60 years per 1000 population) in 2016 from the WHO².

In order to arrive at an understanding of the role of mobile phones in the provision equitable healthcare, the quantitative data analysis is triangulated with qualitative data from a focus group session of healthcare providers in a Federally Qualified Health Center (FQHC) in an underserved community of a large mid-western city.

Results and Analysis

Regression was carried out of a sample of 154 countries for which data was complete for all the variables described above. The results of this analysis are described in the following sections.

Model 1: mHealth and Health Equity

The results suggest that the use of mHealth (MPSIUHI) in a given population is correlated with Health Equity (HEI) as follows: $HEI = 0.023 * MPSIUHI - 0.282$. This means that for each unit increase of MPSIUHI, HEI will increase by 0.023 unit. The following table illustrates these results:

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	113.329	1	113.329	68.379	.000 ^b
	Residual	265.178	160	1.657		
	Total	378.507	161			

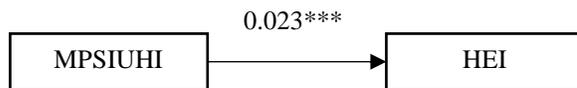
a. Dependent Variable: HEI

b. Predictors: (Constant), MPSIUHI

Table 1. ANOVA for mHealth and Health Equity

The R square is .299 which means that this explains 30% of the occurrences in this sample. The correlation between these two indicators is illustrated as follows:

Figure 1. Relationship between mHealth and Health Equity



The analysis shows that hypothesis 1, “mHealth usage will lead to an increase in health equity” is supported. This means that there may be a relationship between the usage of mHealth and equitable healthcare provision.

Model 2: Social Determinant of Health and Health Equity

The results suggest that the Social Determinant of Health (SDOH) in measured terms of Adult Mortality rate, in a given population is inversely correlated with Health Equity (HEI) as follows: $-0.012 * SDOH + 3.663 = HEI$. This means that for each unit increase of SDOH, HEI will decrease by 0.012 unit. This is illustrated as follows:

ANOVA^a

² <http://apps.who.int/gho/data/node.imr>

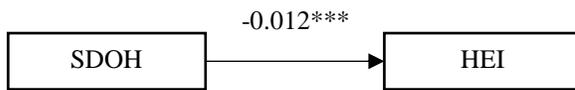
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	158.281	1	158.281	116.933	.000 ^b
	Residual	212.515	157	1.354		
	Total	370.796	158			

- a. Dependent Variable: HEI
- b. Predictors: (Constant), MPSIUHI

Table 2. ANOVA for Social Determinant of Health and Health Equity

The R square .427, which means that this result explains 43% of the occurrences in this sample. This is illustrated as follows:

Figure 2. Relationship between Social Determinant of Health and Health Equity



The above analysis suggests that hypothesis 2: “the greater the Social Determinant of Health measured in terms of Adult Mortality rate, the lower the level of health equity” is supported.

Model 3 Social Determinants of Health, mHealth and Health Equity

The results suggest that the Social Determinant of Health (SDOH) and mHealth (MPSIUHI) in a given population are correlated with Health Equity (HEI) as follows:

$$-0.01 \cdot \text{SDOH} + 0.009 \cdot \text{MPSIUHI} + 2.48 = \text{HEI}$$

This means that there is a negative relationship between HEI and SDOH. There is also a positive relationship between MPSIUHI and HEI. This is illustrated as follows:

ANOVA^a

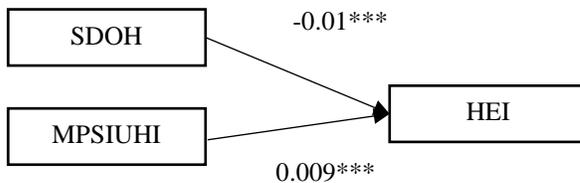
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	167.329	2	83.665	64.146	.000 ^b
	Residual	203.467	156	1.304		
	Total	370.796	158			

- a. Dependent Variable: HEI
- b. Predictors: (Constant), MPSIUHI, SDHI

Table 3. ANOVA for Social Determinants of Health, mHealth and Health Equity

The R square .451, which means that this result explains 45% of the occurrences in this sample. This relationship is illustrated as follows:

Figure 3. Relationship between Social Determinants of Health, mHealth and Health Equity



This means that Hypothesis 3: “Social Determinants of Health and mHealth have a positive effect on Health Equity by reducing the negative effect of the social determinants” is supported.

Model 4 Social Determinants of Health, mHealth and Human Development

The results suggest that the Social Determinant of Health (SDOH) and mHealth (MPSIUHI) in a given population are correlated with Human Development (HDI) as follows:

$-0.001 * SDOH + 0.002 * MPSIUHI + 0.722 = HDI$. This means that there is a negative relationship between SDOH with HDI. There is a positive relationship between MPSIUHI with HDI. These are illustrated as follows:

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.316	2	1.658	293.317	.000 ^b
	Residual	.972	172	.006		
	Total	4.289	174			

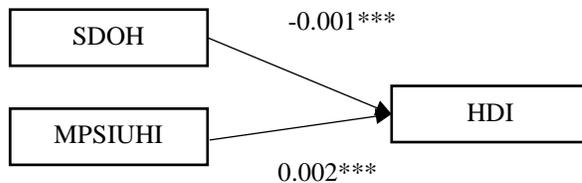
a. Dependent Variable: Human Development Index (HDI)

b. Predictors: (Constant), MPSIUHI, SDOH

Table 4. ANOVA for Social Determinants of Health, mHealth and Human Development

The R square is .773, which means that this result explains 77% of the occurrences in this sample. This relationship is illustrated in the following diagram:

Figure 4. Relationship between Social Determinants of Health, mHealth and Human Development



The above analysis suggests that Hypothesis 4: “Social Determinants of Health, and mHealth and have a positive effect on Human Development Equity by reducing the negative effect of the social determinants”.

These findings have important implications for the provision of equitable healthcare. In the following sections, they are triangulated with qualitative data from a clinic located in an under-served community.

Implications for Equitable Healthcare Provision

In order for equitable healthcare to take place, resources need to be made available and distributed to those who are most at risk. The socio-economic factors and the capability of healthcare providers to identify and treat diseases this is key. The quality of care outcomes of the equal distribution of healthcare can be achieved if a number of factors come into play, such as, quality of healthcare facilities, expertise of providers and access to needed medication and treatment options. There is a sense that equitable healthcare can be achieved using Information and Communication Technology (ICT) to collect, store and analyze data to arrive at treatment options and interventions.

In a focus group session with providers and community healthcare workers in an FQHC, participants were asked about the challenges they face as they use existing electronic health records systems and how they would envision using ICTs to improve the care they offer. It is important to note that these providers offer

care to the most vulnerable people in the communities served by their clinic. Their answers are categorized as follows:

Limitations of existing systems:

"We have a teletherapist here. And we haven't been able to have any teletherapy sessions because our clients have been: one either they do not have a computer or laptop, or two they are very skeptical using new technology."

"using technology occasion when it is not user-friendly, from the perspective of there's nothing natural about it. There is no real logical flow."

"I still think that reliability is still a major issue."

"the way that those questions are placed [in the system] is wrong in terms of how you are asked. Like I don't want to ask about someone's victim like being a victim, um early in my session I mean I might ask that later on as the person until warms up and gets to know me but sometimes in certain EHR, or the way questions are sometimes placed in the EHR system you have to ask them according to that EHR."

"the data you will get our information, MRI, labs, and all that. We can make a connection, that is where the manual billing caps become very handy. In that, you can use time. I spend about two to five minutes reviewing data and then justify what I did."

"we do not have a way to see all the information of the patient from another facility."

Opportunities for mHealth

"No [we use] the same (Patient Health Record accessible via mobile app) PHR system no matter where we are, all the same one. PHR system even for your home, when we go home we can finish there... ..works at different hospitals."

"...with the big rise that we have in the amount of uh not just narcotic abuse but narcotic deaths. It would be great if when we enter a controlled substance, it automatically will prompt us to tell us if the patient has had a controlled substance within the last thirty to sixty days. "

"Physicians appear to be looking for advantages from the system. They want analysis tools as the top categories (e.g., tagging, automatic alerts). The physicians wanted automatic interventions based on automatic communication (e.g., drug addict or frequent narcotic abusers)."

"voice recognition – is this to avoid using the system and revert to old transcription or have they used 'real' voice recognition that converts to text and automatically uploads. I suspect they have had the latter."

"Search function in a specific file. To be able to pull out anything where you could even tag sessions like you tag a picture. Like to be able to pull information."

"Where where where I do not even have to manually tag it, where it automatically tags associated with certain tests "

The above suggests that physicians are faced with two conflicting ways of carrying out the treatment process. The first approach focuses on offering physicians the best available evidence about the most effective treatment for their patients. Evidence-based treatment options, also known as the data-driven approach to healthcare, rely on a combination of data from tests and bio-medical databases on a condition and scientific evidence. Such evidence-based medicine is disease-oriented with evidence based on randomized clinical trials (Sackett et al., 1996). Evidence-based approaches rely on established and often

outdated systems that limit the ability of healthcare workers to connect with their patients, especially those who are the most vulnerable.

The use of mobile phones to monitor heart rates, blood pressure access information and evaluate treatment options give patients control over their care. Patient-centered care entails communication and joint decision making with patients whose preferences are taken into account when developing treatment options suited to the needs of the patients and have reported improved health outcomes. Patient-centered medicine focuses on patient participation in clinical decision making by taking into account the patients' perspective and tuning medical care to the patients' needs and preferences. (Barry et.al. 2012, Oates et.al. 2000, Cliff 2012, Bensing 2000, Sackett et.al. 1996).

Summary, Conclusions, and Contributions

Equitable access to healthcare involves addressing the disparate needs of people while not necessarily offering universal public access to healthcare. The above analysis suggests that equitable access to healthcare can be offered through mHealth implementations. The above analysis also suggests that the social determinants of inequalities of life expectancy and education through the use of mobile phones can enable people to bring about improvements in their lives and be healthy.

The analysis discovered a significant relationship between the use of mobile phones and social determinants of health in the provision of healthcare and human development outcomes. This analysis was triangulated with data from a focus group session with providers and community health care workers from a Federally Qualified Health Center serving disadvantaged patients. An analysis of these transcripts reveals challenges and opportunities for mHealth.

Based on these analyses, this paper contributes to what is known about the use of mobile phones for the provision of equitable healthcare. The concepts explored in this paper have offered a means of understanding the challenges and opportunities for creating a better world with ICTs. In particular, it appears that mHealth can empower people to be more patient-centered while enabling physicians to focus on the evidence-based provision of health care. Limitations of this research are that only the relationship between the three variables was measured. While the relationships between them are significant, we need to address a higher number of qualitative considerations. Unfortunately, data on these measures is limited and cannot be found for all the countries in our sample. This means that we would have to select sets of countries to analyze and triangulate the results of the regression with qualitative data from those countries.

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