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Influence of Information Sharing on Availability of Contraceptives: A Case of Uganda's Public Health Sector

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Abstract:
There is shortage of literature that links information sharing and availability of contraceptives and specifically focusing on the public health sector. This paper examines the influence of information sharing on the availability of contraceptives in Uganda's public health sector. Drawing from the resource dependence theory (RDT), this study adopts a deductive approach to address the issue at hand. Using stratified sampling, quantitative data was collected from 165 self – administered questionnaires from public health facilities in South Western Uganda. PLS-SEM approach was used for data analysis. The findings of the study reveal a positive and significant influence between logistics management information systems (LMIS) and training on the availability of contraceptives in the public health sector. At the same time, the findings also reveal a positive but non-significant influence between sensitization and availability of contraceptives. The government is advised to increase resources to implement more logistics management information systems (LMIS) in public health facilities, improve on capacity building more especially with village health teams (VHTs) and implementing adolescent clinics.

Keywords: Logistics management information systems, sensitization, training, stochastic, bullwhip

1. Introduction

Availability of contraceptives in public health sector plays a key role in the national and human development. Contraceptives are considered a life - saving intervention for both developed and developing countries, whose availability should be given utmost attention (Nara *et al.,* 2020). Besides, previous scholars (Adjei *et al.,* 2015; Ooms *et al.,* 2020; Mezmur, Assefa & Alemayehu, 2021), argue that contraceptives have an impact on regulating population growth that consequently impacts on education and poverty levels as well as maternal and child health, thus their availability is paramount. Jones (2005) and Chin *et al.* (2020) expound that whereas there are so many people globally who do not seek for contraception, their availability specifically in public health facilities plays a key role in minimising teenage pregnancies, regulating population growth and government expenditures while trying to deal with the consequences of their unavailability. Moreover, Chandani and Breton (2001) and Kroelinger *et al.* (2019) reveal that ensuring continuous availability of contraceptives require uninterrupted information flows across the supply chain regarding customer requirements, stock levels and consumption rates.

Previous studiessuch as Ahmadi *et al.* (2015),Orr *et al.* (2016) and Kritchanchai *et al.* (2018) note that timely sharing of quality information amongst different stakeholders in the public health sector is an impetus to enhancing availability of products in the sector. Managing and exchanging information such as customer requirements for contraceptives helps suppliers and other stakeholders to fulfil the orders more quickly (DeLone & McLean, 2002; Mezmur *et al.,* 2021). Similarly, Simchi-Levi and Zhao (2003) argue that information flow is vital in dispelling the myth and misconceptions about the product's characteristics, effects and availability. The most noted hindrance to information flow across the supply chain is the transmission of faulty information 'bullwhip effect' that sometimes disrupts the availability of products especially in the public health sector where demand is highly stochastic (Yadav, 2015; Cook, Waddington *et al.,* 2019). Consistent with the resource dependency theory (RDT) by Pfeffer & Salancik (1978), there is need for public health facilities to continuously and critically analyse both the internal and external environments to manage information asymmetries that could lead to distortion of orders (Davis & Cobb, 2010; Ahmadi *et al.,* 2015). Despite this knowledge, little has been investigated on the appropriate dimensions that can improve information flow management in the public health sector to ensure availability of contraceptives. Consequently, variables such as logistics management information systems (LMIS), sensitization and training may have an important influence on the availability of contraceptives in a developing country's public health sector (Jones, 2005; Simchi-Levi & Zhao, 2003; Yadav, 2015; Kritchanchai *et al.,* 2018).

1.1. Logistics Management Information Systems (LMIS)

Anjomshoae et al. (2017) state that LMIS is a critical tool used in identifying the rate at which the contraceptives are consumed, the needs of the clients and customer orders in these public health facilities, thereby enhancing their availability. Consistent with resource dependency theory (RDT), information is a vital resource that organizations can capitalize on to bring closer the right products needed by the clients (Davis & Cobb, 2010). The RDT assumes that public health facilities manage their dependencies in the face of uncertainty and that, as the demand for contraceptives become more stochastic and dependencies increase, public health facilities seek a logistics management information system that is capable of capturing reliable information and disseminate it to all the stakeholders to minimise stock out situations (Wudhikarn et al., 2018; Moons *et al.,* 2019). Furthermore, Kritchanchai, *et al.* (2018) emphasise that obtaining the right information from the external environment, especially from the users could be a critical resource in procurement planning and in developing efficient distribution networks which enhances the availability of contraceptives. In addition, Seidman and Atun (2017) reveal that improved data systems such as logistics management information (LMIS) shapes the procurement strategy in the sector that subsequently leads to availability of contraceptives in the public health sector. Similarly, Subramanian (2020) notes that logistics management information systems in public health facilities can aid in standardisation of data and improve direct communications with suppliers thereby improving availability of products in the facility if well implemented. Besides, Zhang et al. (2018) also argue that health facilities that have established information systems like LMIS could improve on forecasting and planning, delivery schedules as well as obtaining accurate assessment of customer requirements that subsequently improves availability of contraceptives. Based on this discussion, the study hypothesises that: -

- H1: LMIS has a positive influence on the availability of contraceptives

1.2. Sensitization

Information flow through community sensitization and the involvement of the village health teams in the public health sector improves the positive attitude towards the use of contraceptives and subsequently their availability. Orach et al. (2015) argue that sensitization programs about contraceptives instills confidence and dispels fears and misconceptions about the effects of contraceptives and eventually increases their requisitions in public health facilities. Considering the stochastic nature of demand for contraceptives in the public health sector, constant community sensitizations and outreaches could play an important role in ensuring consistent supply through enabling clients to make appropriate requisitions (Chin et al., 2020). Moreover, Ajewole et al. (2018) and Ajong et al. (2018) reveal that organizations intending to ensure consistent availability of contraceptives require to intensify sensitization campaigns through community-based outreaches, community sensitization meetings, dialogues and radio talk shows. In agreement, Ajong et al. (2018 argues that increased information flows about the benefits and effects of contraception through community sensitization, could increase their requisitions in public health facilities that leads to an increase in their availability. Additionally, Lewis et al. (2013) note that increased knowledge and confidence instilled to communities through sensitizations and outreaches, could help these communities to make appropriate requisitions that shapes the procurement planning and enhance consistent availability of contraceptives.Therefore, based on the above discussion, it can be advanced that information flow through community sensitizations and outreaches could play an important role in promoting availability of contraceptives in the public health sector. The study, therefore, tests the following of hypothesis: -

- H2: Sensitization has a positive influence on the availability of contraceptives

1.3. Training

Training health care providers keep them abreast with the knowledge and information regarding the range of contraceptive choices available for their clients so that they are able to make rational decisions about the contraceptives for which to requisition (Orr *et al.,* 2016 & Cook *et al.*, 2019). In addition, Coe & de Beyer (2014) and Subramanian (2020) reveal that training of community distributors increases awareness in communities, that eventually improves requisitions from clients thereby improving their availability. Similarly, Jones (2005) and Wudhikarn *et al.* (2018) argue that the major root causes of contraceptives unavailability in public health facilities arise from lack of accurate and reliable information regarding the whereabouts of these contraceptives as well as how to obtain them. Previous scholars such as Kroelinger et al. (2019) also acknowledges the role of training on increasing awareness and staff capacity to administer some of the products that require some technical skills hence providing a basis for a sustainable provision of contraceptives in the sector. In agreement, Stone et al. (2020) reveal that training programs in the public health sector could expand on the number of distribution centers in the communities and enhance the confidence among the users and subsequently improving the ordering frequencies. Based on this discussion therefore, it can be advanced that training programs in the public health facilities could be key in the availability of contraceptives in the public health sector. Based on this discussion therefore, the following hypothesis is worth testing: -

- H3: Training has a positive influence on the availability of contraceptives

2. Methodology and Research Approach

This study was cross-sectional and was conducted between December 2020 and March 2021. The usable questionnaires of 165 from public health facilities in South Western Uganda were collected. South Western Uganda was chosen for this study because of its highest population density of 300 persons/km², besides being one of the regions with the highest teenage pregnancies (Prada *et al*., 2016). The region comprises of eight hospitals and 314 public health centres, all to talling a population of 322 public health facilities in the south western region. The sample size of the study was 175 that was determined using Krejcie & Morgan table of 1970.

The study employed a multi-stage sampling design. The public health facilities in South Western Uganda were stratified into hospitals, health centre IVs, health centre IIIs and health centre IIs. A stratified random sampling procedure is a probability sampling procedure in which the population is divided into several relevant strata, and a random sample is drawn from each stratum (Saunders *et al.,* 2009). It is assumed that the strata are internally homogeneous, which is typical of the public health facilities in Uganda's public health sector. Since districts have different numbers of the respective units, probability proportional to size (PPS) was used to ensure a proportionate distribution of the sample. Then simple random sampling was used to select a health unit from each stratum in a district based on a list of units in a category obtained from the ministry of health. At the health facility, an officer responsible for managing logistics activities for contraceptives was given a questionnaire to provide complete information regarding this study from the five districts, i.e., Kabale, Kanungu, Kisoro, Rukungiri and Ntugamo districts. Alongside a formal letter requesting logistics personnel of these public health facilities, the questionnaires were either handed to the participants or emailed.

2.1. Measures

To avoid the common method bias (CMB), all independent variables were operationalized using a seven-point scale ranging from one to seven, while the dependent variable was measured using a five – point likert scale ranging from one to five (Tehseen et al.,2017). Indicators for both independent and dependent variables were established based on theoretical and empirical literature (Klarner et al., 2013). Table 1 shows a list of the items used.

Construct / Indicator	Outer Loadings	Composite Reliability	AVE
Logistics Management Information Systems (LMIS)			
LMIS makes it easier for our health facility to make requisitions according to client's requirements.	0.756	0.809	0.586
Customers' needs awareness for contraceptives has increased because of LMIS use in our health facility.	0.809		
LMIS provides data reports on delivery of contraceptives for our health facility	0.730		
Sensitization			
Sensitizations carried out by our facility have increased clients' knowledge about the available contraceptives.	0.815	0.858	0.668
Sensitization of contraceptives has increased the number of users for our facility.	0.850		
Confidence has been instilled amongst our clients and are able to make proper choices due to sensitizations.	0.785		
Training			
Training of health care providers has increased their competence in providing the right information to our clients.	0.850	0.804	0.673
Guidance and counselling services to our clients has led to an increase in the requisitions for contraceptives	0.790		
Contraceptives Availability			
Our health facility often visits the community to obtain information regarding their contraceptive needs.	0.685	0.824	0.539
Our health facility often changes distribution centres to make sure that they avail contraceptives to every client.	0.747		
Commonly demanded contraceptives are always purchased in bulk to ensure continuity in serving our clients.	0.703		
Our heath stores are always filled with multiple brands to ensure multiple choices by clients.	0.798		

Table 1: Measurement Model Results

2.2. Analysis and the Results of the Study

Data analysis was carried out using SmartPls software version 3.2.8 to obtain the partial least squares – structural equation modelling output (PLS-SEM). PLS-SEM has been used in this study because it has been proved to be an ideal tool in making proper interpretations of the results and thus simplifying decision making (Awang *et al.*, 2015). According to hair et al. (2013), there are two outputs of PLS-SEM: 1) the Measurement model output that assess the validity and reliability of the study constructs and 2) the structural model that assesses the model quality and the bootstrap results indicating the hypothesized relationships.

2.3. Assessment of the Reflective Measurement Model

Numerous scholars (Hair et al.,2013 & 2014; Henseler et al., 2015; Ringle *et al.,*2020) have suggested a criterion for evaluating and accepting the validity and reliability of the measurement model. In this explanatory study, indicator

reliability was achieved with the outer loadings being at least 0.4 and those above that make the AVE not meet its threshold of 0.5 minimum (Hair et al., 2013).

The internal consistency reliability is traditionally checked using Cronbach's alpha. However, scholars such as (Sarstedt *et al.,* 2014; Ringle *et al.,* 2015; Hair *et al.,* 2019) argue that Cronbach's alpha is not suitable for PLS-SEM because it is sensitive to several items in the scale, and the measure is also found to generate severe underestimations when applied to PLS path models and suggested composite reliability since its more reliable, with its coefficients higher than those of cronbach's alpha. Composite reliability values of > 0.70, shows that there is internal consistency of the instrument (Nunnally 1978; Hair *et al.,* 2006; Hair *et al.,*2013; Ringle et al.,2020). This study therefore used composite reliability to test for the internal consistency of the instrument as illustrated in Table 2 and was met.

Variables	Composite Reliability	AVE
Availability of Contraceptives	0.824	0.539
Logistics management information systems	0.809	0.586
Sensitization	0.858	0.668
Training	0.804	0.673

Table 2: Assessment of Construct Reliability

2.4. Assessment of the Construct Validity

This study employed the Heterotrait-Monotrait (HTMT) ratio of correlation was used to assess the constructs discriminant validity. According to Henseler *et al.* (2015) &Hair *et al.* (2019), to discriminate between two variables, the HTMT ratio should be significantly smaller than 1. Scholars such as (Chin, 1998; Henseler *et al.,* 2015) further reveal that when the HTMT ratio is 0.85 and above, there is an HTMT problem. There are three criteria used in assessing discriminant validity using HTMT (Henseler *et al.,* 2015; Sarstedt *et al.,* 2014; Hair *et al.,*2019).

- The first one and the most conservative HTMT critical value ($HTMT_{0.85}$)
- The second one is the liberal HTMT critical value ($HTMT_{0.90}$)
- $HTMT_{Inference}$ is the third one, which is below the value of 1 criterion for bootstrapping. $HTMT_{Inference}$ should indicate discriminant validity between all construct measures.

The constructs are therefore empirically distinct from each other when the HTMT ratios of the correlations are much smaller than 1. Table 3 shows that the constructs of this study are empirically distinct from each other since the highest value of 0.631 is much smaller than the most conservative HTMT critical value of 0.85 and also the bootstrapping routine results show that the upper confidence interval limits are below 1.

Variables	Availability of Contraceptives
Availability of contraceptives	
Logistics management information systems	0.515 [(0.088 0.364)]
Sensitization	0.273 [(-0.045 0.213)]
Training	0.631 [(0.105 0.404)]

Table 3: Showing the HTMT

2.5. Assessment of the Structural Model

The study a assessed the quality of the model, an analysis of the direct relationships between the key elements of information flow in the public health sector, that is, logistics management information systems (LMIS), training and sensitization on the availability of contraceptives thus testing hypotheses H1, H2 and H3.

Table 4 presents the results of the structural model estimation and evaluation of the influence of logistics management information systems, training and sensitization as key elements of information sharing on availability of contraceptives in a developing country's context. The criterion for assessing a PLS structural model (Awang et al., 2015), for instance the coefficient of determination $R2$ for the direct relationship between information sharing and the availability of contraceptives and has an acceptable but low value of 0.196. The value is above the acceptable thresholds hence signifying the model's predictive validity (Chin, 1998; Awang et al., 2015; Ringle et al., 2020). This analysis reveals that information sharing explain only 19.6% of total variations in the availability of contraceptives in public health facilities. The remaining 80.2% is explained by other factors. Consistent with these findings the results from the structural model through the blindfolding procedure show that the $Q2$ values of procurement are 0.086 which is well above zero, thus indicating the predictive accuracy of the PLS path model (Henseler et al.,2015).

Paths	β	T Statistics	P Values	CI BCa (95%)	R^2	Q^2
LMIS -> AC	0.219	2.597	0.005	[(0.088 0.364)]	0.196	0.086
Sensitization -> AC	0.075	0.936	0.175	[(-0.045 0.213)]		
Training -> AC	0.264	2.874	0.002	[(0.105 0.404)]		

Table 4 Showing Path Coefficients

Notes; Confidence intervals were computed based on the biased corrected 95% (Single – tailed) test.
The cross-validated redundancy measure $Q2$ was derived from the blindfolding procedure; $R2$= Coefficient of determination; AC = Availability of contraceptives; LMIS = Logistics management information systems; BCa = Bias corrected and accelerated confidence interval

3. Discussion of Findings

The findings from the study reveals a positive and significant influence between logistics management information and availability of contraceptives, thus H1 is supported H1[(β = 0.219, p < 0.05, CI (0.088; 0.364)]. This result signifies that an improvement in the adoption of logistics management information systems leads to an improvement in the availability of contraceptives to clients in the public health sector. Logistics management information systems enables public health facilities to collect clients' data on time, analyses and disseminates this information to different stakeholders so that customer requirements are fulfilled on time and also cycle times are reduced. The findings are consistent with those of Anjomshoae et al. (2017) state that LMIS is a critical tool used in identifying the rate at which the contraceptives are consumed, the needs of the clients and customer orders in these public health facilities, thereby guaranteeing constant availability. These results are also consistent with the RDT, which assumes that public health facilities manage their dependencies in the face of uncertainty and that, as the demand for contraceptives become more stochastic and dependencies increase, public health facilities seek a logistics management information system that is capable of capturing reliable information and disseminate it to all the stakeholders to minimise stock out situations (Pfeffer & Salancik, 1978; Wudhikarn et al., 2018).

The findings from the study reveals a positive but non-significant influence between sensitisation and availability of contraceptives, thus H2 is supported H2[(β = 0.075, p > 0.05, CI (-0.045; 0.213)].This postulates that an increase in the level of sensitization of contraceptives in communities does not necessarily lead to an increase in the availability of contraceptives. The result could be attributed to a number of factors are dominant in Uganda's public health sector which among others include; the stochastic nature of demand for contraceptives where ordering frequencies cannot be pre-determined with certainty, the bureaucratic tendencies coupled with the centralisation procurement structure that is prevalent in the public health sector and religious beliefs for instance the catholic faith discourages the use of contraceptives. The result is in disagreement with those of previous scholars such as Orach et al. (2015), Ajewole et al. (2018) and Ajong et al. (2018) who argue that organizations intending to ensure consistent availability of contraceptives, requires to intensify sensitization campaigns through community-based outreaches, community sensitization meetings, dialogues and radio talk shows.

The findings further reveal a positive and significant influence between training and availability of contraceptives, thus H3 is supported H3[(β = 0.264, p < 0.05, CI (0.105; 0.404)]. This means that an increase in training of staff on administering contraceptives and the use of LMIS leads to an increase in the availability of contraceptives in the public health sector. This signifies that training enables public health facilities to provide contraceptives which are demanded but lacked experienced staff to provide them to clients, more especially the permanent contraceptives like vasectomy, castration and tubal ligation at health centre IIs and Health centre IIIs. This is consistent with the previous scholars such as Jones (2005),Coe & de Beyer (2014), Wudhikarn *et al.* (2018) and Subramanian (2020) who argue that training of community distributors increases awareness in communities, that eventually improves requisitions from clients thereby improving their availability.

4. Conclusions and Implications

The study examined the influence of information sharing (logistics management information systems, training and sensitization) on the availability of contraceptives in the public health sector. Based on theoretical and extant literature, it was hypothesised that information flow has a positive influence on the availability of contraceptives. Apart from sensitization, the other two hypotheses are statistically significant and supported. Based on these findings therefore, it can be concluded that for the sector to enhance and promote availability of contraceptives given their stochastic nature of demand in the public health sector, there is need to ensure that there is constant flow of quality information among the different stakeholders. This can be done through the increased use of logistics management information systems to captures clients' specific information, up-dates and disseminates the information to the different stakeholders and through carrying out trainings to the staff on how to administer the different types of contraceptives. Although the study results indicate that the contribution of sensitization is non-significant on the availability of contraceptives in the public sector, it should not be neglected completely as it might increase awareness to clients. The government and the management of these public health facilities should improve on the capacity building through trainings, installation of LMIS and the renumerations of staff to motivate them to collect timely and accurate date to enable suppliers to supply the right contraceptives to the right customers and thereby improving on the availability. Implementing adolescent clinics should also be emphasised as a way of creating awareness and instilling confidence among the youth in communities. As for areas for further research, future studies might need to consider comparing the influence of information flows on availability of contraceptives looking at both the public and private sector. Future research might also consider investigating the influence of sensitisation on the availability of contraceptives to see whether the results are different from those of the public sector.

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