Effects of Digital Technologies on Health Service Delivery and Quality Management in Sri Lankan Health Care Systems

RMS Veronika[1#] and PADACS Jayathilaka[2]

[1]Faculty of Computer Science, Uva Wellassa University, Sri Lanka
[2]Faculty of Graduate Studies, General Sir John Kotealawala Defence University, Sri Lanka

[#]shalini.veronika@pearson.com

Abstract- Quality of health service in accordance with professional standards and client expectations is important and the first step for it is a quality improvement in existing health service. The main purpose of this study was to get an idea about the quality healthcare attributes and its effectiveness with regards to the traditional systems in health care in Sri Lanka. Further, discuss and analyse the quality attributes of digital health systems in Sri Lanka. Higher healthcare quality results in satisfaction for the clients specially patients, community other stakeholders like health sector employees, health suppliers, and better performance for the health-related organisations. During the Covid-19 global pandemic situation, the usability of digital health facilities increased as a spike to overcome the problem of reaching doctors physically. If the quality of healthcare services improves, costs decrease, productivity increases and better service would be available for clients, which in turn enhances organisational performance and provides long-term working relationships for employees and suppliers. This study was carried out through the administration of a questionnaire addressed to 385 walk-in patients in Sri Lanka during the time period of 15th January 2021 to 15th February 2021. Data were analysed using the descriptive statistical method. The findings replicate positive feedbacks to engage with new digital platforms in the global pandemic situation. Moreover, the findings above affirm the lack of reaching the digital infrastructure, insufficient skills and technical knowledge in dealing with e digital innovations as well as new applications, it is impossible to successfully adopt digital health resources in health care delivery in order to improve the effectiveness and quality of the existing system.

Keywords— digital health systems, quality, effectiveness

I. INTRODUCTION

Quality, because of its subjective nature and intangible characteristics, is difficult to define. (De Messenger, J., et al ,2008). Healthcare service quality is even more difficult to describe and measure than in other sectors. The increase of the usage of digital platforms particularly during global pandemic time redirect Sri Lankans to get adopt digital platforms among general practitioners is to get contact to the health services for the citizens in real time. Digital platforms like mobile, web applications, online meetings with doctors have a better-quality level of patient's satisfaction, quality of life, safety and an outcome like the effectiveness of services.

The complex nature of healthcare practices, the presence of many contributors with different interests in healthcare delivery and ethical considerations add to the difficulty of improving the quality of existing healthcare applications (Miller, A.C., 2006). The development of web or mobile based health systems benefits and report medical experts in both developing and advanced countries with innovative levels. Undoubtedly, digital health platforms contributed to improve the quality of every sector in human life. The improved usage of digital and cloud-based resources in organizations has supported to improve the information level of the patients Goel, S. (2014).

Nowadays, Patients have the unintended of ability to the visual view of the health status by using computers and smart devices. The decrease of medical and health related errors influences on holistically improving the quality of healthcare products and patients' wellbeing. Other structures engaged with of quality attributes of health sectors are effectiveness, affordability and rapid development of existing health systems. They are fundamental attributes in guaranteeing national's welfare and improvement of a country as well. These

better-quality productivities, possibility to result in enhanced health care employee morale and continuous maintenance. Evidence proposes that e-health tools use with modern technology have a positive effect on users and their health (Rodrigues, J. 2014). Thus, users of digital web applications are more tending to structured and improved supportive abilities, and with machine learning behavioural analysis outcomes, as compared to the traditional way of procedures in the same health facility.

Health care stakeholders, medical professionals face challenges by lack of knowledge and utilization of digital platforms in day to day activities in conducting automotive approach. This is due to several factors such as not being integrated with IT related fields and industries due to lack of knowledge expertise in both medical and IT fields such as medical business analytics, Bioinformatic specialists, medical system developers and medical quality assurances engineers.

A.   Scope and Significance of the Study

The recent increasing burden of health care specially during the ongoing Covid 19 pandemic situation cost has been regarded as the primary contemporary issue affecting the health care industry in every nation of the world. According to the world health organization, the healthcare sectors and hospitals that using systematic cloud or data centre-based applications in fully automotive health systems have been able to reduce organizational operational cost and other costs associated with traditional methods.

As of the world bank reports, in 2019 Sri Lanka provide 100% access or facilitate to electricity. Without an electricity facility, it is impossible to successfully adopt digital and e-resource strategies. Another factor to improve the quality of health care e systems is the reliable internet facilities and connections. Therefore, besides the electricity rural areas should improve by the connectivity to central health systems with internet connections. In addition, electricity and internet facilities can enhance social connectivity, social awareness through the shared experiences of SMS alerts, television broadcasting, use of popular digital social applications. Therefore, digital devices play a major role in the quality of health care systems worldwide. According to the digital data report 2019, Sri Lanka has 31.80 million mobile phone usage, which indicates a good number to increase the adaptability of health care applications among them.

Digital infrastructure relevantly touches the adoption basic of health care applications such as basic knowledge of e-channelling, basic video conference knowledge, hands on experience with the report, document sharing and monitoring make the task of adoption into e-health facilities fast and more effective with the general public. The basic adoption got increased rapidly due to the ongoing global pandemic situation which led the authorities to improve the quality of the services day by day. Therefore, the scope of this study is to identify the effects of Digital Technologies on health service delivery in existing systems and areas to be improved in the quality management in Sri Lankan Health Care Systems (Greenwood, D., Khajeh-Hosseini, A., Smith, J., Sommerville, I., 2010).

B.   Research Problem

Is there any effect on digital health services and quality management in Sri Lankan Health care systems? This research contributes significantly to the understanding of the gaps in the existing digital health systems to deliver effective health care to the people of Sri Lanka where had rapid growth during the pandemic situation and new normal trends. During Covid 19 situation online health care facilities had revolutionary and remarkable growth compared to the last decade. With these changes, the quality of systems and infrastructures had raise problems to be addressed in a systematic way. This research will help to facilitate innovative patient, doctors' other stakeholders' rapport and conversely lead to better care outcomes and communications among them.

C.   Research Question

1) What is the existing knowledge about the digital health facilities of Sri Lankan people?

2) How effective, efficient and usefulness of the digital health facilities?

3) factors to be improved to sustain the quality of digital applications and the digital services?

D.   Research Objective

The use of digital platforms in healthcare is growing rapidly within Sri Lanka. The aim of this study is an evaluation of the present digital platform usage and knowledge, the potential of modern web or mobile applications for health reasons, and quality management aspects regarding the use of digital health applications to improve the usability of digital applications in health care systems.

E. Limitations

This research was conducted to capture digital health infrastructure and its quality. Therefore, the data was collected from stakeholders in government hospitals only. No private hospitals were conducted for the research. Data was collected based on the available platforms and mainly focused on their quality usability and stakeholder's IT knowledge and no economic factors such as household income, savings, other incomes, monthly expenditures were considered in this research.

F. Ethical Considerations

The personal data of the participants was not recorded in the research. Hence the reference code for each participant is generated during data recording. Further the questioner is designed to extract only relevant information required by the conceptual framework and operationalisation of the study.

II. METHODOLOGY

This descriptive quantitative based & Explanatory research design was carried out through the administration of a questionnaire addressed to 385 walk-in participants in the Out-Patient Department (OPD), Inpatient(ward) Services, Surgery, Maternal services, Clinical and Specialist sections like Skin Services, Scan department, Gynaecology, department X-ray and, Public Health Services of a selected government and private hospitals in Sri Lanka.
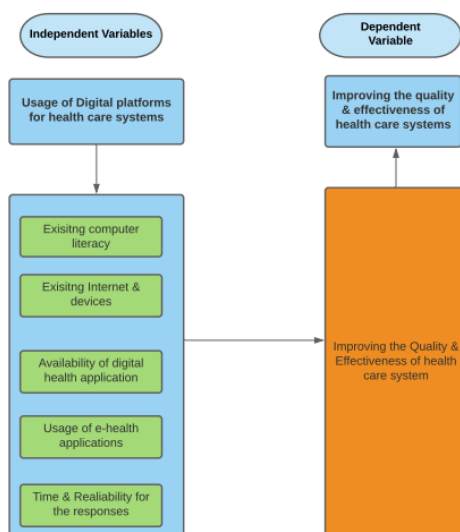

Figure 1. Conceptual Framework
Source: Authors

The research approach is purely quantitative with a questionnaire survey method. The questionnaire

was composed of main four parts further describes in Figure 2 of the conceptual framework.

- Sociodemographic data.

- The present use of digital platforms/application systems in everyday life and for health reasons.

- Estimated potential of eHealth for cross sectoral online patient-physician communication.

Explanatory research design is about when the researcher identifies the relationship, or the linkage of identified variables below.

- Existing computer literacy

- Existing Internet & devices

- Availability of digital health application

- Usage of e-health applications

- Time & Reliability for the responses

In this case, researcher has identified a clear correlation between each variable under digital health and traditional health. Therefore, the conceptual framework is designed to identify the relationship between dependent and independent variables.

A. Formulation of research hypotheses

1) H1a: Digital e-health applications positively impact health care systems in Sri Lanka.

2) H1o: Digital e-health applications do not positively impact health care systems in Sri Lanka.

B. Sample Population

The population for the proposed study was selected by government and private hospitals distributed in nine provinces including Western Province, Central Province, Southern Province, Uva Province, Sabaragamuwa Province, North Western Province, North Central Province, Northern Province and Eastern Province.

385 participants were randomly selected from major hospital departments as mentioned from major units, including Out-Patient Department (OPD), Inpatient(ward) Services, Surgery, Maternal services, Clinical and Specialist Services, Skin etc. However, to have a reliable and manageable size, the sample size of 385 Based on a priori power analysis by G*Power, using the parameters of Confidence Level in 95% Confidence Interval 5% Population consider as a number of adults in Sri Lanka 17600372 according to world bank reports.

C.   Data collection and Time Frame

Data collection was done via the questionnaire from 15th January 2021 to 15th February 2021 that was designed to capture useful characteristics with open ended and some closed ended questions sketched in the questionnaire used to collect and analyse data for the study.

The designed questionnaires were divided into four main sections where section A confined questions which related to sociodemographic data that the public details of stakeholders such as background data of the random respondents. In section B contained the research objectives related to questions of the study like present use of digital systems in everyday life for health care and section C about the estimated potential of eHealth for cross sectoral online patient-physician communication. Statistical analysis was performed using SPSS software (IBM Corp., USA).

D.   Data Processing
The main tool for the data collection was the structured questionnaires. The close ended positive questions were designed with five-point Likert scale in order to examine how strongly factors are agreed or disagreed according to Sekaran and Bougie (2013). The data collected by translated Sinhala questionnaire was distributed among the selected sample of weapon training instructors. The collected primary data were initially processed manually by using a simple random sample method. That process included the data coding, classification, numbering and editing of the total solution. Then a master worksheet was prepared using SPSS 21. Table 3.1 contains the weighted value distributed among survey questions.

III. RESULTS AND DATA ANALYSIS

Descriptive data analysis conduct to identify the user's idea about the digital based health care

applications use in Sri Lanka. Correlation analysis was conducted to identify the variables in this study. The researcher has identified traditional health care facilities and e-health facilities practices under five variable dimensions in the form of health care stakeholders.
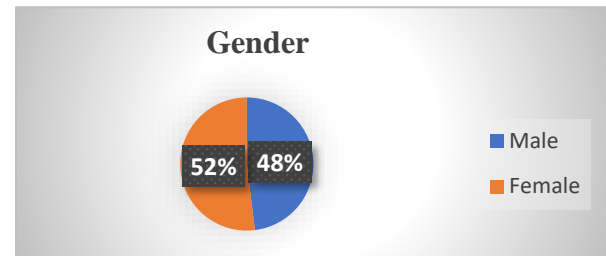

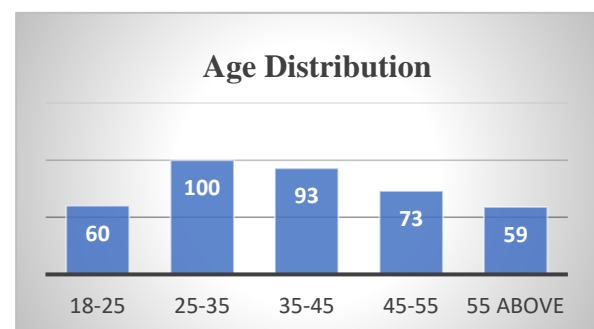Figure 2. Gender
Source: Advanced Excel - Authors

Figure 3. Age Distribution
Source: Advanced Excel - Authors

There 52% random participants were female and 48% were males from a total of 385 total participants indicate in the Figure 2 and the majority was female participants.

Age distribution was spared from 18 to 25, 25 to 35, 35 to 45, 45 to 55 & 55 above results as the Figure 3. The majority were between the age of 25 to 35 age group. Sri Lanka as having more affordable telecommunication facilities compared to the south Asian countries.
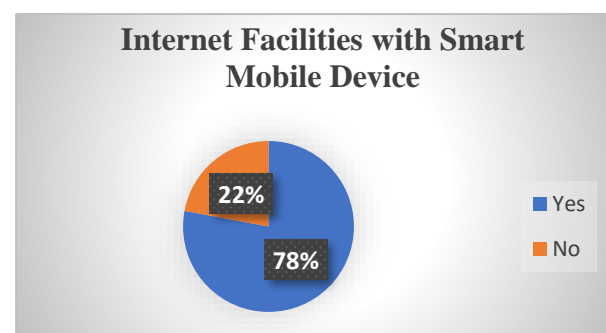

Figure 4. Internet Facilities with Smart Mobile Device
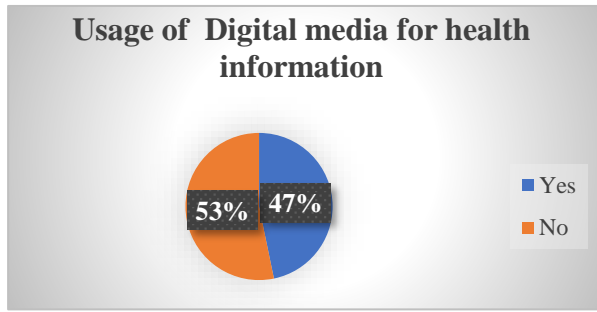Source: Advanced Excel - Authors

**Figure 5. Usage of Digital Media for Health
Information
Source: Advanced Excel - Authors**

**Figure 7. Willingness to Use Digital Media for
Health Information**

Source: Advanced Excel - Authors

Among those 385 random participants, 78% of participants had at least a smartphone with internet facilities in Sri Lanka as indicated in Figure 4.

Among those 385 participants, 53% of participants use digital media for health-related activities. Therefore, they use internet facilities or any digital media for their day to day health care applications such as booking a doctor via online appointment, reading and watching videos related to health care systems, accessing medical reports via online platforms, using video conferences for getting pieces of advice and communication with doctors and medical staff describes according to the Figure 5.
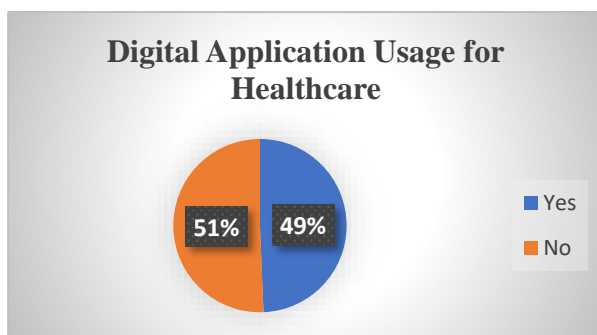
Among the participants, 57% of the majority have the willingness to use digital based information systems instead of traditional health care systems for their health-related activities describes in the Figure 7.

This indicates people have the willingness to learn new platforms, discover the fast-reliable accessibility to medical staff for quick advice, reduce the time duration getting for waiting for inspection of the medical party in traditional ways by using digital health care systems according to Figure 7. Most of them have a positive impact of learn about new digital platforms and use them for their medical related activities.

**Figure 6. Digital Application Usage for Healthcare
Source: Advanced Excel - Authors**

Therefore, 51% have installed specific digital applications in their smart device or laptop installed for day to day health care related systems as mentioned in the Figure 6. These applications were developed by some service provides from private hospitals, network facility providers and maybe from third party software companies with the ability to give single sign on facilities to interconnect with hospitals and stakeholders.
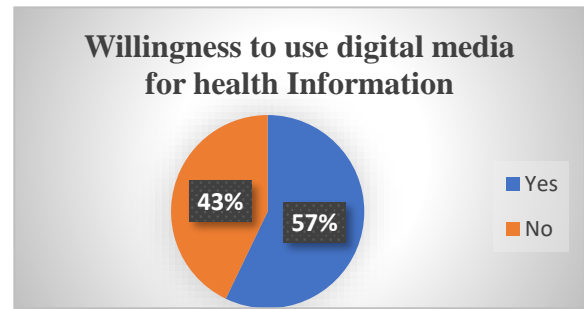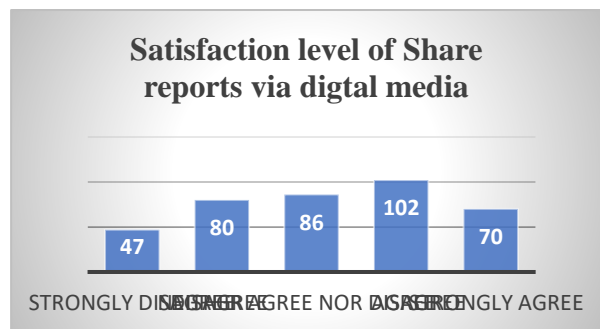

**Figure 8. Satisfaction Level of Share Reports via
Digital Media
Source: Advanced Excel – Authors**

According to Figure 8, the Majority of participants agree with the method of share medical laboratory reports, Xray's, ECG, scans, mammography reports via online method. Therefore, they don't want to wait until the report's release from laboratories and collect them manually. They can access their personal medical account from anywhere when the hospital system release or upload relevant reports to relevant accounts or for their personal emails. This is a well known facility using by most of the private hospitals in Sri Lanka meantime.
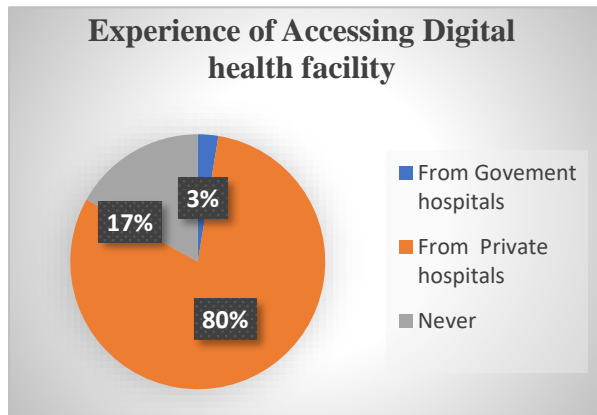

Figure 9. Experience in Accessing Digital health facility
Source: Advanced Excel - Authors

Among the 385 participants, 80% of the majority has accessed digital health facility from private hospitals, 17% from government hospitals and 3% never had these facilities experienced in their life. These results indicate there should be rapid development in the government health care system to engage with information technology and digital media to develop e health care system for direct engagement with the local public in Sri Lanka for the effectiveness and efficiency of the local public indicate in the Figure 9.
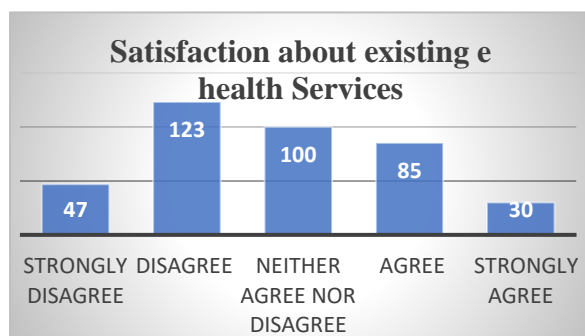

Figure 10. Satisfaction about Existing E-Health Services
Source: Advanced Excel - Authors

There is a majority of unsatisfaction among the local public about the existing e health services in Sri Lanka as describes in the Figure 10. Among the participants, there were only 85 participants agree with the existing e-health services and only 30 people had strong satisfactory level about health service.

Pearson correlation was considered in the analysis of correlation under this section. The following table shows the correlation digital health facilities with the improvement of the existing health care system in Sri Lanka that indicate the results in Table 1 below.

Table 1. Meta-synthesis analysis – Theorizations.

Correlations			(b)	(c)
(a)			Simulator training is effective	Supplement to get practical experience and interesting
Usage of Digital platforms for health care systems	Pearson Correlation		1	.463**
	Sig. (2-tailed)			0
	N		385	385
Improving the quality & effectiveness of health care systems	Pearson Correlation		.463**	1
	Sig. (2-tailed)		0	
	N		385	385
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: SPSS - Authors

As per the following correlation, the output shows that there was a negative correlation between usage of digital platforms for health care systems with the Improving the quality & effectiveness of health care systems have not affected the existing traditional health care system.

Therefore, the researcher has identified Usage of Digital platforms do not affect the existing traditional health care system per the survey results in this time period. Correlation output shows that there was a negative correlation between Digital platforms for health care systems and Improving the quality & effectiveness of health care systems. Therefore, the researcher can come to the conclusion that existing digital platforms are effective than traditional health care systems and the null hypotheses getting rejected and the H1a hypotheses getting prove as Digital e-health applications positively impact health care systems in Sri Lanka On the other improve the digital practical experience in e-health and interesting of giving knowledge were positively

correlated with the effectiveness of existing health care system in Sri Lanka.

IV. DISCUSSION

The research goal is to evaluate and understand the existing digital health facilities in Sri Lanka and get an idea about the public satisfaction and ideas to improve healthcare distribution in future. This study supposes practical to evaluate the overall impact and power of digital systems related to health facility delivery. The future benefits and facilities that estimates to achieve in Sri Lanka. The improvements of the current Sri Lankan hospital systems as an entity or department could be gain attributed to several renovations and combined with digital makeovers.

The research results and findings indicate the significant influence of the current Sri Lankan health system. From that results included workload reduction among healthcare stakeholders, decrease time consuming or waiting time of patience, minimized errors or bugs which engaged with the paper-based manual or traditional records-keeping system. Further researchers recognised that clients time searching for misplaced stakeholders, client records and files and folders amount decreased because of the unique repository location in cloud or data centre offered by the digital health system. The implemented digital health system provides up-to-date transparent records keeping facilities to the public. The healthcare delivery can be improved by the idea of centralizing common cloud location or data centre for hospital records to exchange medical data within local hospitals with help of central repository access.

V. CONCLUSION

Therefore, conclusions related to digital health care systems should be designed cautiously considered for large scale migration and rapid adoption of the change in Sri Lanka. From the mentioned findings above, the study indicates recommends the following:

- Software applications should be developing more user-friendly to use by all ages/ different educational backgrounds of public people in Sri Lanka.

- The Software systems should integrate value added functions like video conferencing automated reports, patient SMS alerts and prompts.

- Explore alternative facilities like training and awareness to learn more about using the health applications.

- Ministry of Health articulates relevant policies to provide the structures for implementation in health care institutions in Sri Lanka.

REFERENCES

Alkhalil, A., Sahandi, R., John, D., 2014. Migration to Cloud Computing: A Decision Process Model, Central European Conference on Information and Intelligent Systems. Faculty of Organization and Informatics Varazdin, pp. 154-163.

De Maeseneer, J., et al., Funding for primary health care in developing countries. BMJ, 2008. 336.7643: p. 518.

Goel, S. (2014) Textbook of Hospital Administration. Elsevier Health Sciences, APAC, London.

Greenwood, D., Khajeh-Hosseini, A., Smith, J., Sommerville, I., 2010. The cloud adoption toolkit: Addressing the challenges of cloud adoption in enterprise. Arxiv preprint.

Harries, A.J., PM. Zachariah,R. Rusen,ID. Enarson,DA., How health systems in sub-Saharan Africa can benefi t from tuberculosis and other infectious disease programmes. INT J TUBERC LUNG DIS, 2009. 13((10)): p. 1194–1199.

Miller, A.C., Jundi-Shapur, bimaristans, and the rise of academic medical centres. J R Soc Med, 2006. 99(12): p. 615-7.

Perry, B., & Gesler, W. , Physical access to primary health care in Andean Bolivia. Social Science & Medicine, 2000. 9: p. 1177-1188.

Rodrigues, J. (2014) Advancing Medical Practice through Technology: Applications for Healthcare Delivery, Management, and Quality. Medical Information Science Reference/IGI Global, Hershey, PA.

World Health Organization (2014) E-Health.http://www.who. int/topics/ehealth/en/

World Health Organisation, Engaging for health. Eleventh General Programme of Work 2006-2015, WHO, Editor. 2006.

World Health Organization, The health of the people: The African regional healh report, R.O.f. Africa, Editor. 2006: World Health Organization.

ACKNOWLEDGEMENT

AUTHORS BIOGRAPHIES

A high-end professional accredited from the International Software Testing Qualifications Board as a Certified Software Tester and currently working as a Software Quality Engineer in Pearson Education Global. A professional calibre enshrined with a Postgraduate Diploma in Business Management (UK), and graduated in the discipline of Industrial Information Technology at the Uva Wellassa University of Sri Lanka, in 2017 and currently reading for Masters in Bussiness Admininstration (University of Gloucestershire - UK). Pursuing interests in exploring new technologies, conducting Research and Traveling.

A military officer with a blend of military, academic and administrative competencies. A professional calibre enshrined with a Postgraduate Diploma in Business Management and Marketing (UK), and graduated in the discipline of Management at the Sir John Kotelawala Defence University of Sri Lanka, in 2018; graduated form Defence and Staff College, Sri Lanka in 2020 and currently reading for Masters in Bussiness Admininstration (University of Gloucestershire - UK). Pursuing interests in exploring new technologies, conducting Research and Traveling.