Development and Validation of a Model for Tracking Administration of Malaria Drugs in Uganda: A Health Informatics and Pharmaceutical Surveillance Study

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ABSTRACT

The aim of this study was to develop and validate a model for Integration of ICT in Tracking Administration of Malaria Drugs in Uganda for both health workers and health units. A descriptive and correlational research design were used. Descriptive statistics was used during data analysis, analytical approach was used for model development, and model validation employed experts' knowledge technique. Findings: Model variables revealed strong and positive relationships, Controls, Intention and Actual use of ICT was weak. The controls strongly impacted ICT Integration, Intension and Actual Use of ICTs. Conclusion: model is communicative, relevant to the operations, understandable, adequate for tracking issues, improves rates of execution of malaria drugs information needs, cheap, accurate, reduces operational costs, worth adoption, and model positively support clinical activities.

Keywords: *Tracking Administration of malaria Drugs, ICT Integration, Clinical Activities, Malaria Intrinsic, Extrinsic and Technological Controls.*

I. INTRODUCTION

Tracking of drugs generally is an important role a government has through her ministries and departments. In Uganda, a department of MoH (National Medical Stores (NMS) was created (SURE, 2012) through the drugs policy (EPRC, 2010) due to the widely associated inefficiencies of drugs management such as, lack of accountability and absence of institutional checks on the flow of pharmaceuticals and medical supplies. This body is responsible for making sure that all drugs reach all areas which have a therapeutic need. However, as a major challenge, essential drugs/medical supplies were not reaching the people at the right time, nor were they being delivered in the right quantities via a supply-driven approach (EPRC, 2010). So the MoH delegated its drug supply function to NMS through a National Drug Policy and Authority Act of 1993. Drug supply involves the identification of therapeutic needs, quantification of the current and future needs, procurement, distribution and use. This therefore is conceived to define the scope and trend of tracking of such medicines and drugs from the procurement agency to the consumers. Tracking of these drugs in this study focused on the process of supply from the National Drug Stores (NDS) to the basic unit of consumption of such drugs which is the Health Center one or communities (HC1). This concept therefore motivated the researcher to address such concerns through development and validation of a model for ICT integration in tracking administration malaria drugs with the focus of improving healthcare services of malaria patients in health units.

II. METHODOLOGY

The study followed a Positivism – Post-Positivism perspective while model development took analytical approach (multiple regression). Descriptive and co-relational research design were used to analyze the opinions of the thirty five (35) experts (health workers and researchers). Descriptive statistics and multiple regression were used during data analysis to establish the relationships between them for both health workers and health units.

III. DATA ANALYSIS

For objective i), data analysis took a descriptive statistics (frequency distribution, central tendency measures and dispersion measures); For objective ii), in order come up with a model, the researcher used an analytical approach to evaluate the existing Models. Multivariate analysis (Standard multiple regression) techniques was used; For objective iii); Validation of the model was done using experts knowledge technique, multiple regression was done as a basis for determining the relationship between the variables, impact of independent variables on the net benefits (Tracking administration of malaria drugs) and the model fitness.

IV. THE MODEL

This model depicted the idea of tracking administration of malaria drugs (TAMD). It is an extended DeLone & McLean IS success model (2002, 2003 and 2017 version). This model dropped system quality and user satisfaction and replaced them with communication effectiveness and ICT integration, while another variable "Controls" was introduced (Figure 1.1). It retained information quality, technology quality and intension to use and actual use. Controls, intension to use and actual use of ICT and ICT integration were considered moderating variables.

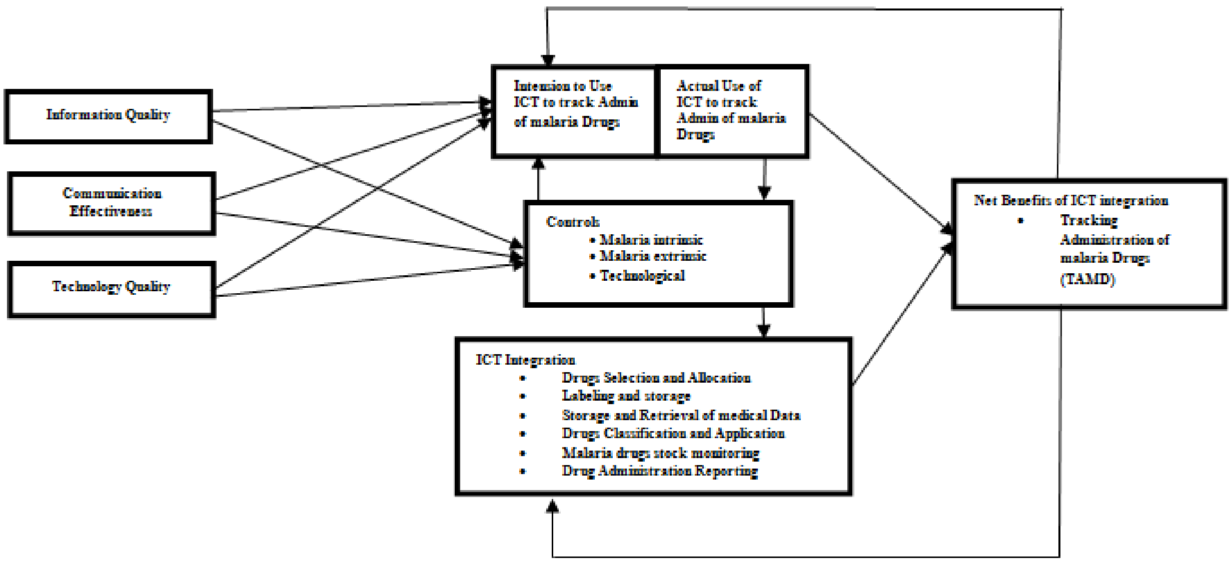


Figure 1.1: The Conceptual Framework for ICT Integration and Tracking Administration of Malaria Drugs. [Source: extended from Success Model DeLone & Mclean, (2002 & 2003)]

V. RESULTS

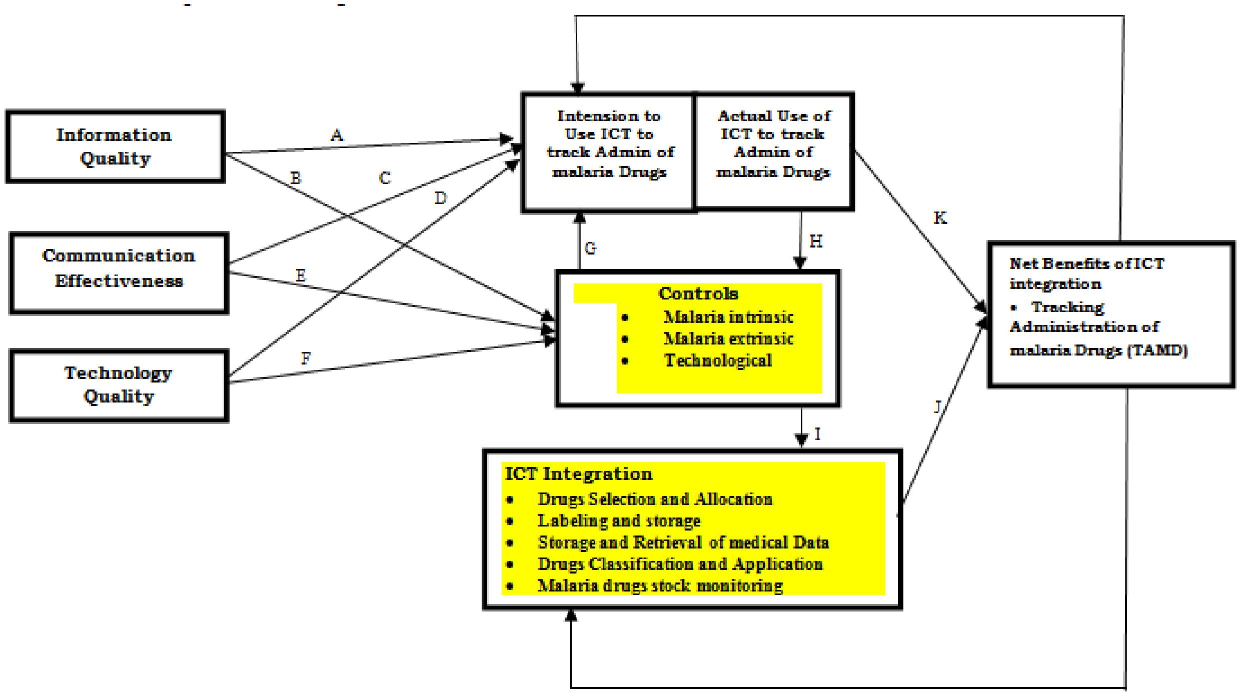
Relationship among the variables / constructs, were established using Pearson's cross product bivariate deviation and covariance's option Table 1 and Fig1.2 were generated showing how significant the correlation existed.

Table 1: Pearson's Cross-product deviation and covariance matrix of Variables of the model

Variables		MIC	MEC	TEC	TE	INT	IUAU	IQ	CE	QT	QoS
MIC	Malaria Intrinsic Controls	1.000									
MEC	Malaria Extrinsic Controls	0.048	1.000								
TEC	Technological Controls	-0.015	0.076	1.000							
TE	Technological Enhancement Controls	-0.166*	-0.133	0.292**	1.000						
INT	ICT Integration	-0.290**	0.271**	0.508**	0.407**	1.000					
IUAU	Intension to Use and Actual Use	-0.194*	0.253**	0.198**	-0.195**	0.369**	1.000				
IQ	Information Quality	-0.187*	0.154*	0.359**	0.228**	0.522**	0.145*	1.000			
CE	Communication Effectiveness	-0.122	0.199**	0.353**	0.171**	0.541**	0.258**	0.491**	1.000		
QT	Quality of Technology	0.099	-0.049	0.441**	0.258**	0.467**	0.174*	0.336**	0.582**	1.000	
QoS	Quality of Service	-0.152*	0.158*	0.371**	0.042	0.420**	0.294**	0.475**	0.358**	0.274**	1.000

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

The results in the table above revealed that there is a strong and significant linear positive correlation between TAMD and TEC, INT, IQ and CE and lastly between QT and CE as their correlation indices rated above 0.5 representing well above 50% at the level of $p = 0.01$. On the other hand, a measurably good significant and positive linear correlation between IQ, CE, QoS and TEC, between INT and TE, between IUAU, QT, QoS and INT including QoS and CE as for their correlation indices rated well above 30%. Never the less MIC exhibited a linear positive and negative correlation with all the variables for which the negative was significant at the level of $p = 0.05$ except with INT which occurred at 0.01. This therefore suggest that all the variables support the model of best fit. Therefore the implication of the positive influence of the independent variables on dependent variable is that any change evoked onto the independent variable causes a direct change on the dependent variable in the designated direction. The letters of the alphabet below represent the hypothetical relationships between constructs of the conceptual frame work.



A. Increase in Information Quality cause a significant (0.145*) positive increase in the intention to and actual use of ICT in tracking administering malaria drugs
B. Increase in Communication effectiveness cause a significant (0.258**) positive increase in intention to and actual use of ICT in tracking administering malaria drugs
C. Increase in Technology quality cause a significant (0.174*) positive increase in intention to and actual use of ICT in tracking administering malaria drugs
D. Increase in Information Quality influence a significant positive increase in reduction of controls (Malaria Extrinsic Controls MEC, 0.154*; Technological Controls TEC 0.359** and Technological Enhancement / complimentary factors TE 0.228**) and a significant negative reduction on Malaria Intrinsic controls MIC (-0.187*) of use of ICT in tracking administering malaria drugs. The negative coefficient of correlation suggests an opposite direction as compared to the three that make the up the controls but still fits on the regression line
E. Increase in Communication effectiveness influence a significant (MEC, 0.199**; TEC, 0.353** and TE, 0.171**) positive increase and a negative (MIC, -0.122 ;) in reduction of controls in the use of ICT in tracking administering malaria drugs
F. Increase in Quality of Technology influence a significant (MIC, 0.099; TEC, 0.441** and TE, 0.258**) positive increase and negative (MEC, -0.049) reduction of controls of use of ICT in tracking administering malaria drugs. The Negative sign on the correlation coefficient for MEC indicates the opposite direction Controls are the constraints or limitations that can affect the process of identification and tracking of administration of malaria drugs. These controls also cause effect onto the intention and actual use of ICT in

the same process and include malaria based and professional activities (diagnosis, treatment and other clinical practices), technological and technological enhancement / complimentary factors

G. Increase in reduction of controls (MIC, -0.194*; MEC, 0.253**; TEC, 0.198** and TE, -0.195**) in use of ICT cause an increase in intention to and actual use of ICT in tracking administering malaria drugs
H. An increase in intention to use and actual use of ICT in tracking administration of malaria drugs influence an increase in both positive (MEC, 0.253**; TEC, 0.198**) and negative (MIC, -0.194*; and TE, -0.195**) purported controls for the actual tracking processes.
I. Increase in reduction of controls (MIC, -0.290**; MEC, 0.271**; TEC, 0.198*0.508** and TE, -0.195*0.407**) of use of ICT cause an increase in tracking administration of malaria drugs
J. An increase in tracking administration of malaria drugs using of ICT cause a high significant positive increase in the net benefits of ICT integration (TAMD) (0.501**, p = 0.000) in tracking administration of malaria drugs.
K. Increase in intention to use and actual use of ICT cause an appreciably higher positive increase in the net benefits of ICT integration (TAMD) (0.750**, P = 0.00) in tracking administration of malaria drugs

Table 2: Correlation between Intention and Actual Use of ICTs, Tracking administration of malaria drugs, ICT Integration and Net benefits

Correlations			
Variables	Intension and Actual Use of ICT (IUAU)	ICT Integration (TAMD)	Net Benefit of ICT TAMD
Intension and Actual Use of ICT	1.000		
Tracking Administration of malaria drugs basing on ICT Integration	0.363**	1.000	
Net Benefit of ICT Integration	0.750**	0.501**	1.000
**. Correlation is significant at the 0.01 level (2-tailed).			

VI. REGRESSION ANALYSIS OF THE MODEL CONSTRUCTS

Regression is a quantitative technique to evaluate the impact of numerous simultaneous influences onto a single dependent variable in terms of degree of relationship, form and direction of correlation (*Pallant, 2005).* The outcome of the multi-regression analysis was used to test the significance of the constructs that were used to develop the model. The issues which were considered to facilitate the measurement of the correlation during the development of the model for tracking the administration of malaria drugs in Uganda included Standardized (Beta) and Unstandardized (B) coefficients and the standard error (SE), R Square values. i) Unstandardized values are coefficients obtainable when a regression is performed on an actual variables called unstandardized variable. Thus the coefficient is labelled B, this defines the degree of correlation and /or interpret the direction of correlation between variables as positive or negative. ii) Standardized coefficient is an estimated value obtainable after analysis of the predictor (IV) variable which has been standardized (its variance is 1.0), thus the coefficient is labelled Beta (β). This coefficient measures and / or estimates the strength of each predictor (IV) variable influence on a dependent variable. iii) Standard Error (SE) measures the distance existing between the regression line and the points that make it described as strong / perfect or weak relationship. iv) R depicts the measure of correlation between observed value and the predicted (dependent) variable. This suggests the magnitude of variation of the dependent variable which represents that of the independent variable. But the amount of variation in the dependent variable that is represented in the independent variables is measured by the value referred to as the coefficient of determination called R^2 Adjusted thus gives the most useful measure of the success of the model. v) The significant value (sig value or Pvalue) suggests the impact of the independent variable onto the dependent one which case that when the Pvalue is less or equal to 0.05 the relationship between the independent and the dependent variable then is significant whereas above (Pvalue > 0.05) this the relationship is not significant. All the above are common representation of regression analysis and were key in model determination.

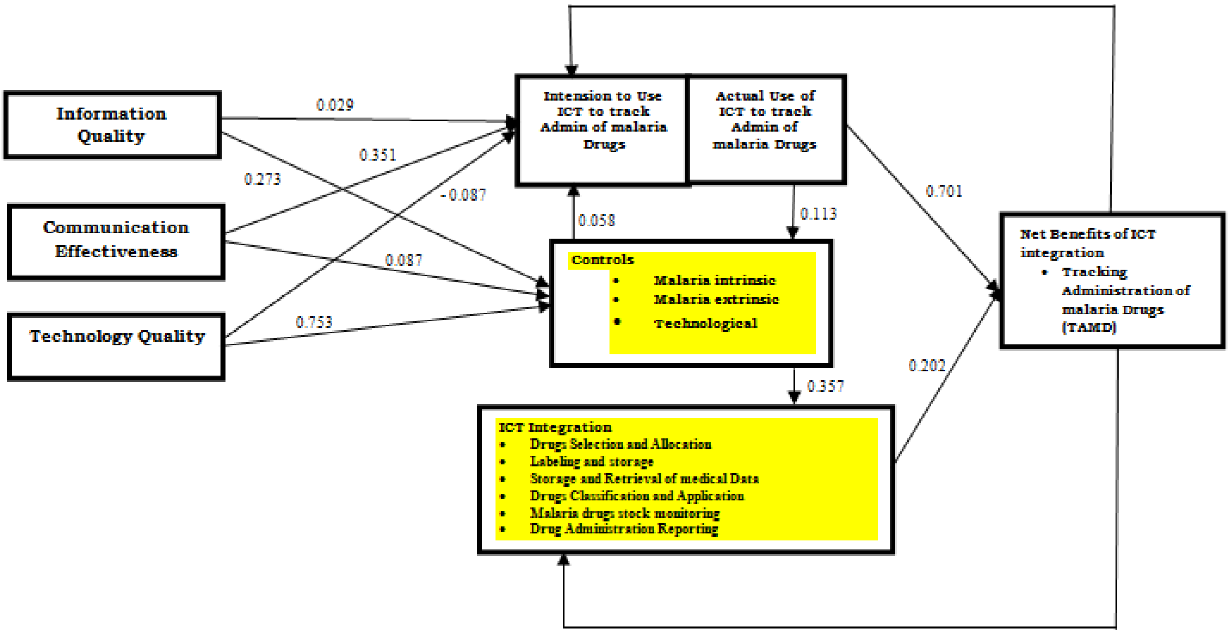


Figure 1. 2: The Conceptual Framework for ICT Integration and Tracking Administration of Malaria Drugs. [Source: extended from Success Model DeLone & Mclean, (2002 & 2003)]

Multiple regression of the presumptive controls in using ICT in tracking administration of malaria drugs.
The results of regression above reveals that there exists a very strong significant (Pvalue =0.00) correlation between Technology Quality and the controls which affect tracking administration of malaria drugs as the B value rates higher at 0.753. This implies that technology quality positively influences a strong reduction in the controls / constraints in tracking administration of malaria drugs (Beta β = 0.306), information Quality and Communication effectiveness also positively influence a reduction in the controls in tracking administration of malaria drugs (Beta values for IQ and CE = 0.274 and 0.039 respectively) whereas CE has a very low correlation with the presumptive controls, is achieved not significant (Pvalue >0.05). In this model, although QT and CE are seemingly perfect to the regression line (Standard error SE = 0.208 and 0.202 respectively) IQ appear far away also in a positive direction. The amount of variation (Adjusted R^2 =0.206) between the controls of tracking administration of malaria drugs and the independent variables (TQ, IQ and CE) is very low thus, make the model more useful by 21%. Presumptive Controls = 84.037 + 0.753 (TQ) + 0.273(IQ) + 0.087(CE). (R^2 =0.206, 21.0%) ……………………….1

Multiple regression of the Intension and Actual Use of ICT in tracking administration of malaria drugs
In the interest of the intension and actual use of ICTs in tracking administration of malaria drugs it was discovered that CE had a positive significant correlation with the Intension and Actual use of ICTs in tracking administration of malaria drugs. (B = 0.351). IQ is revealed not significantly (Pvalue = 0.612) correlated to Intention and Actual use (B = 0.029). This means that although it is clear that it influences positively the Intension to Use ICTs (Beta β = 0.042) the impact is very low, so it is not an important factor to influence Intention and Actual use of ICTs in the tracking of administration of malaria drugs in health units in Uganda. Technology Quality (TQ) was revealed having a negative linear correlation with Intension and Actual Use of ICTs (B = - 0.087) and further has a negatively influences on the same (Beta (β)= - 0.050). Nevertheless, the variation between these variables is also low (adjusted R2 = 0.034) hence suggestive of the worthiness of the model by 3.4%. Intension and Actual Use = 24.304 - 0.087 (TQ) + 0.029 (IQ) + 0.351 (CE) (R^2 = 0.034= 3.4%)…………….. …….2

Multiple regression of the Controls of ICT in tracking administration of malaria drugs
The table above explains that when the presumptive controls are caused to influence the intension and actual use of ICTs as dependent variable in tracking administration of malaria drugs, results reveal that there exists a very small positive correlation (B = 0.058) which was described not significant (Pvalue > 0.05). The influence accounted for by presumptive controls on the intension to use was also very low (Beta β = 0.081) suggesting that a positive weak increase in the reduction in the controls of using ICTs in tracking administration of malaria drugs cause a very small

positive influence on the intension and actual use by health workers in the health units. The contribution accounted for by such controls to the intension and actual use in the model is not significant as rated at 0% (R^2 =0.00). When the situation was reversed that made the intension and actual use of ICTs as independent variable and the presumptive controls dependent, the difference in the results was realised only by a positive correlation (B= 0.113) which was significantly higher than before. This situation described what could be termed as sensitivity analysis.

Multiple regression of the presumptive controls in tracking administration of malaria drugs
The results of regression of the presumptive controls on tracking administration of malaria drugs basing on ICT integration reveal that there exists a high significant (Pvalue <0.05) positive correlation between the presumptive controls and ICT Integration rated at 0.537. It further suggested that an increase in the reduction of the controls has a strong and positive influence (Beta β = 0.391) on tracking administration of malaria drugs basing on ICT integration by 14.7% (Adjusted R^2 = 0.147) for the model. Results further indicate a low deviation between the variables (SE=0.104) which explains a positive linear regression where the points on the line are not far away from it.

Multiple regression of the ICT Integration in tracking administration of malaria drugs on the Net benefits. Results revealed that there exists a significant (Pvalue = 0.000) positive correlation between integration of ICT and net benefits (B = 0.202). It further suggested that the integration influences strongly the net benefits by 39.8% basing on the fact that Beta (β) values was positively rated at 0.398, this represents further the same value for which the ICT integration in tracking administration of malaria drugs accounted for in the model development. The generated variance between the variables (R^2 = 0.154) predicted model worthiness by 15.4%.

Multiple regression of Intension and Actual Use of ICT on the Net benefits
Intension and Actual Use of ICT in tracking administration of malaria drugs in health units cause a highly significant (Pvalue = .000) positive correlation on the net benefits of ICT integration (B = 0.705). The results further revealed that intension and actual use of ICT impacts very strongly the net benefits by over 70% (Beta = 0.715) thus the independent variable accounted the dependent variable to the model by 71% (Adjusted R^2=0.709). The summaries of relationships of the variables or constructs explain the overall structure equations that represent the model for the integration of ICT in tracking administration of malaria drugs in the health units. Controls = 84.037 + 0.753 (TQ) + 0.273(IQ) + 0.087(CE). (R^2 =0.206, 21.0%) ....1 Intension and Actual Use = 24.304 - 0.087 (TQ) + 0.029 (IQ) + 0.351 (CE) (R2 = 0.034= 3.4%) ....2 Net Benefits of ICT integration = 0.058 (Presumptive Controls PC) + 0.113 (IUAU) + 0.537 (TAMD) (R2 = 0.709 = 71.0%)…....……..……………………………………. 3

VII. MODEL VALIDATION

Model validations in the context of finding the reality of worthiness of the developed artifact in the essence of answering the questions for the reasons of development of the model explains the virtues that represent the reality and truthiness fit to answer the questions for which the model was developed. Ssemalulu (2012), confirms that validation of an artifact as it answers the question whether the input-output transformation of the instrument within its domain of practicability has sufficient accuracy in representing the real cause for its development, further suggests also that, validation deals with building the right instrument. His concentrate recommendations narrowed on two methods of validation which include expert validation and sensitivity analysis which this study earmarked. The expert knowledge evaluation techniques referred to in this context included Heuristic evaluation, Cognitive walkthrough, Conversion – oriented Evaluation, Content Audit and UX (user experience) Review technique (Allan and William, 1998). This study therefore could have rotated on any of them or all basing on the scope of the expert(s). The model validation using expert knowledge (validation) approach where the questions that required expert dominion and responses to find the truthiness and fitness of the model were formulated and answered in respect to three major concerns which included usefulness, effectiveness and usability of the model in health units and hospital environments. A target population of thirty five (35) medical experts were selected and an equivalent number of instruments (questionnaires) were distributed. The retrieval rate of the instrument amounted of 70% which is by standard acceptable for analysis was achieved. In this study, the three concepts were attributed to the respective definitions as Usefulness focused on valuability and suitability the model endows to the health unit and hospital medical environments during tracking administration of malaria drugs. The usability looked at the extent at which the model is perceived usable by health workers basing on the skills owned that benchmarks the level of interaction and effectiveness referring to how competently and successfully (Ssemaluulu, 2012) the model supports the processes of tracking administration of malaria drugs to in health units during malaria management.

7.1 Descriptive statistics of model variables

Descriptive statistics of variables Usefulness (representation and use) of the model Result indicate that majority of the experts to the rate of 66.7% acknowledge that the model represents the actual constraints that affect tracking administration of malaria drugs in medical environments. The implication for this is that it can then be significantly benchmarked and integrated to furnish the need for tracking administration of malaria drugs in Uganda if the malaria burden is to further reduce morbidity and mortality. The minority 33.3% are indicative of aspects like limited Staffing with 28.6%, Poor attitude towards use of ICT with 42.9% and lack of knowledge 28.6% could be addressed as was suggested in the conceptual model as factor that influence intension and actual use of the ICT. The experts' responses on the use of the model in the interest of tracking administration of malaria drugs in Uganda within the medical environment revealed as positive as the majority with 71.4% suggesting that integrating the model in health units and hospitals would enhance greatly and supplement strategies in the bid to solve the malaria problem. Whereas use of the model became dominant, the aspect of lack of skill to use ICT (by 57.1%) was frequent.

Descriptive statistics of variables on Usefulness (usefulness, benefit rating and adoption) of the model

The results suggest that majority of health workers recommend the model being useful in tracking administration of malaria drugs (70%) while 30% regarded it very useful as far as the benefits it can render to the health workers as very high at 66.7%, followed by those who rated it high at 28.6%. This implies that when adopted for tracking administration of malaria drugs the benefits are enormous. This model is strongly and negatively agreeable to provide a scalable rating (47.6%) that it can as well be operationalized for other pharmaceutical supplies and drugs for the same purpose.

Descriptive statistics of variables on effectiveness, communicative, relevancy and understand ability) of the model

The results in the table suggest that majority of the health workers suggest that the model is communicative 52.4% and positively relevant 52.4% in terms of activities for tracking administration of malaria drugs. Further it is revealed that the model is easy to understand 71.4% because its arrangement in terms of the issues pertaining to the tracking of administration of malaria drugs is adequate in the arrangement 52.4%. This implies that the model give a platform of adoption due to its effectiveness. This is supported by the fact that the respective coefficients of variation (CoV) are relatively low and depictive of the reality of being communicative 33.6% relevancy 36.4%, understandability 27.0% and 33.7% well arranged. Although majority of the responses on the effectiveness of the model are skewed more negative represents ontological relevancy, understandability and arrangement which are key for adoption by the health infrastructure.

Descriptive statistics of effectiveness of the model

The results in the table above reveal that health workers positively believe that the model improves the rate at which information needs about malaria drugs are executed (Yes = 90.5%, std. = 0.301, CoV = 27.4%) by making it cheap to manage information flows entailed in the drug administration (Yes = 90.5%). This implies that tracking the administration of malaria drugs is more possible when the information follow is clear as exhibited by the technologies used i.e. ICT that is exemplified by the model hence the usability component of the model. Further the results suggest that the model is accurate (Yes = 100%) for the role of tracking administration of malaria drugs which positively reduces the operational cost in the health units (Yes= 95.2%. The health workers responses are suggestive that the model is worth adoption (Yes = 76.2%) in the medical environment.

Descriptive statistics of variables on usability of the model

In the case of finding the usability of the model, results in the table above reveal that majority of the health workers strongly agree that the model can be used by all at different levels of administration (strongly agree = 76.2%, Std = 0.436, CoV = 35.2%) with minimum guidance (66.7%) in all department of the health unit / hospital to address the issues of malaria drug administration (57.1%, Std. 0.768, CoV = 40.4%). For that which category of health workers should the model be appropriated for adoption, is clear that senior staff (agree = 38.1%) wanted it more while other health workers disagreed with this assertion and suggested that can be used by others as well (disagree = 33.3%). This explains the level of suitability of the model in medical environment usable to simultaneously run multi-transactions about malaria drugs (agree = 66.7%, std. = 0.539, CoV = 30.6%) in order to positively supports inter-operational and clinical activities in the health unit / hospitals (Strongly Agree =57.1%, Agree = 42.9%, std. = 0.507, CoV = 35.5%).

7.2 Regression analysis of the constructs of tamd model

The validation of the TAMD model was based on three constructs and these included Usefulness of the model, Effectiveness and Usability in the health units and hospitals. The regression was intended to establish the impact of usefulness, effectiveness and usability of the model to the designated net benefit as tracking administration of malaria drugs. This is postulated in the findings as shown in the tables below.

Influence of usefulness to the net benefit as tracking administration of malaria drugs

The results suggest that the total usefulness has a strong relationship with the net benefit in health units (B = 3.37) and strongly and linearly positively impacts tracking administration of malaria drugs in health units in hospitals in Uganda ($\beta = 0.96$). This implies and confirms that the model is more useful and if adopted contributes positively to reduce constraints and restraints in of malaria drugs administration. The regression line that explains the model fit situation suggests that the degree of fitness is much higher because the points which make up the linearly positive regression are very close to the line thus indicating high cohesiveness and fitness. The adjusted R square value reads 0.912 therefore the validation of the models in tracking administration of malaria drugs in Uganda predicts 91.2% total significant usefulness.

Influence of effectiveness to the net benefit as tracking administration of malaria drugs.

The results suggest that the total the effectiveness has a strong positive relationship with the net benefit in health units (B = 1.982) and linearly positively impacts tracking administration of malaria drugs in Uganda ($\beta = 0.96$). This implies and confirms that the model is effective and if adopted contributes positively to reduce constraints and restraints in of malaria drugs administration. The regression line that explains the model fit situation suggests that the degree of fitness is much higher because the points which make up the linearly positive regression are very close to the line thus indicating high cohesiveness and fitness. The adjusted R square value reads 0.939 therefore the validation of the models in tracking administration of malaria drugs in Uganda predicts 93.9% total significant effectiveness.

Influence of usability to the net benefit as tracking administration of malaria drugs

The results suggest that the total the *Usability* has a strong and positive relationship with the net benefit in health units (B = 2.135). It linearly, significantly and positively impacts tracking administration of malaria drugs in Uganda ($\beta = 0.956$). This implication rules that the model is usable and if adopted contributes positively to reduce constraints and restraints in of malaria drugs administration. The regression line that explains the model fit situation suggests that the degree of fitness is much higher because the points which make up the linearly positive regression are very close to the line thus indicating high cohesiveness and fitness. The adjusted R square value reads 0.909 therefore the validation of the models in tracking administration of malaria drugs in Uganda predicts 90.9% total significant usability. **8.**

VIII. SUMMARY OF RESULTS ON MODEL VALIDATION

The model significantly represents the actual constraints that affect tracking administration of malaria drugs (66.7%, CoV 36.3%), however other constraints such as poor attitude towards use of ICT take center stage 42.8% followed by Limited staffing and Lack of knowledge to Use ICT each at 28.6% together with CoV of 40.8%.as the highest and actual use of the model in health units / hospitals was accepted at 71.4%, CoV 35.9%.

Usefulness

The model was discovered very useful to the health workers (Yes = 70.0%, CoV 36.1%) and provides very high benefits (66.7%, CoV 42.7%) and agreed that model is scalable (52.4%, CoV 33.7%). The adjusted R^2 (square) value reads 0.912 therefore the validation of the models in tracking administration of malaria drugs in Uganda predicts 91.2% total usefulness as compared to 71% before validation.

Effectiveness

The results revealed that the model is communicative (52.4%, CoV 33.6%); relevant to the operations of tracking administration of malaria drugs in Uganda (52.4%, CoV 36.4.0%); easily understandable (71.4%, CoV 27.0%) and adequately arranged (52.4%, CoV, 33.7%) to address the issues of tracking administration of malaria drugs in health units / hospitals. The model can be quoted to improves the rate at which information needs about malaria drugs are executed (Yes = 90.5%, std. = 0.301, CoV = 27.4) by making it cheap to manage information flows entailed in the drug administration (Yes = 90.5%, std. = 0.301, CoV = 27.4 %). The model is accurate (Yes = 100%) for the role of tracking administration of malaria drugs which positively reduces the operational cost in the health units (Yes = 95.2%, std. = 0.218, CoV = 20.8%). The health workers responses are suggestive that the model is worth adoption (Yes = 76.2%, std. = 0.436, CoV = 35.2%) in the medical environment, thus, the adjusted R^2 (square) value reads 0.939 therefore the validation of the models in tracking administration of malaria drugs in Uganda predicts 93.9% total significant effectiveness.

Usability

The results suggest that the model can be used by every health worker at all level of drug administration (strongly agree = 76.2%, std = 0.436, CoV = 35.2%) with minimum guidance (agree = 66.7%) in all department of the health unit / hospital to address the issues of malaria drug administration (agree = 57.1%, std. 0.768, CoV = 40.4%). The senior medical staff (agree = 38.1%) suggest that the model is suitable to this section of staff while other health workers disagreed with this assertion and suggested that it is suitable for use by other medical staff as well at different levels (disagree = 33.3%). This explains the level of suitability of the model in medical environment usable to simultaneously run multi-transactions about malaria drugs (agree = 66.7%, std. = 0.539, CoV = 30.6%) in order to positively supports inter-operational and clinical activities in the health unit / hospitals (Strongly Agree =57.1%, Agree = 42.9%, std. = 0.507, CoV = 35.5%). The adjusted R^2 (square) value read 0.909 therefore the validation of the models in tracking administration of malaria drugs in Uganda predicts 90.9% total significant usability.

IX. CONCLUSION

In terms of model development, constructs of the model exhibited positive and strong correlations. The influence of controls, the intention and actual use of ICT was very weak to the development of the model. Controls exhibited a strong impact on Intension and Actual Use of ICTs and tracking administration of malaria drugs using ICTs. In terms of model validation the prediction indicate that Usefulness. The model is very useful to the health workers and provides very high benefits because it is scalable models in tracking administration of malaria drugs in Uganda.

Effectiveness

The model is communicative relevant to the operations of tracking administration of malaria drugs in Uganda; easily understandable and adequately arranged to address the issues of tracking administration of malaria drugs in health units / hospitals, improves the rate at which information needs about malaria drugs are executed by making it cheap to manage information flows entailed in the drug administration, accurate for the role of tracking administration of malaria drugs because it positively reduces the operational cost in the health units, is worth adoption in the medical environment.

Usability

The model can be used by every health worker at all level of drug administration with minimum guidance in all department of the health unit / hospital to address the issues of malaria drug administration. The model was liked by all medical staff at all levels in order to positively support inter-operational and clinical activities in the health unit / hospitals.

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