

## 'Hybrid Doctors' Can Fast Track the Evolution of a Sustainable e-Health Ecosystem in Low Resource Contexts: The Sri Lankan Experience

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### Abstract

*Although e-health is an area recognized as essential in the rapid development of healthcare systems in low resource contexts, many challenges prevent the emergence of an effective e-health ecosystem. Lack in capacity around health informatics is one of the main challenges. Based on a longitudinal case study gathering data pertaining to a master's program in biomedical informatics in Sri Lanka designed for doctors, in this paper we demonstrate that creating 'hybrid doctors' may be the way forward. We illustrate how hybrid doctors conversant in healthcare and information and communication technology (ICT) are able to facilitate the creation of an e-health ecosystem in a way that it would contribute significantly to the ICT driven healthcare reforms. Through this case study we highlight the importance of multidisciplinary, participatory design, strategic investments, learning that aligns with developmental needs, networking, gaining legitimacy and re-packaging perspectives on 'health informatics capacity development'.*

### Keywords:

Health Information Systems; Education, Medical; Medical Informatics,

### Introduction

Capacity development around health informatics remains a considerable challenge in low resource settings [1]. In the absence of adequate capacity, many countries lag in incorporating e-health solutions to elevate their healthcare systems and gain better health outcomes [2]. With the recognition that technology could be a main driver in achieving sustainable developmental goals in 2030 [3], identifying ways and means of incorporating technology in healthcare has gained considerable interest.

Developing health informatics capacity among doctors or healthcare professionals has been a focus of attention for a considerable period [4]. The International Medical Informatics Association's (IMIA) initiatives in developing programs to improve health informatics capacity among healthcare professionals have been well received. However, in low resource contexts, capacity development in health informatics remains in the hands of non-governmental organizations or local universities supported by donor agencies [2,5]. Although such programs have contributed to the development of local capacity in health informatics to various degree, there is limited evidence on the impact of these programs in the wider e-health ecosystem of a country.

In 2008, the Postgraduate Institute of Medicine (PGIM), University of Colombo, Sri Lanka in collaboration with the

Department of Informatics of the University of Oslo, Norway and the Health Informatics Society of Sri Lanka embarked on an ambitious program in the creation of 'hybrid doctors'. Funded by the NORAD program for Master Studies (NOMA), the program aimed to develop health informatics capacity among doctors in Sri Lanka by developing, implementing and scaling up frugal health information systems without having to depend on imported health informatics expertise. Currently at ten years after implementation, the Master's program in Biomedical Informatics in Sri Lanka at the PGIM has trained more than 150 medical doctors, and the e-health ecosystem in Sri Lanka has been disrupted towards one of the most dynamic in the region. The program has not only generated capacity, but it has also had a high impact on national level health information systems, health informatics policy, innovations, networking, publications and South-South knowledge translation, and expertise sharing. We have been unable to find similar examples of programs in other low/middle income countries that have paved the way towards a standalone specialty in health informatics for doctors.

In this paper, we summarize a decade of work around this capacity development initiative in health informatics in a systematic manner in view of identifying the key factors that contributed to the success of this program. We also discuss how the capacity development effort disrupted the e-health ecosystem in Sri Lanka, a low and middle income country, in a relatively short period of time. In doing so, we address one of the burning questions in health informatics, how to successfully innovate and sustain health information systems in low resource contexts.

### Methods

Drawing from data gathered from 2008 to 2018, allowed us to observe the changes taking place within the e-health system that consisted of people, organizations and the environment. In line with Pettigrew's illustration on longitudinal field research [6] and case study research as described by Yin [7], we adopted a longitudinal case study method. The authors of this paper have been involved in this project as principle investigators, project managers, researcher cum educators and as trainees. This has allowed different authors to bring in different perspectives in the interpretation of study data. Using multiple methods, which included semi-structured interviews, focus groups, document analysis, online discussion forums and e-mail communications; we gathered qualitative data pertaining to different yet seemingly overlapping phases of program evolution. Based on our understanding of key developments that took place since the inception of the master's program, these phases were classified as 1) initiation 2) legitimation and institutionalization 3) impact generation and 4) scaling and sustainability phases –

Additional reports have been published on the evaluations of program outcomes as reported by students and the PGIM. Thematic analysis was conducted on the data, where all authors of this paper participated in collectively building themes emerging from the systematically coded data. This approach to data analysis enabled us to overcome the researcher bias that generally plagues information system research [8,9].

## Results

In presenting the results, we will provide an overview of each of the phases in general, followed by presentation of the key themes that were developed.

### Initiation

The initiation phase consisted of the first two years following signing the memorandum of understanding between the PGIM and the University of Oslo. This phase was highlighted by the creation of a multidisciplinary board comprising of academics and practitioners from various academic disciplines, the Ministry of Health (MoH), professional organizations such as the Health Informatics Society of Sri Lanka (HISSL) and the private sector. The Northern partner, the University of Oslo, provided technical support, but did hold a position on the board. The board had the power to decide how the program should be run in accordance with the university regulations in collaboration with the partners such as the MoH, other universities, professional organizations and private sector enterprises. The key tasks performed by the multidisciplinary board were to develop the curriculum, identifying the training strategy, create learning opportunities for the trainees, negotiate with the stakeholders on the implementation of the program and manage NORAD in the development and implementation of the master's program.

The initiation phase was characterized by a proactive effort towards facilitating multidisciplinary and participatory design, largely through the creation of a multidisciplinary board. This phase was also characterized by the decisions made on strategic investments in training unit development, trainer training and network building, which contributed to the emergence of a conducive learning environment for teaching and learning. In particular, effective utilization of donor funds to student projects aimed at improving service delivery in various state health institutions. The health institutions in this case benefited in two ways. First, the student projects helped solve issues related to service delivery in a training unit. Second, the fulfilment in establishing a basic infrastructure for these projects facilitated implementation and sustainment of these projects. Given that students were involved in frugal innovations and the scope of the master's projects were limited, the cost incurred for each project was minimal. This enabled the board to support multiple projects across the health care system.

### Legitimizing and institutionalizing

The legitimizing and institutionalizing phase of the program represented the first three to four years of the program where the first two batches of graduates became part of the MoH workforce as Medical Officers in Medical Informatics (MOMI). The creation of the post, a unique position for a medical officer within the health sector of a low resource context, was one of the key characteristics identified during this phase. The acceptance of the graduates of the program by the MoH as an integral part of its master-plan for e-health was another critical component during this phase. We identified that this recognition was gained through advocacy and demonstration of competency by the newly graduated doctors and champions of the program. In this phase, roles that were previously filled by experts from other fields (e.g. ICT, engineering) who limited healthcare background transitioned to

being within the MoH and were replaced with the MOMIs. In addition, the data collected during this phase illustrated how placement of students cum doctors in various healthcare institutions and programs were solicited by the stakeholders for the master's program. We identified the integration between the academic program and practice as an important theme during this phase.

Other themes recognized during this phase included: South-South collaborations between the program and the regional partners paving way towards sharing of expertise and knowledge regionally. At the same time, recognition of the qualification by the MoH as a means of promotion for the doctors generated renewed interest among potential candidates for the program. This essentially meant that all doctors who qualified this program would be funded by the MoH and would receive full pay after two years. We found this to be a key contributor towards the sustainment of the program beyond the funding period from NOMA.

### Impact Generation

The impact generation phase began in from the fourth year and continued to the present. At the beginning of this phase some of the students' projects started attracting the attention of the MoH as proposing potential systems that could be scaled island wide to facilitate national health information flow. This recognition was encouraged by placement of students in strategic locations where there was a need for health information system development or upgrading of existing systems. Additionally, adopting open source software tools made students' projects attractive to the stakeholders.

The phase was also highlighted by the involvement of the graduates of the program in the development and implementation of health information systems, e-health policy and guidelines, consultations with various stakeholders (including donor agencies) and scientific publications presented at various national and international forums. Table 1 highlights some of these impacts.

As highlighted in Table 1, this phase also demonstrated the entrepreneurship potential of the graduates working with various international and private sector organizations on various health informatics projects. The tendency of the private sector and other organizations to seek expertise of the graduates of the program was perceived by us as an indication of further legitimization of the program and development of competencies of the graduates, and facilitation of building an ecosystem across organizational boundaries.

The involvement of the graduates within various aspects of the e-health ecosystem was also facilitated by the HISSL, which became the main representative body of health informaticians of the country. Many of the opportunities gained by the students and graduates to network with the industry, foreign and local experts, as well as donor agencies were facilitated through HISSL.

Table 1 – Impacts of the Biomedical Informatics Master's program (2008 – 2018)

Areas of Impact	Indicators of high Impact
Practical HIS development	National/program wide HISs developed and implemented – more than 12 Institution focused HIS – more than 20
Research papers published	Journal papers – 37; Conference presentations – 88 (up to 2017)
Networking opportunities: International conferences attended	More than 7 regional and international conferences attended (e.g. APAMI, APMEC, e-Health Asia, AEHIN etc.) by students and faculty of the health informatics program.
Networking opportunities: International conferences hosted (organized by HISSL)	e-Health Sri Lanka 2010 and 2014. IFIP 9.4 conference 2014 eHealth Asia 2015 Commonwealth Digital Health Conference 2016, 2017, 2018 APAMI conference 2018 AeHIN conference 2018
Networking and advocacy	Networks established through educational program and supporting activities Linking with organizations such as Health Information Systems Program/DHIS2, OpenMRS, AeHIN, IMIA, Commonwealth Medical Association Active contribution within national bodies such as National eHealth Steering Committee, National Foundation for Open Source Health Software Drafting of National eHealth Policy, National eHealth Standards and Guidelines Pioneering work around Health Identification Number.
Program evolution and sustainability	Eight batches since 2008 Introduction of the MD program - two batches in training (38 students). Gradually increasing demand for the master's program since the introduction of the MD with board certification in Health Informatics Government investment of approximately 40 to 50 million LKR on trainee scholarships since 2008 (up to 2017) Investment set to increase by approximately 100 million LKR each year to support a one-year foreign placement for each MD trainee to gain foreign exposure.
Entrepreneurs hip contributed through capacity development	HISP Sri Lanka was established Multiple e-health companies were engaged with dealing with personal medical records, e-learning, social media, etc. Individual consultations carried out for international development partners such as UNICEF, WHO, USAID, Vital Strategies (VS) and the private sector.

### Scaling and Sustainability

This phase was recognized with the renewed interest generated among the potential candidates for the capacity development program following the approval of the MD program in health informatics. With the creation of this program, those who have successfully completed the master's program would be able to specialize in health informatics similar to any other specialty in medicine. The acceptance of the MD program as a specialist qualification by the MoH further highlighted the ongoing institutionalization process. The return of doctoral level qualified resource personnel in health informatics from their overseas training also demarcated this phase, as it facilitated a path for higher level capacity development directly in Sri Lanka. The creation of a pool of resource personnel from graduated doctors also characterized this phase as an important contributor towards the scaling and sustainability of the program, as it fulfilled the need for trainers with experience in systems development and implementation from the local context.

### Discussion

The creation of hybrid doctors who are conversant in healthcare and ICT have enabled Sri Lankan e-health ecosystem to benefit in multiple ways. Firstly, the case study illustrates how government investment in training medical professionals as health informaticians enables them to drive innovations, which are frugal, scalable, sustainable and context sensitive. Secondly, the case study also illustrates the effective use of development funds aimed at capacity development and healthcare system strengthening. In this case, the funds enabled not only training of doctors, but also in creating the learning environments that facilitated innovation, collaboration and sharing of knowledge both within and outside the local context.

However, a capacity development program particularly in low- and middle-income countries cannot exist in isolation without being linked with the development efforts within the healthcare system [5]. This was clear from the Sri Lankan experience as one of the key factors contributing to the success of the program was its alignment with the national health sector development initiatives. This was achieved through the multidisciplinary multi-stakeholder governing body, the board, and the early exposure of the trainees to problem solving in real life e-health projects. The stakeholders were equal partners in the training similar to the status of the academic institution hosting and running the program and the funding agency providing technical support. The participatory design approach [10, 11] adopted in developing the program ensured that local needs are embedded in the training and that student learning was context oriented, rather than a mere transfer of knowledge from North to South. Networking, therefore, became a key competency for the doctors undergoing training in health informatics, as the knowledge that they were expected to harness was not always transferable but was also tacit in nature [12].

Traditionally, health informatics capacity development in low resource contexts is dependent on donor funding [13,14] and is dominated by academic institutions [15]. These are often interdisciplinary and do not necessarily partner with the development efforts in a country. Traditional capacity development programs for health informatics also tend to target people who are competent in ICT [5], which may be partly due to the lack of interest among doctors in becoming health informaticians. From a socio-cultural point of view, a doctor is perceived in many contexts as a person who would treat a person wearing a stethoscope. Even the doctors in these contexts may not pursue their interests as they become confined to the acceptable societal perception of a doctor [16]. In the case

of Sri Lanka, the barriers towards creating hybrid-doctors were broken through multiple means: clear and progressive career paths, guarantee of employment, community of doctors who are also health informaticians, network opportunities with likeminded people both within and outside their own context, and legitimation gained by professionals within their work settings. The perceived change however was not achieved overnight, particularly when it came to change underlying perceptions and beliefs. The case study demonstrated the need to evolve with the changing socio-cultural-political environment for capacity development effort that can be sustained and impactful [17].

As mentioned earlier, one of the key aims of this program was to create an entity who could be the bridge between the domains of ICT and healthcare. In other words, the entity being trained needed to be recognized by the stakeholders of e-health – the MoH, the ICT industry, the development partners, doctors, other healthcare and non-healthcare professionals, academia, etc. Recognition of a doctor as an integral part of the healthcare sector [18] appears to have helped them perform their expected role in bridging the domains of healthcare and ICT. While their role of being doctors enabled them to decode the complexities existing among healthcare professionals in accepting and complying with technology implementations, their expertise in health informatics enabled them to explain the needs of the healthcare system to ICT professionals. During system implementation and scaling up, the doctors had the power to make decisions, negotiate with other professionals, gather and analyze data and intervene in problem resolution. More importantly, they garnered trust among stakeholders of health informatics paving the way for the bridging their dual roles.

While the hybrid-doctors had impact through active participation in the design, development, implementation and scaling up of health information systems, the e-health ecosystem appears to have evolved in several directions. The direct involvement of the doctors in e-health projects within the MoH triggered many more departments and campaigns to identify technology needs and engage in frugal HIS developments. Additionally, the private sector identified the potential of these doctors in serving as idea generators and consultants, which further encouraged private sector involvement in the e-health ecosystem of the country. The development agencies also recognized the potential of hybrid-doctors, which enhanced development support and collaborations. Beyond the local contexts, the e-health ecosystem started to link up with international networks through the connections made by hybrid-doctors, and enabled sharing of knowledge and expertise that extended across different countries. Such networking has long been advocated in the development of health information systems in low resource contexts [19]. The path of evolution however may not always be clear-cut and controllable [20], thus highlighting the need to continuously look at capacity development as part of the evolving e-health ecosystem, rather than as a narrowly focused educational effort. In other words, the creation of hybrid doctors and facilitating the cultivation of an e-health ecosystem reminded us of the Aristotelian quote, 'the whole is greater than the sum of its parts'.

## Conclusions

In this paper we illustrated how a capacity development program in health informatics for doctors disrupted the e-health ecosystem in Sri Lanka and achieved high impacts. We attribute the program's success to the multidisciplinary and participatory design approach and integration with ongoing development efforts within the healthcare system. We also highlighted the

importance of motivating the students by creating a conducive learning environment, ensuring career pathways and changing the traditional perspective about doctors. Hybrid-doctors was at the core of the emerging e-health ecosystem in Sri Lanka in performing the important role of bridging ICT and healthcare domains.

The nature of the training, which was context sensitive and action oriented, promoted the idea of frugal innovation by linking academia and practice at a very early stage. Not only did the students have to solve real life problems, but they also had the opportunity to contextualize their learning. The learning in this case was not an isolated academic exercise, but a graduated process of integrating health informatics expertise within the healthcare system.

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