E-logistic Practices and Health Care Supply Chain Management for Public Referral Hospitals in Uganda

Sumaya M. Kagoya [ID]
Department of Applied Computing and Information Technology, Makerere University Business School, Uganda
Email: skagoya@mubs.ac.ug

Kezia H. Mkwizu
The Open University of Tanzania
Email: kmkwizu@hotmail.com

Abstract

This paper examined e-logistic practices and health care supply chain management in the context of Ugandan public referral hospitals. The prime objective was to examine the relationship between e-logistics operations and performance of health care supply chain management. A quantitative research approach was utilized to gather data from public referral hospitals respondents using structured survey questionnaires. For data analysis, descriptive statistics and Partial Least Squares-Structural Equation Modelling were utilised, aided by SmartPLS 3. Findings showed a positive significant relationship between e-logistics operations and performance of health care supply chain management in the context of Ugandan public referral hospitals. This study implies that the key e-logistics operations in relation to the performance of health care supply chain management, are central management of drugs, the correct order picking of drugs given to the right patients for quality control, and presence of an electronic system to update stock daily. Additionally, the findings designated that, e-logistics operations are related to the performance of health care supply chain management in terms of ICTs tracking systems and data transparency. The practical implication to the health sector- stakeholders, is to consider ICT-tracking systems and data transparency for e-logistics operations and performance of health care supply chain management.

Introduction

Adding electronic means in logistic practices is what every organisation wishing to attain a competitive age would yarn to achieve due to its merits which may accrue from it especially in areas of supply chain management (Kim & Lim, 2022; Grams, 2022). Additionally, logistic practices and management via incorporation of Information Communication Technology (ICT) is very relevant in today's varying business environments (Vinoth *et al.,* 2022; Cohen & Roussel, 2022). It is argued that e-logistics is of great importance in health supply chain management (Chen, Meng & Choi, 2022).

In health care supply chain management, health organizations have tried to seize the opportunity offered by ICTs to move towards a new management based on the control of financial, administrative and medical aspects (Tortorella *et al.,* 2022; Benzidia *et al.,* 2019). Similarly, Hristov (2022), Volland *et al.* (2017) highlighted the importance of the logistics function as a strategic place in the management of hospitals. Shen *et al.* (2007) and Bayer *et al.* (2022) commented that most studies have focused on the trajectory of intra-site patients by proposing innovative practices to optimize circulation and safety of care units.

African countries face challenges in health care supply chain management (Luganda *et al*., 2022; Baccedil & Erkan, 2021). One of the challenges identified by Pule (2014) is poor logistic and procurement procedures. Luganda *et al*. (2022) found that the challenges in Uganda's health supply chain system include ineffective structure to assist functions of planning, coordinating and managing but also a shortage of funds and skilled staff, and slow adoption of e-logistics information systems. Luganda and others (2022) proposed for more investment in areas such as policies and infrastructure.

In addition, Benzidia *et al.* (2016) cited that logistics culture is not adequately addressed in the strategic vision of hospitals, while Luganda *et al*. (2022) mentioned challenges like e-logistics and the need for more research in health care supply chain management, which motivated this research study. to examine e-logistics operations and health care supply chain management in the context of Uganda's public referral hospitals. Although literature there is an extensive literature on health care supply chain management (Fathollahi-Fard *et al.,* 2022; Ash *et al.,* 2022; Kim & Kim, 2019; Mackintosh *et al.,* 2018), there is still limited studies on e-logistics operations and health care supply chain management, particularly in the developing countries like Uganda.

More so, despite the fact that prior researchers (Tasnim *et al.,* 2022) did a great job based on the reviewed literature, however, there is a methodological gap in the area of quantitative studies, as most of the preceding authors focused more on qualitative studies which were chiefly carried out in the developed nations. Although such qualitative studies give a deep understanding of some respondents' personal insights which might be hidden feelings, their findings cannot be applied to every nation with varying levels of development in all spheres (Kagoya, Tinali & Caine, 2021). This implies that, such results become ungeneralizable to developing nations such as Uganda, which makes this study viable. Beached on this status quo, coupled with the alluded challenges in the reviewed literature from previous scholars, plus the prerequisite for more research in the health care supply chain management, where it is flimsy or scantly conducted especially in the developing countries (Uganda inclusive) (Ho *et al.,* 2022) and a call for further academic probe becomes a necessity. Important to master, is the fact that, delays in supply of drugs due to use of traditional logistic methods, may result to high death rates in the referral regional hospitals in Uganda (Link *et al.,* 2022).

Also, prior researchers jotted that covid-19 has exposed the reality that, the healthcare sector is the most crucial sector which needs to be given first priority by all nations, coupled with ICT usage to aid logistic operations and dissemination of information (Sumaya & Mushi, 2022; Zhang *et al.,* 2022; Kagoya, 2020a). Therefore, this current study is motivated to research on e-logistics operations and health care supply chain management in the context of Ugandan public referral hospitals. It should be recalled that, this study's specific objective is to examine the relationship between e-logistics operations and performance of health care supply chain management in the Ugandan public referral hospitals.

Additionally, to bridge the gap on the methodology and contextual limitations in understanding health care supply chain management, therefore, this study was guided by the Unified Theory of Acceptance and Use of Technology (UTAUT) to specifically examine the relationship between e-logistics operations and performance of health care supply chain management in the context of Uganda's public referral hospitals. This study hypothesised that; **H1**: There is a positive relationship between e-logistics operations and performance of health care supply chain management. The study is significant and important to health care stakeholders in regard to the issue of e-logistics operations in relation to performance of health care supply chain management in public referral hospitals in order to improve the health sector.

Literature review

Empirical literature review

E-logistics functions as a nerve system to guide and support the entire supply chain for flexible flow of information in the entire organisation (Chen, Meng & Choi, 2022; Zhang *et al.,* 2022; Huang, Chan & Chung, 2022). Similarly, from the experts in the industry and academia of logistics and supply chain management, e-logistics is regarded as the use of systems and technologies to achieve productivity and competitiveness in transport, logistics and supply chain management. Preceding researchers suggest that, the ICTs may be used for; time compression, Just-in time (JIT), vendor- managed inventory (VMI), collaborative planning forecasting and replenishment (CPFR) plus cross docking (Wang & Pattit, 2016; Karatas *et al.*, 2022; Mushi & Kagoya, 2022).

It is worth noting that, in this research study, e-logistic practices refer to activities undertaken by public referral hospitals to promote effective health care supply chain management using ICTs. ICTs used in logistics, aid in smoothening the entire process of pressing and receiving orders of drugs instantly and subsequently administering to the right patients in the referral hospitals and this is in line with prior researchers (Király *et al*., 2022). On the other hand, multitudinous authors assert that, procurement is an important logistic function that should not be ignored, when dealing with supply chain management (Li *et al*., 2022; Israel, 2022). More so, Shahin *et al.* (2022), define e-procurement as a process of procurement of required resources or services by making use of ICT.

It should be remembered that, several authors have perceived the concept of health care supply chain management in a number of angles. For instance, Chopra and Meindl (2007) and Ashcroft (2006) delineate the concept of health care supply chain management as controlling and flow of information, materials, services and money through any activity in a way that promotes the quality of an organization's operations and satisfy consumers' needs. Conversely, Mathur *et al.* (2018) regard health care supply chain management as the process involving group effort of coordination with various channel partners (suppliers, customers and intermediaries) that act. For purposes of this paper, health care supply chain management refers to the management of information flow, goods and services in the public referral hospitals.

Various studies have been conducted on health care supply chain management (Wu, Zha & Yu, 2022; Kim *et al.,* 2022; Huang, Chan & Chung, 2022; Luganda *et al.,* 2022; Kagoya & Mkwizu, 2019). Additionally, other scholars argued on development linkages in the health sector

in an effort to build more literature in understanding health care supply chain management (Pananond, 2022).

Arora and Gigras (2018) carried out a study on the importance of supply chain management in the health care of third world countries with the aim of finding vulnerabilities among departments and proposing measures to reduce them. They found that integrating subsystems, streamlining workflow and use of technologies can assist in the implementation of supply chain management, through ensuring availability of medicine and product at the right time and coordination on all departments.

Abdalla and Nakagawa (2022) conducted a study on green logistics, using supply chain innovation to mediate the relationship between entrepreneurial leadership, and adaptability in Japan, China and Sudan. The findings envisaged that in spite of the different and altering business environment, there was a positive relationship between entrepreneurial leadership, and adaptability. The results placed extra emphasis on adopting pertinent and up-to-date technology and refining the procedures of supply chain. This study is also supported by past researchers conducted globally (such as, Huang *et al.,* 2022), which dwelt on digitalization of logistic practices in health care organisations in different continents.

Additional study by Cherono (2022) asserted that, e-logistics increase efficiency, cuts costs via reduction of paper work and its time saving thus enabling Kenyan companies to capture, track goods and aid clients to gain confidence in companies dealing with logistics. On the contrary, this current research study suggests that managers and other key stakeholders to involve e-logistic practices in health care supply chain management in the public referral hospitals in Uganda.

Tan and Parcia (2022) researched on donation and request efficiencies in times of crisis. From the input-oriented DEA assessments, recommendations to reduce excessively inflated inputs and reallocate donors to other hospitals in need were forwarded. This study found that, at the hospital-level, quantity requests for items were magnified. Inputs found in excessive use were recommended to be reduced to improve services to an optimal level. Donors excessively solicited by a hospital were also recommended to make pledges for other hospitals on the platform. Counts of requested items and their corresponding quantities were also suggested to be reduced for optimality.

Lin (2022) researched about e-logistics by focusing on how electronic-green supply chain management is influenced by Information technology in Taiwan firms. Findings revealed that, competitiveness plus environmental superior performance are crucial for electronic green supply chain management in the context of Taiwan. It also reveals that electronic-green supply chain management internal integration is influenced by Information technology infrastructure. On the other hand, Yin and Li (2022) conducted a study using algorithm to come up with e-logistic equation from a sample size of 91 obtained from panel data. Findings revealed that emphasis should be placed in supply chain financial agricultural products to calculate accurately cooperative customers' compliance probability.

Another study was conducted by Suleiman (2015) on factors that influence the adoption of that e-procurement as a function of e-logistics and value addition in health care supply chain management in Tanzania. The findings revealed that it was easy for internal employees to adopt e-procurement but difficult for supplier to adopt new systems due to lack of knowledge and cost of operations. On the contrary, this research suggests that, public referral hospitals should utilise e-logistic operations just in time to track, deliver the right drugs to the right patients. This would

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perhaps reduce on the high death rates which ooze from delays due to the use of traditional brick and mortar logistic methods.

Chen, Meng and Choi (2022) researched on Part E transportation review development plan while focusing on e-logistics for a period ranging from 1997-2021 and established seven emerging future research topics. The data was analysed via bibliometric approach to get findings regarding future directions in the Part E transportation trends.

It is worth noting that quite a number of previous scholars in health care supply chain management emphasized the use of ICTs in conducting logistic (Liu *et al.*, 2022; Zhang *et al.*, 2022). For instance, Zhang *et al.* (2022) studied supply chain management in financial activities via fusing the behavioural data and demographics, to predict credit risk of small and medium enterprises. Findings revealed that behavioural data for dynamic financing and enterprise static demographic data are vital in SMEs for boosting risk prediction for credits.

Masheti (2016) did a study in Kenya to investigate e-procurement practices, as an e-logistic function and operational of pharmaceutical manufacturing firms in Nairobi. The application of descriptive statistics and regression analysis revealed that e-procurement enabled pharmaceutical manufacturing firms to improve order processing, reduce material lead time, decreased transaction costs, improved product/service quality and increased order placement. Further findings showed that, e-planning, e-supplier selection, e-tendering and e-sourcing influenced the operational performance of pharmaceutical manufacturing firms in Nairobi. Based on these findings, it was recommended that, more investment should be directed to e-procurement in order to experience optimal benefits such as, widening the scope of suppliers. Conversely, the current study suggests that there is a significant positive relationship between e-logistic operations and performance of health care supply chain management in the context of Ugandan public referral hospitals.

Using a quantitative approach, Mackintosh *et al.* (2018) found that, in the context of poor access to reliable medicines, extensive reliance on private medicines purchase, increased globalization of procurement systems, domestic linkages between health and industrial sectors have been weakened in the East Africa countries. The results of Mackitonsh *et al.* (2018) are in-line with the previous studies by Inderfurth, Sadrieh and Voigt (2013) and Grainger (2021) who pointed out that, Uganda's health care sector faces a multitude of challenges due to procurement and logistic procedures such as, poor sourcing procedures and bullwhip effect that can affect information flow.

The reviewed literature indicates that, health care supply chain management requires more research and in particular, Uganda, which still faces challenges in its health care sector in relation to logistic practices. Therefore, this paper examines health care supply chain management and e-logistic practices with the specific objective of examining the relationship between logistics operations and performance of health care supply chain management in the context of Ugandan public referral hospitals.

Theoretical Literature Review

Preceding scholars emphasize theoretical literature review that, aids in the chronological flow and clear linkage among the study objectives, methodology and results (Chu *et al.,* 2021). It should be noted that, positivist researchers utilise theoretical underpinning while dealing with

quantitative research to minimise biasness that may affect the overall findings of the study (Kazdin, 2021; Gucciardi, Lines & Ntoumanis, 2022).

Unified theory of acceptance and use of technology (UTAUT)

Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by Venkatesh, *et al.* (2003), with the assumption that individual's internal schema of beliefs about usage and acceptance of technology (Chopdar *et al.*, 2022). When dealing with matters regarding technological adoption and usage like e-logistics, it is deemed important to employ theories like UTAUT hence its relevance in this research (Yeong *et al.*, 2022; Kagoya & Mbamba, 2021). UTAUT has been pragmatic in various research and capacious scholars have employed it in their prior studies (Venkatesh, 2022; Kagoya & Mbamba, 2021; Khatun *et al.*, 2017). The study by Khatun *et al.* (2017) examined cloud-based mHealth service for primary care and revealed that the relationship between performance expectancy and behavioural intention are not significant. The selection of UTAUT in this research was due to the assumption that, an individual's behavioural intention to use a technology is influenced by performance expectancy, effort expectancy, social influence, and facilitating conditions. In this paper, performance expectancy, effort expectance, usability and benefits respectively, were analysed to predict the relationship between e-logistic practices and health care supply chain management. UTAUT supported the specific objective that argues that, there is a statistical positive significant relationship between e-logistics operations and performance of health care supply chain management in the Ugandan context.

Conceptual Framework

The conceptual framework in Figure 1 shows the hypothesized relationship which stated as **H1:** There is a positive relationship between e-logistics operations and health care supply chain performance.
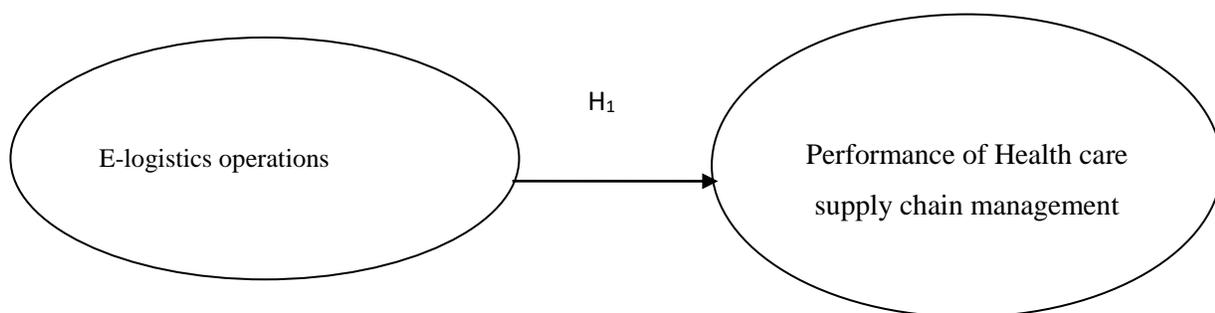

Figure 1: Conceptual Framework. Source: Compiled from Literature

Figure 1 illustrates a conceptual framework which was developed after a thorough literature review done by proceeding researchers. Thus, this framework has been used to envisage that there is a positive relationship between e-logistics operations and health care supply chain performance in the context of Uganda referral hospitals. The framework depicts both independent variable (e-logistic operations) and dependent variable (Performance of Health care

supply chain management) and their relationship which is hypothesized by H_1. This implies that, use of ICT in logistic operations lead to performance of health care supply chain management) and vice versa leaving other factors constant.

Methodology

This study used a quantitative approach which considers a positivism and deductive philosophical orientations for purposes of testing the hypothesis stating that, there is a significant relationship between e-logistics operations and performance of health care supply chain management. The area of study is in Uganda and the staff, procurement, and logistic managers of six regional referral hospitals (Jinja, Kiruddu, Masaka, Mbarara, Kabale and Arua), were the respondents in this study. Purposive sampling was used in order to obtain data from informed respondents who were knowledgeable about the subject matter and in most cases are few in numbers compared to their clients and other fields in Uganda (Luganda *et al*., 2022). This makes choice of purposive sampling technique the most effective and efficient in this study. Due to ethical reasons of confidentiality and privacy, the individuals' names of the respondents were not included in this research. This was agreed upon by the researchers and the respondents before data collection. Structured questionnaires were utilised to gather information from a sample size of 40 respondents (staff) from public referral hospitals within Uganda.

The measurement items for logistics operations, were adopted from Pinna, Carrus and Marras (2015) whereby the 9 indicators were obtained. These included: There is frequent supply receipt of drugs at the hospital in a timely manner (Log15); There is bulk storage of drugs in the hospital (Log16); There is proper arrangement of drugs in the hospital (Log17); There is central management of drugs in the hospital (Log18); The order picking of drugs is at the right time (Log19); The order picking of drugs is given to the right patients for evaluation (Log20); The order picking of drugs is given to the right patients for quality control (Log21); There is stock replacement of drugs just in time in the hospital using logistic management information systems (Log22); There is a person to update stock daily (Log23).

Conversely, the measurement items for performance of health care supply chain management were adapted from Mathur *et al*. (2018). The 7 statements for performance of health care supply chain management were; There is higher performance expectation for savings from health care supply chain management (Per24); There is need to integrate health care supply chain management data with hospital data using ICTs tracking systems (Per25); Hospitals should use data analytics to improve performance of health care supply chain management (Per26); Hospitals should use benchmarks to improve performance of health care supply chain management (Per27); Managers should reposition health care supply chain as a strategic function in hospitals (Per28); Managers should build trust with health care supply chain partners (Per29); Managers should improve data transparency across the health care supply chain management (Per30).The composite reliability indicated for logistics operations (0.92) and for performance on health care supply chain management (0.82). This study used descriptive statistics assisted with SPSS version 21 and Partial Least Squares Structural Equation Modelling (PLS-SEM) assisted with SmartPLS Version 3 to analyse data collected from the respondents.

Partial Least Squares-Structural Equation Modelling was utilized in this research study since it considered beyond measurable doubt, to be the desired slant while dealing with complex structural and formative models (Hair *et al.,* 2021; Yıldız, 2022; Kagoya & Mbamba, 2021).

These models are grounded on crucial aspects like statistical significance, indicator weights relevance, collinearity indicators, and convergent validity (Sarstedt *et al.,* 2022).

Results

The demographic information of the sampled respondents is shown in Table 1. Findings indicate that majority of respondents were males (52.5%), between 36 to 45 years old aged (52.5%), have university education (100%), and married (42.5%). These results suggest that, majority of respondents were educated married males between 36 to 45 years old.

Table 1: Respondents Demographic Information

		Frequencies	Percentage
Age Groups	18-25	5	12.5%
	26-45	5	12.5%
	36-45	21	52.5%
	46 years and above	9	22.5%
Gender	Male	21	52.5%
	Female	19	47.5%
Marital Status	Single	9	22.5%
	Married	17	42.5%
	Divorced	6	15%
	Widowed	8	20%
Education	University	100%	100%

Source: Field data (2019)

Reliability and validity assessments

The composite reliability and Average Variance Extracted (AVE) are indicated in Table 2 showed that e-logistics operations is 0.92 and for performance on health care supply chain management 0.82. According to Ringle, Wende, and Becker (2015) and Kagoya and Mbamba (2021), composite reliability values of 0.70 and above are considered acceptable and reliable for further analysis.

Table 2: Composite reliability and AVE values for e-logistics operations and performance of health care supply chain management

Variables	Composite Reliability	AVE
e-logistics operations	0.920	0.717
Performance of health care supply chain management	0.820	0.704

Source: Field data (2019)

The factor outer- loadings for the e-logistics operations and performance health care supply chain management as per Table 3 indicated acceptable values of 0.70 and above thus supporting recommendations by Hair and Sarstedt (2019), and Hair, Howard, and Nitzi (2020). Those variables that had values below 0.70 were dropped from further analysis.

Table 3: Outer-loadings e-logistics operations and performance of health care supply chain management

Variables	Outer-loadings
e-logistics operations	
Log 18	0.859
Log 21	0.773
Log 23	0.903
Performance of health care supply chain management	
Per25	0.943
Per30	0.721

Source: Field data (2019)

The discriminant validity was done prior to further analysis of the Variance Inflation Factor (VIF). Table 4 shows the discriminant values for e-logistics operations and performance of health care supply chain management by using Fornell-Larcker Criterion to ensure that the values acceptable for all variables are below 1. The Fornell-Larcker Criterion can be used to assess the discriminant validity in research for purposes of preventing multicollinearity issues (Rönkkö & Cho, 2022; Sarstedt *et al.,* 2022).

Table 4: Discriminant validity for e-logistics operations and performance of health care supply chain management

Variables	Discriminant Validity R	
	Log	Per
E-logistics operations (Log)	0.835	
Performance of health care supply chain management (Per)	0.369	0.838

Source: Field data (2019)

Prior to bootstrapping analysis, the collinearity values based on Variance Inflation Factor (VIF) for the retained items as per Table 5 are Log18 (2.316), Log21 (2.029), Log23 (1.597), Per25 (1.251) and Per30 (1.251). These values have indicated VIF < 4 or VIF < 5 and this is acceptable according to Hair, Black, Babin and Anderson (2010) and Ringle, Wende and Becker (2015) respectively.

Table 5: Collinearity statistics (VIF) values for e-logistics operations and performance of health care supply chain management

Variables/Codes	Collinearity (VIF) values
E-logistics operations:	
Log18	2.316
Log21	2.029
Log23	1.597
Performance of health care supply chain management	
Per25	
Per30	1.251
	1.251

Source: Field data (2019)

The inferential statistics using PLS-SEM analysis through the bootstrapping technique revealed in Table 6 as significant with p value (p=0.000) for e-logistics and performance of health care supply chain management.

Table 6: T-value and P-value for e-logistics operations and performance of health care supply chain management

Independent Variable	T-Value	P- Value	Decision
e-logistics operations	2.82	0.00	Support

Source: Field data (2019)

Furthermore, the significant relationship between e-logistics operations and performance of health care supply chain management (p=0.000). The findings in Figure 1 show that the T-value (2.82) is above 1.96 and therefore, e-logistics operations have a significant relationship to performance of health care supply chain management.
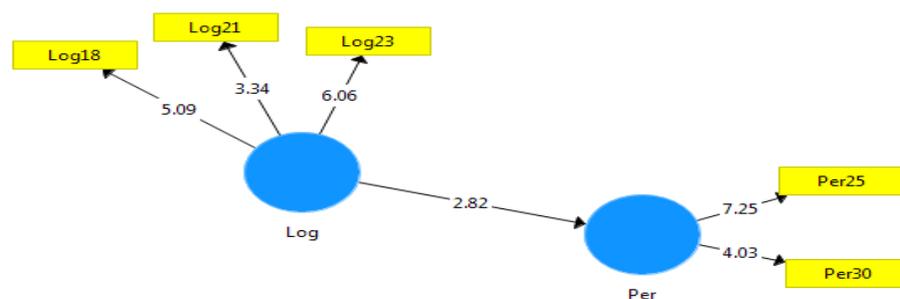

Figure 1: T values of e-logistics Operations (Log) on Performance of healthcare supply chain management (Per)

In Figure 2, the p value (p=0.000) further indicated that the relationship between e-logistics operations (Log) and performance of health care supply chain management (Per) is significant. Thus, the significant results for the hypothesis supports the UTAUT theory applicability in

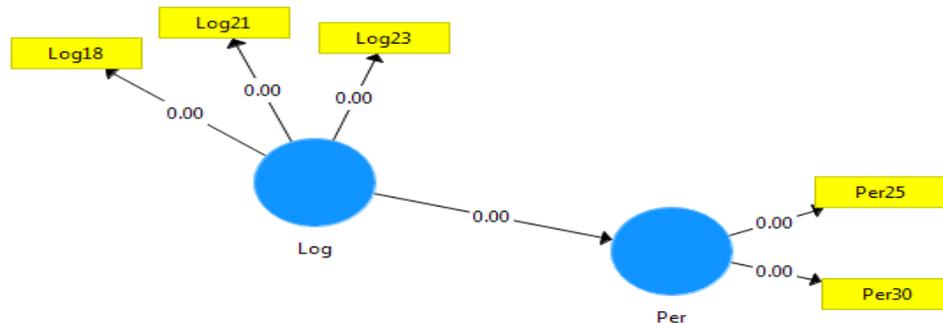explaining the relationship between e-logistics operations and performance of health care supply chain management.

Figure 2: P values for e- logistics Operations (Log) and Performance of healthcare supply chain management (Per).

Discussion and interpretation of the research findings

Information on the demographic of the respondents for this study suggests that, the majority of the respondents were characterised as educated middle aged married men. Furthermore, most of these educated middle aged married men opinions on e-logistics operations have indicated a significant relationship to performance of health care supply chain management. These significant findings suggests that "central management of drugs in the hospital" (Log18), "the order picking of drugs is given to the right patients for quality control" (Log21), and "there is a person to update stock daily" (Log23) are indicators of e-logistics operations that predict performance of health care supply chain management in terms of the need to integrate health care supply chain management data with hospital data using ICTs tracking systems, and managers should improve data transparency across the health care supply chain management.

The results of this study differ from Arora and Gigras (2018) because in the context of Uganda, the predictors of performance of health care supply chain management are "there is central management of drugs in the hospital", "the order picking of drugs is given to the right patients for quality control" and "there is a person to update stock daily". In addition, the results of this study are in line with Masheti (2016) and Luganda *et al*. (2022) which recommended for more investment in e-logistics and e-procurement practices to reap optimal benefits like widening the scope of suppliers. The need to reap the benefits of ICT usage support former studies such as; Karatas *et al.* (2022), and Kagoya and Mbamba (2021).

This study's reliability measurement using composite reliability were beyond the recommended level of 0.7, hence portraying acceptable values of (0.92) and (0.82) for e-logistics operations and for performance on health care supply chain management respectively. Similarly, the discriminant validity for e-logistics operations and for performance on health care supply chain management was in line with the threshold in that, the variable nearing the numerous constructs should be unrelated to each other. The discriminant validity values of this study are in

line with other preceding authors for items in the data collection tool that measures various constructs ought not to correlate (Rönkkö & Cho, 2022; Yarkoni, 2022).

Prior studies on PLS-SEM emphasize that, researchers should first cater for matters regarding multicollinearity then proceed with assessment structural model (Chopdar *et al.,* 2022; Kagoya & Mbamba, 2021). In this study, prior to bootstrapping analysis, the collinearity values were checked and the retained items were Log18 (2.316), Log21 (2.029), Log23 (1.597), Per25 (1.251) and Per30 (1.251). The results indicated Variance Inflation Factor (VIF) of less than 4 which is acceptable according to Hair, Black, Babin and Anderson (2010), Ringle, Wende and Becker (2015), and also in line with past studies (such as, Berber *et al.,* 2022; Banerjee, 2022). Likewise, the rule of thumb for VIF when dealing with multicollinearity aspects should be less than 10 (Sarstedt *et al.,* 2022; Donini *et al.,* 2022; Gokmen, Dagalp & Kilickaplan, 2022). This also means that, the model is not polluted with common bias method effects (Kock, 2022; Kagoya, Tinali & Caine, 2021). Those variables with collinearity that are not within the acceptable range were dropped and were not considered for further analysis.

The inferential statistics using PLS SEM analysis through the bootstrapping technique revealed that there is significant relationship between logistics operations and performance of health care supply chain management (p=0.000). The findings in Figure 1 show that the T-value (2.82) is above 1.96 and therefore, e-logistics operations showed significant relationship to performance of health care supply management. In Figure 2, the p value (p=0.01) further indicates that the relationship between e-logistics operations (Log) and performance of health care supply management (Per) is significant. This suggests that (Log18, Log21 and Log23) are indicators of e-logistics operations that predict performance of health care supply chain management in terms of the need to integrate health care supply chain management data with hospital data using ICTs tracking systems (Per25), and managers should improve data transparency across the health care supply chain management (Per30).

The significant results of the relationship between e-logistics operations and performance of health care supply chain management support the UTAUT theory, and UTAUT is used in this study to emphasize the importance of technology (e-logistic operations) acceptance and use by individual managers and other key stakeholders in the context of Ugandan public referral hospitals. This suggests that, e-logistics operations can predict performance of health care supply chain management hence stakeholders in the health sector should consider e-logistics operations as key to good performance of health care supply chain management. The results of this study differ from Liu *et al.* (2022) and Arora and Gigras (2018), because in the context of Uganda, the predictors of performance of health care supply chain management are "there is central management of drugs in the hospital", "the order picking of drugs is given to the right patients for quality control" and "there is an electronic system to update stock daily". In addition, the results of this study are in line with Wu, Zha and Yu (2022) and Masheti (2016), which recommended for more investment in e-logistics practices to reap optimal benefits like widening the scope of suppliers.

From a theoretical perspective, these significant results depicting a positive significant relationship between e-logistics operations and performance of health care supply chain management testifies that, the hypothesis of the current study is supported by UTAUT theory. This infers that, e-logistics operations predict performance of health care supply chain management in the context of Uganda's public referral hospitals. These results are supported by preceding researchers whose findings depicted that, there is a positive significant relationship

between e-logistics practices and performance of health care supply chain management (Alzoubi *et al.,* 2022; Ash *et al.,* 2022)

Conclusion

This paper specifically examined e-logistics operations and performance of health care supply chain management in the Ugandan referral public hospitals. The study findings reveal a significant positive relationship between e-logistics operations and performance of health care supply chain management and this was supported by UTAUT which emphasizes technology acceptance and use. Therefore, this study concludes that, there is a positive statistically significant relationship between e-logistics operations and performance of health care supply chain management in Uganda's public referral hospitals. The indicators of e-logistics that positively and significantly predict performance of health care supply chain management are central management of drugs in the hospital, the order picking of drugs is given to the right patients for quality control, and there is an electronic system to update stock daily. Moreover, the e-logistics operations predict indicators of performance health care supply chain management which are "there is need to integrate health care supply chain management data with hospital data using ICTs tracking systems" and "managers should improve data transparency across the health care supply chain management".

Implications

The results of this study have a theoretical implication in the context of Uganda public referral hospital whereby the UTAUT theory can be applied to explain the relationship between e-logistics operations and performance of health care supply chain management in the Ugandan. This study has implications to managers dealing in e-logistics, procurement plus supply chain, practitioners and academia who may aim at attaining a competitive edge, in their daily business and academic operations (Mushi & Kagoya, 2022; Sahinyazan, Rancourt & Vertex, 2021; Kagoya; 2020b). The outcome of this study guides the policy makers and practitioners in the health care sector to consider the predictors of e-logistics operations for effective decision making in the health sector. These include among others, "a central management of drugs in the hospital", "the order picking of drugs is given to the right patients for quality control" and "there is an e-logistic system to update stock daily" in relation to performance of health care supply chain management.

Recommendations, limitations and future studies

Based on the findings, the study recommends managers to ensure that E-logistics operations are maintained to aid performance of health care supply chain management. This can be done by employing proper and new ICTs tracking systems which will ensure data transparency. This implies that all stakeholders in the healthcare sector should embark on using electronic means for logistics operations and abandon the brick-and-mortar methods in health care supply chain management. This will reduce on the high rate of mortality rates in referral hospitals, when the right drugs delivered and given on time to the right patients. More so, the e-logistic operations system will save a lot of drugs from getting expired before they given to the right patients hence saving costs, lives and tax payers' money. Due to the scanty literature in the Ugandan context as

observed in the literature review, this study recommends that more research should be conducted in developing countries like Uganda about e-logistic operations to manage health care supply chain management and avoid rampant death rates in public referral hospitals.

This study has limitations, which were small sample size and mainly quantitative approach. Therefore, future studies can explore further the relationship of e-logistics operations and healthcare supply chain management using larger sample size and mixed approach. Similarly, this study, was limited to Ugandan public referral hospitals, where by the findings may differ from those in the private hospitals where logistic issues may be quickly handled for proper decision-making. Although these findings may be generalized to other African countries with similar public referral hospital settings like that of Uganda, there is still need for imminent researchers to carry out comparative studies between Uganda and other countries with differing levels of economic, political development, cultural and technological, to come up with differences and similarities.

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