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User Experience on a New Medical Supplies Management Information System at The National Hospital of Sri Lanka

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ABSTRACT

Introduction: The new Medical Supplies Management Information System (MSMIS), an e-based logistics management system was implemented in 2023 by the Medical Supplies Division of the Ministry of Health, Sri Lanka to effectively manage medical supplies among state healthcare institutions across the island. The new system replaced the previous MSMIS to incorporate wider aspects of supply chain management on par with the changing environment.

Methods: It was a mixed-method descriptive study conducted at the National Hospital of Sri Lanka (NHSL) in 2023. A survey was done with the help of a tailor-made tool (5-point Likert scale) among all the users of MSMIS at NHSL. Key information interviews and observational visits were done to complement the quantitative findings.

Objective: The study aimed to evaluate the experiences of users in the new MSMIS by comparing it with the previous one at the NHSL.

Results: More than 60% of respondents (n=21) were found to have negative or highly negative experiences with all ten components of the system evaluated. The composite mean score of overall experience was 2.17(SD=0.56). The qualitative data fortified the findings of the quantitative data.

Conclusion: The majority of MSMIS users at the NHSL had a negative experience with the new MSMIS in comparison with the previous system.

Recommendation: It is recommended for similar studies on a larger scale (regional/national) to produce findings with fewer concerns for validity and reliability.

Introduction

Medical Supplies Management Information System (MSMIS)

MSMIS is an online-based (electronic-based) logistics management information system implemented by the Medical Supplies Division (MSD) of the Ministry of Health, Sri Lanka [1]. It enables real-time monitoring and management of the supply chain under MSD[1]. The MSD is the main organization responsible for providing all pharmaceuticals, surgical items, laboratory items, radioactive items, printed materials, etc. for government sector healthcare institutions nationwide[2]. The MSMIS was first initiated in 2015 by outsourcing the e-system, expanded later, and continued until 2023[2]. In 2023, MSD insourced a new e-based MSMIS by replacing the previous system to meet existing demand and challenges in logistics management.

The Importance of a Logistics Management Information System (LMIS)

A logistics management information system (LMIS) is an organized system for collecting, processing, reporting, and using health product data gathered across all levels of the health system[3]. Effective supply chains depend on functional LMIS. LMIS data are essential for quantification processes and for planning distribution along the supply chain, avoiding overstocks and products going out of stock[3].Preparing summary and feedback reports is easier and less time-consuming when the LMIS is automated[4]. Digital LMIS applications can automatically populate report elements, especially if the eLMIS is also used for routine inventory control, and for opening balance, receipts, consumption, losses, or adjustments that are recorded with every transaction[4]. With the click of a button, the eLMIS can generate a summary report and a requisition order with suggested replenishment quantities[4].

It also can quickly identify mathematical errors, highlight missed deadlines, list the percentage of expected reports received, and search for data averages, highs, and lows[4].One point is clear: affordable and successful healthcare operations must eliminate all waste and inefficiency from the healthcare delivery system[5]. One of the important areas of delivering health care service is medical supply and inventory management[5]. Health care is unique in its medical supply management. Each medical item may be considered critical when delivering health care services; the need for a supply item may be infrequent but essential when needed[5].

National Hospital of Sri Lanka (NHSL)

The NHSL is the largest hospital in Sri Lanka under the Ministry of Health with a bed capacity of 3404. It has treated 250000 inward patients and two million outpatients annually [6].

The new MSMIS at NHSL

It was around five months passed since the introduction of the new MSMIS at NHSL during data collection. It has yet to be implemented at the level of internal (wards, theatres, ICUs, etc.) and external (dispensaries to patients) endpoints of the medical supply chain. Presently, the system is used by pharmacists, Medical Laboratory Technologists (MLTs), and Radiographers who manage the stores and inventories at the hospital level.

Research problem

Evaluating the user experience and its determinants is a vital exercise to gauge the effectiveness of the information system and the value of its investment[1].In the process of designing the information system, there are difficulties for the system users to understand and operate the system. An evaluation is needed to reduce the difficulties encountered by them in understanding the system for its effective operationalization. A good information system is a system that can be easily understood by users of the system[7]. Usability and positive user experience are vital in designing information management platforms to achieve their objectives [8]. User experience studies help to improve the information systems(e.g. through end-user-oriented designs) based on lessons learned. [9]

Objective

The study aimed to evaluate the experience of users in the new MSMIS by comparing it with the previous one at the NHSL

Methods

It was a mixed-method (both qualitative and quantitative approaches were adopted) descriptive study conducted at the NHSL in September 2023. The study began with key informant interviews with pharmacists inside and outside of NHSL to build information to develop a tool to assess the experience of users on the newly introduced MSMIS. The information was boosted with further interviews with medical directors and professionals in health informatics who designed the system. The tool was developed in a way to compare the new system with the previous one. It was a simple tool (self-administered questionnaire) composed of ten items/components (questions). The questions and answers were constructed in a way that could provoke the respondents to seriously spend some time reading them and answering. The experiences were measured on a five-point Likert scale. Interestingly, each scale was designed differently (for each component different response choice categories were used)[10]. The tool was validated with the help of experts. All users of MSMIS at NHSL were included in the study (n=21). Their answers were reinforced by qualitative interviews with the sectional heads among users by using the same questionnaire as a guide. In addition, direct observational visits were conducted to inspect the information system to verify their answers. Thus, the triangulation of data ensured the validity of the study findings. A scoring method (Likert scale value) was followed to convert the ordinal scale (of the Likert scale) into an interval scale. The scoring was done in a way the more positive experiences got the maximum points (most positive experience - 5 points, positive experience - 4 points, neutral - 3 points, negative experience - 2 points, most negative experience - 1 point)[11]. This helped to compare user experiences on each component assessed. And assisted in developing a composite scale to measure the overall experience of users on the new MSMIS in comparison with the previous one. Descriptive statistical methods were applied with the help of SPSS 25 software in the analysis and presentation of quantitative data. The thematic analysis was performed for qualitative data analysis, where the themes were the ten components of the questionnaire.

Results

User experience (Frequency)

The findings of the survey revealed that the users' experiences were negative on all the components evaluated. The results were [(N=number of users with negative opinions (percentage)]: speed [N=15 (72%)], user-friendliness [N=13 (62%)], simplicity of data entry and processing [N=16 (76%)], time taken for data entry and processing [N=14 (67%)], data availability for decision-making [N=12 (57%)], relevance of data [N=13 (62%)], accuracy of data [N=16 (76%)], availability of real-time data [N=13 (62%)], integration of the system [N=11 (53%)], and data security [N=17 (81%)]. Overall, 66% of the users were found to be negative with at least one component of the newly introduced MSMIS than the previous one. 4% of users were positive with at least one component of the new MSMIS than the previous one (Table 1).

Table 1: Experience of users on the newly introduced MSMIS in comparison with the previous one, at NHSL in 2023

Component	User experience											
	Very negative		Negative		Neutral		Positive		Very Positive		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Speed	9	43	6	29	5	24	0	0	1	5	21	100

User-friendliness	3	14	10	48	7	33	0	0	1	5	21	100
Simplicity of data entry	4	19	12	57	4	19	1	5	0	0	21	100
Time taken for processing	10	48	4	19	4	19	3	14	0	0	21	100
Data available for decisions	3	14	9	43	7	33	2	10	0	0	21	100
Relevance of data	3	14	10	48	8	38	0	0	0	0	21	100
Accuracy of data	3	14	13	62	5	24	0	0	0	0	21	100
Availability of real-time data	1	5	12	57	8	38	0	0	0	0	21	100
Integration of the system	2	10	9	43	10	48	0	0	0	0	21	100
Data security	7	33	10	48	4	19	0	0	0	0	21	100
Total	**45**	**21**	**95**	**45**	**62**	**30**	**6**	**3**	**2**	**1**	**210**	**100**

User experience (mean score)

The mean scores of user experiences on the newly introduced MSMIS in comparison with the previous one were: speed 1.95(SD=1.07), user-friendliness 2.33(SD=0.91), simplicity of data entry and processing 2.10(SD=0.77), time taken for data entry and processing 2.00(SD=1.14), available data for decision-making 2.38(SD=0.86), relevance of data 2.24(SD=0.70), accuracy of data 2.10(SD=0.62), availability of real-time data 2.33(SD=0.58), integration of the system 2.38(SD=0.67), and data security 1.86(SD=0.73). The mean composite score was 2.17(SD=0.56) (Table 2).

Table 2: Mean score of user experience on the newly introduced MSMIS in comparison with the previous one, at NHSL in 2023

Component	Mean score
Speed	1.95(SD=1.07)
User-friendliness	2.33(SD=0.91)
Simplicity of data entry and processing	2.10(SD=0.77)
Time taken for data entry and processing	2.00(SD=1.14)
Available data for decision-making	2.38(SD=0.86)
Relevance of data	2.24(SD=0.70)
Accuracy of data	2.10(SD=0.62)
Availability of real-time data	2.33(SD=0.58)
Integration of the system	2.38(SD=0.67)
Data security	1.86(SD=0.73)
Mean composite score	2.17(SD=0.56)

Qualitative data

The findings of the qualitative part of the study are listed below against ten thematic areas (Table 3).

Table 3: User experience on the newly introduced MSMIS in comparison with the previous one, at NHSL in 2023 - Qualitative findings

Thematic area	Findings
Speed	Some distribution points (stores) were directly linked by new fibreoptic connections, some were not. A proportion of those having direct fibreoptic connections were positive/neutral about the speed of the system, the rest were not.
User-friendliness	Most of them felt the new system was not user-friendly when compared with the previous one.
Simplicity of data entry and processing	Most of them view the new system as a bit more complicated than the previous one. They argued some steps were unnecessary.
Time taken for data entry and processing	The majority thought the new MSMIS consumed more time than the previous one due to some lengthy processing.
Available data for decision-making	According to the majority, the previous system had better automation and summary reports for their decision-making.
Relevance of data	Many of the users highlighted some data (e.g. long history sheet obliterates the screen whenever entering an item in the system) that was never required. They claimed the previous system had precise data.
Accuracy of data	Users explained a few incidents of flaws in the data. They remembered that was

	not the case in the previous MSMIS.
Availability of real-time data	Some were not happy with the stock balances indicated by the new system. They said that they couldn't find their stock balances at some points. However, could find it in the previous system, they uttered.
Integration of the system	Users found it difficult to understand the components. Still, they claimed that they face more challenges in the integration with MSD at the higher level and sub-stores at lower levels, than with the previous system.
Data security	The vast majority were unhappy with the data security of the new MSMIS. They said the previous system automatically logged out within minutes if no new entry was made. However, the new system needs to be logged out manually. They argued the possibilities of data manipulation by third persons in case of slips in logging out from the system.

Discussion

Methodology

Evaluation of user experiences with the help of a tailor-made tool was a regular practice at the initial stages of implementation of an information management system to ensure the effectiveness of the program as it provides room for improvement. The MSD did the same during the introduction of previous MSMIS for medical supplies management [1]. The comparison-evaluation studies often use open, scale, and mixed ratings [12]. Smaller questionnaires with fewer questions usually increase the response rate and the quality of information [13]. 5-point Likert scales are abundantly used to measure people's opinions on a particular object effectively [11][14].

Converting the ordinal scale (of a Likert scale) into an interval scale is a common practice by researchers to measure mean scores, but it provides less sense when the results are not normally distributed [15]. It's better to present the data in frequencies when responses are not normally distributed [15]. This study presented data in both ways to enlighten the findings[10]. The study could be considered a pilot study when considering the study population (n=21), for a greater study with a bigger population involving multiple institutions [16].
Hardware, software, network communications, data, people, processes, and integration among these are the major components of an information system [17]. Accuracy, completeness, consistency, currentness, accessibility, compliance, confidentiality, efficiency, precision, traceability, understandability, availability, portability, and recoverability are the features of data quality [18]. These are the information considered within the local context of MSMIS in determining the items of the questionnaire.
The principal component analysis of data showed the initial Eigenvalue of 5.1 and the first component accountable for 51% of the total variance. All the factors loaded above 0.6 and five of the factors loaded above 0.8. Thus, the Cronbach's alpha was 0.872. However, it's not advisable to calculate Cronbach's alpha when the sample size is less than 30 [19]. Yet the findings are encouraging that particular tool could prove its internal consistency in a larger scale study.

Findings

The findings could have triggered a warning alarm among designers and administrators of the new MSMIS as the users at NHSL were found to be highly negative with all components studied of the new system than the previous one. Above 60% of respondents were negative/highly negative with whatever component evaluated: speed (72%), user-friendliness (62%), simplicity of data entry and processing (76%), time taken for data entry and processing (67%), data availability for decision-making (57%), relevance of data (62%), accuracy of data (76%), availability of real-time data (62%), integration of the system (53%), and data security (81%).A mere 4% of respondents were identified to be positive with at least one of the components studied. The overall experience of users was estimated by a mean composite score was stood at 2.17(SD=0.56). As portrayed by the frequency distribution of user experiences, none of the mean scores computed for individual components crossed the halfway mark on the scale (all individual mean scores were found less than 2.4). The qualitative data findings and direct observations highly reinforced the quantitative findings.

It noticed that the users understood the need for a more comprehensive MSMIS by covering the areas that were not focused on in the previous system like procurement management, inventory management, donation management, local purchases, etc. They hailed the good things included in the system. They were seeking improvements in the new system by considering their opinions. Some were even afraid that the consequences of these alleged deficiencies could affect their carrier in the form of system-induced stock shortages or third-person sabotages.

Positive user experiences deliver better outcomes than intended. To ensure programs with greater adoption, the developers of digital health solutions should focus more on the interaction of the end-user with the software and device [20].Good user experience design can make a software application more usable, which means that it is easier for users to understand and use the application[21]. This can help to reduce the learning curve for users and improve their overall experience with the application[21].Improved usability can have several benefits for systems like: reduced training cost, fewer user errors, good quality of data, better adoptability of software, enhanced user satisfaction, improved productivity, and ultimately achieving the goals & objectives of the program [21].

In summary, interventions have to be made early to rectify the possible discontent brewing among users at NHSL towards the new MSMIS in comparison with the previous one to reap benefits out of the heavy investment made[22].

Limitations

There were only 23 users at NHSL during the period of the study which could impair the validity of the study findings due to reduced power and enhanced chance for errors [23]. Likewise, it did not help validate the questionnaire through statistical methods like factor analysis. The study understood the deficiency and tried to overcome it by complementing the quantitative component with the qualitative aspect. The data triangulation approach described earlier under the methodology assisted in producing valid results. No attempts were made to apply any inferential statistics by recognizing the deficiency in the research population. The principal component analysis and Cronbach's alpha reliability checks were done with the clear precaution of inadequate sample size.

There were greater variations in institutions under the Ministry of Health, Sri Lanka in their structure, line of control, capacity, and performance. The NHSL couldn't be matched with any other institutions in quantity and dimensions of services provided and available resources to support.

The above reasons highlight the weaknesses in generalizing the findings of the study to a wider setting under the Ministry of Health.

Conclusion

The new MSMIS an e-based logistics management system was implemented in 2023 by the MSD under the Ministry of Health, Sri Lanka to effectively manage medical supplies among state healthcare institutions across the island. The new system replaced the previous MSMIS that had been implemented in 2015, to incorporate wider aspects of supply chain management on par with changing internal and external environment.

The study found, that a mere 4% of users of the new MSMIS at NHSL had having positive experience with at least one component of the ten aspects studied when comparing the new system with the previous one. More than 60% of respondents reportedly had negative or highly negative experiences with all ten components of the system evaluated. The composite mean score of overall experience was 2.17(SD=0.56). The qualitative data fortified the findings of the quantitative data.

Recommendation

There were concerns over the validity of findings due to the narrow study population at NHSL and in generalizing the results to a wider setting of healthcare institutions under the Ministry of Health. But the findings couldn't be ignored as it might be a whistle-blower of a greater discontent among users under the carpet. Therefore, it is recommended to conduct larger-scale studies at regional and national levels with adequate sample size to ensure the validity and reliability of the study findings. The present tool could be applied in future larger-scale studies which could help ensure the internal consistency and construct validity of the questionnaire. The researcher has plans for such expanded studies by utilizing the results and experience gained this time. Future studies on this program much necessitated, concerning the vitality of the MSMIS in ensuring universal health coverage through effective and uninterrupted medical supplies for free healthcare services.

Reference

[1] K. T. Samararathna, S. Thantreege, and L. Panapitiya, "User Experience in Medical Supplies Management Information System in the Supply Chain Management at the Medical Supplies Division, Ministry of Health, Sri Lanka," *Sri Lankan J. Med. Adm.*, vol. 23, no. 0, p. 20, 2022, doi: 10.4038/sljma.v23i0.5408.

[2] S. L. Medical Supplies Division, Ministry of Health, "Medical Supplies Management Information System (MSMIS) Expansion Project," 2015. https://www.msd.gov.lk/index.php/31-msmis-expansion-project

[3] UNDP, "LMIS," 2023. https://undp-capacitydevelopmentforhealth.org/category/key-system-for-health/procurement-and-supply-chain-management/distribution/lmis/

[4] JSI, "THE SUPPLY CHAIN MANAGER'S HANDBOOK the Supply Chain Manager ' s Handbook," *USAID | Deliv. Proj.*, 2019.

[5] E. Xu, M. Wermus, and D. B. Bauman, "Development of an integrated medical supply information system," *Enterp. Inf. Syst.*, vol. 5, no. 3, pp. 385–399, 2011, doi: 10.1080/17517575.2011.566630.

[6] National Hospital of Sri Lanka, "Clinical care," 2015. http://www.nhsl.health.gov.lk/web/index.php?option=com_content&view=article&id=8&Itemid=136&lang=ta

[7] D. O. Putra and A. Setiawan, "The Importance of User Experience Analysis in the Design of an Education Information System Application," vol. 436, pp. 1208–1211, 2020, doi: 10.2991/assehr.k.200529.253.

[8] O. D. Alao, E. A. Priscilla, R. C. Amanze, S. O. Kuyoro, and A. O. Adebayo, "User-Centered/User Experience Uc/Ux Design Thinking Approach for Designing a University Information Management System," *Ing. des Syst. d'Information*, vol. 27, no. 4, pp. 577–590, 2022, doi: 10.18280/isi.270407.

[9] C. Dörner, J. Heß, and V. Pipek, "Improving information systems by end user development: A case study," *Proc. 15th Eur. Conf. Inf. Syst. ECIS 2007*, pp. 783–794, 2007.

[10] J. D. Brown, "Likert items and scales of measurement?," *SHIKEN JALT Test. Eval. SIG Newsl.*, vol. 15, no. March, pp. 10–14, 2011.

[11] I. Kusmaryono, D. Wijayanti, and H. R. Maharani, "Number of Response Options, Reliability, Validity, and Potential Bias in the Use of the Likert Scale Education and Social Science Research: A Literature Review," *Int. J. Educ. Methodol.*, vol. 8, no. 4, pp. 625–637,

2022, doi: 10.12973/ijem.8.4.625.

[12] J. a. Itmazi and M. G. Meg\'\ias, "Survey: Comparison and Evaluation Studies of Learning Content Management Systems," *Unpubl. Manuscr.*, no. June, pp. 1–8, 2005, [Online]. Available: http://moodle.org/pluginfile.php/554/mod_forum/attachment/127164/MICRO_PAPER.pdf

[13] H. Sharma, "How short or long should be a questionnaire for any research? Researchers dilemma in deciding the appropriate questionnaire length.," *Saudi J. Anaesth.*, vol. 16, no. 1, pp. 65–68, 2022, doi: 10.4103/sja.sja_163_21.

[14] T. C. James and O. Lee, "Using Likert-type scales in the social sciences," *J. Adult Educ.*, vol. 40, no. 1, pp. 19–22, 2011.

[15] G. M. Sullivan and A. R. J. Artino, "Analyzing and interpreting data from likert-type scales.," *J. Grad. Med. Educ.*, vol. 5, no. 4, pp. 541–542, Dec. 2013, doi: 10.4300/JGME-5-4-18.

[16] T. Details, "Pilot Study Sample Size Rules of Thumb Example 1 – Flat Sample Size Rules of Yhumb," *PASS Sample Size Softw.*, no. 2016, pp. 1–4, 2018.

[17] & W. A. Ly-Huong T. Pham, Tejal Desai-Naik, Laurie Hammond, "1.2: Identifying the Components of Information Systems," *LibreText*, 2010. https://workforce.libretexts.org/Bookshelves/Information_Technology/Information_Systems/Information_Systems_for_Business/01%3A_What_Is_an_Information_System/01%3A_What_Is_an_Information_System/1.02%3A_Identifying_the_Components_of_Information_Systems#:~:text=Hence%2C information systems can be,data%2C people%2C and processes.

[18] M. Talha, A. A. El Kalam, and N. Elmarzouqi, "Big data: Trade-off between data quality and data security," *Procedia Comput. Sci.*, vol. 151, pp. 916–922, 2019, doi: 10.1016/j.procs.2019.04.127.

[19] P. Samuels, "Advice on Reliability Analysis with Small Samples Statistical Methods – Scale reliability analysis with small samples Research question type : Most," *J. ResaerchGate Tech. Rep.*, no. August 2015, pp. 2–6, 2016, doi: 10.13140/RG.2.1.1495.5364.

[20] M. Blanchard, "Important of User Experience in Healthcare," *Heal. Policy Technol.*, vol. 12, no. 100753, 2023.

[21] SCHNELL, "Importance of user experience in software development," 2022. https://www.bespokesoftwaredevelopment.com/blog/importance-user-experience-software-development/#:~:text=Good UX design can make,number of benefits for businesses.

[22] N. Kannangara, "Controversy surrounds establishing information management system," *DailyMirror*, Colombo, 2023. [Online]. Available: https://www.dailymirror.lk/print/opinion/Controversy-surrounds-establishing-information-management-system/231-268641

[23] J. U. Blackford, "Leveraging Statistical Methods to Improve Validity and Reproducibility of Research Findings," *JAMA Psychiatry*, vol. 74, no. 2, pp. 119–120, Feb. 2017, doi: 10.1001/jamapsychiatry.2016.3730.