Factors associated with stock out of malaria test kit in Oshana region, Namibia

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Abstract
Malaria continues to be a serious communicable disease whose impact on public health in Namibia is massive. Some improvement in reducing the number of malaria cases has been made in the country, but the sporadic availability of malaria diagnostic test kits (mRDT) continues to slow down government efforts to eliminate malaria in the country. Given the nature of current conditions, justification exists for a study to determine the factors associated with stock out of malaria rapid test kit (mRDT) in Namibia. Mixed method approach was employed, whereby in quantitative aspect, the study adopted a descriptive approach to acquire data from a period of five years retrospectively (2012 - 2016). To gain insight into qualitative aspects of the study, key informants at all levels of the supply chain in Oshana region were interviewed. Pharmaceutical knowledge of ordering mRDT is needed to prevent stock out of mRDT. It is a recommendation of this study that training is needed for staffs who are involved in ordering of pharmaceutical items.

Introduction
Effective management of supply chain requires uninterrupted availability of both medicines and rapid diagnostic test kits (RDT) within the distribution system. However, recent studies have indicated stock-outs of diagnostic test kits particularly Malaria Rapid diagnostic test kits (mRDT) are sporadically reported due to ineffective supply chains. An ineffective supply chain impacts patient survival by increasing mortality and morbidity. Despite many efforts by the Namibian government to strengthen supply chain of diagnostic kits like malaria rapid diagnostic test kits (mRDT) there is still sporadic shortage/stockout of mRDT in the public health facilities. This study examines the factors associated with stock out of mRDT in Namibia.

Materials and Methods
Mixed Methods approach, Convergent descriptive design was used. A retrospective, quantitative, descriptive design was applied and reviewed different documents over a five-year period (2012-2016). Information from Syspro database, regarding the quantity of mRDT for the period of 5 years (2012-2016) that expired, ordered, received, issued by CMS to OMRMD and from OMRMD to all health facilities (excluding Eloolo clinic), was reviewed retrospectively. On the qualitative side, a phenomenological design was used to expand quantitative results by interviewing key informants in the supply chain of essential medicines.

Study setting
The study was conducted at Oshakati Multi Regional medical depot (OMRMD), five health centers (H/C), namely Ondangwa H/C, Ongwediva H/C, Oumik H/C, Oshakati H/C, Okatana H/C and twelve health clinics, namely Onamutayi, Eluwuta, Enkono, Okaku, Ompundia, Uukwiyuuushona, Ekamba, Eheke, Ethafo, Okaukameshe and Okauekoje, in Oshana region. Oshana region is one of the fourteen (14) regions in Namibia and is situated at the northern part of the country where Malaria is an endemic.

Participants/Key informants
The study participants include managers, pharmacists, pharmacist assistants, nurses, transport officers and drivers who are involved in supply chain in the region. They participated were 17, of which three were managers, five pharmacists, three pharmacist assistants, four nurses, one transport officer, and one driver.

Sampling technique for health facilities
Oshakati Multi Regional Medical depot (OMRMD), all health facilities in Oshana region were selected for sampling except Eloolo clinic. The reason for excluding Eloolo clinic is due to the time it started operating, because it was officially opened in 2015.

Sampling technique for key informants
The researcher used a purposive-sampling technique to identify health professionals and other professionals based on variation in experience and the kind of positions held, the researcher decided to use a purposive sampling technique known as maximum-variation sampling in order to tap the widest possible range of perspectives relating to the supply chain.

Sample size for key informants
The saturation point was reached at 17 key informants’ interviews.

Data collection procedures
Quantitative data on initial stock, quantity ordered, received issued, expired as...
from 2012-2016 were collected from all health facilities by examining existing data from Syspro database for inventory management, Malaria monthly reports and Electronic dispensing tools (EDT). Furthermore the researcher conducted individuals face to face taped recorded interviews with key informants in order to gain more insight of the factors associated with stock out of mRDT.

Data analysis
The data was then analyzed by SPSS version 24 software, in which binary linear regression was applied to find the factors associated with stock out of mRDT with the significant level of 0.05. The qualitative aspects were analyzed thematically using Atlas.ti software.

Ethical consideration
The researcher sought permission from the University of Namibia (UNAM), School of Public Health, Ministry of Health and Social Services (MoHSS) and from respective study sites. No names of participants were identified or recorded in the final report.

Results
The study findings will be presented separately, first the quantitative results followed by qualitative findings.

Quantitative findings
The findings regarding the factors associated with stock out of malaria rapid test kit indicated that the predictor quantity of mRDT ordered by OMRMD from Central Medical Store with p value of 0.03 is significant predictor at the level 5%. While the following predictors: Initial stock, Quantity received by OMRMD from CMS, Quantity issued to HFs, Quantity ordered from OMRMD by HFs are not significant predictors of stock out of mRDT at the 5% level. The findings are shown in Table 1.

The Binary logistic regression indicates that quantity of mRDT ordered by OMRMD from CMS is a significant predictor for stockout of mRDT (p-value <0.05). The other four predictors - initial stock, quantity received by OMRMD from CMS, quantity issued to health facilities, quantity ordered from OMRMD by HFs, the leading times (time between the moment of placing of the order and receiving of the order consignment), suspected cases of malaria and constant are not significant. Each of these predictors “explain” 1% of the variability of stock out for mRDT. Quantity of mRDT ordered by OMRMD from CMS is significant at the 5% level critical value of Wald = 4.036, (p-value <0.05). The odds ratio (OR) for quantity of mRDT ordered by OMRMD from CMS is 1. (95% CI varying from 1 to 1.002).

![Figure 1. Conceptual framework of variables that causes stock out of mRDT in Oshana. Adapted and modified from the conceptual framework of Organizational practices influencing availability of essential medicines in hospitals.](https://example.com/figure1.png)

Table 1. Factors associated with stock out of mRDT.

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95% C.I. for EXP(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Stock</td>
<td>.000</td>
<td>.000</td>
<td>2.851</td>
<td>1</td>
<td>.091</td>
<td>1.000</td>
<td>1.000 1.000</td>
</tr>
<tr>
<td>Quantity ordered by OMRMD from CMS</td>
<td>.000</td>
<td>.000</td>
<td>.095</td>
<td>1</td>
<td>.758</td>
<td>1.000</td>
<td>.999 1.001</td>
</tr>
<tr>
<td>Quantity Received by OMRMD from CMS</td>
<td>.000</td>
<td>.000</td>
<td>.042</td>
<td>1</td>
<td>.837</td>
<td>1.000</td>
<td>.999 1.001</td>
</tr>
<tr>
<td>Quantity ordered by HF from OMRMD</td>
<td>.001</td>
<td>.000</td>
<td>4.036</td>
<td>1</td>
<td>.045*</td>
<td>1.001</td>
<td>1.000 1.002</td>
</tr>
<tr>
<td>Quantity issued to HFs</td>
<td>.002</td>
<td>.001</td>
<td>3.461</td>
<td>1</td>
<td>.063</td>
<td>.998</td>
<td>.996 1.000</td>
</tr>
<tr>
<td>Lead Time for delivery to OMRMD</td>
<td>.133</td>
<td>.076</td>
<td>3.108</td>
<td>1</td>
<td>.078</td>
<td>1.143</td>
<td>.985 1.325</td>
</tr>
<tr>
<td>Lead Time for delivery to HF</td>
<td>.086</td>
<td>.080</td>
<td>1.161</td>
<td>1</td>
<td>.281</td>
<td>.917</td>
<td>.784 1.073</td>
</tr>
<tr>
<td>Consumption at Clinics</td>
<td>.021</td>
<td>.014</td>
<td>2.209</td>
<td>1</td>
<td>.137</td>
<td>1.021</td>
<td>.993 1.049</td>
</tr>
<tr>
<td>Consumption Health Centres</td>
<td>.002</td>
<td>.005</td>
<td>.178</td>
<td>1</td>
<td>.673</td>
<td>.998</td>
<td>.988 1.008</td>
</tr>
<tr>
<td>Total Suspected Malaria Cases</td>
<td>.025</td>
<td>.016</td>
<td>2.601</td>
<td>1</td>
<td>.107</td>
<td>.975</td>
<td>.945 1.005</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.516</td>
<td>2.528</td>
<td>3.190</td>
<td>1</td>
<td>.074</td>
<td>.074</td>
<td>.011</td>
</tr>
</tbody>
</table>

CMS: Central Medical Store, OMRMD: Oshakati Multi-Regional Medical Depot, HF(s): Health Facilities.
Qualitative findings

Seventeen key informants were interviewed. Their experiences in supply chain range from 2 years to 21 years, and the highest level of education attained range from certificate to the degree level. The findings from the key informants are presented according to the themes that emerged from the interviews. Four themes and sub-themes were developed accordingly.

Theme 1: Stock out of mRDT

Regarding the question on stock out of malaria rapid test kit, the key informants responded that the problem is lack of consumption data.

Sub theme 1a: Lack of consumption data

Most of key informants (88%, n=15), explained their experiences and reported that the system is not functioning properly. That is evident from these statements:

“The system which is in place is pull system, therefore we are assuming that what the health facility is requested is exactly what it needs, but that is not the case, because most of health facilities, especially clinics are requesting more than or equivalent to a health centre or sometimes equivalent to hospital consumption!! Therefore, based on the issuing alone does not reflect a true picture on the ground, though it is easy and not time consuming.”

The other one has this to say:

“My biggest concern is the rate of expired medicine and wastage (mRDT) due to overstock. Using the software like FESC (Facility electronic stock card) does not help 100% to quantify exactly what was consumed. Lack of proper consumption data has resulted to have more medicines which are expired and also run out of stock because of under estimate of consumption”

Sub theme 1b: Limited storage capacity

Regarding the limited storage capacity, the majority ninety four percent (94%, n = 16) stated there is a problem with storage, which lead to medicine to expire as they are stored at a wrong place and staff might not be aware that they have stock. That was expressed by key informants in the following statements:

“Because of the limited storage and improper arrangement you will find that the medicines are ordered and receive, but don’t use, but the staff realized that medicine was there, but have already gotten expired”.

“The storage space has always been a problem, and this makes some health facilities to pile up boxes on the floor; this practice can compromise the quality of medicines”.

Sub theme 2: Medicine policy and decision makers

Sub theme 2a Lack of transparency in pharmaceutical supply chain

The key informants complained about lack of proper communication between the management and lower level staff. There is a lack of supervision visits and that contribute lack of transparency in pharmaceutical supply chain. This is evident from the statements below:

“Sometimes there is no communication between the management and other lower levels, e.g. sometimes people from management level can come for supportive supervision once in a year. And most of the time we are not receiving any feedback/report after supervision”.

However some of key informants gave positive responses as they indicated that there are some improvements.

“There is more improvement when you come to the issue of transparency compared to the previous years, for example these days we have a pharmaceutical dashboard whereby stock status reports are posted, so that all stakeholders in pharmaceutical supply chain can be aware of the stock status in the country as whole and individual health facilities around the country”.

Sub theme 2b: No specific budget allocated to health facility

Some key informants suggested that it will be better if they know their pharmaceutical budget allocation. Thirty five percent (35%, n = 6) said;

“If we could know or be aware of exactly the money/budget allocated for pharmaceutical services to every level, staff could have the sense of responsibility, this will lead to order and use medicine wisely rather than what is being done currently. Medicine are being ordered without a clear knowledge of the budget allocated in their health facilities”.

Sub theme 2c: Lack of proper preparation during implementation of a policy/guidelines

Regarding the proper preparation during policy/guidelines implementation the staff from Intermediate Hospital Oshakati indicated that they experience problem when ordering their stock. Although they are close to OMRMD they are requested to order from the Central Medical Store. Eighty eight percent (88%, n = 15) had to say this:

“OMRMD is very close to IHO but because of the policy and decision makers, we are sending our main order from CMS which is located more than 700km from Oshakati and do not allow to send our main order to OMRMD which is a few hundred meters from IHO. This makes unnecessary delay of services”.

Sub theme 2d: Task shifting

Twenty nine percent (29%, n = 5) of the key informants had to say “Nurses have a lot of work to do relating to the nursing field, giving them another task (shifting task) will comprise the quality of services, and they will concentrate more on the task they know better”.

Theme 3: Knowledge/training in pharmaceutical logistics

Sub theme 3a: Shortage of trained staff

All key informants (100%, n = 17) echoed the same view that the “Shortage of trained staff in the supply chain lead to overstock or understock especially at the lower level. Clinics are headed by registered nurses who are not well trained on the issue of supply chain of medicine”.

Sub theme 3b: Ordering and storage technique

82% (n = 14) the key informant said “We are ordering based on the ordering schedule which we received from OMRMD but the technique or what should we consider before ordering, we don’t know!”.

Theme 4: Transportation

Sub theme 4a Delays in deliveries

Forty-seven percent (47%, n = 8) of the key informants from all levels of the supply chain were dissatisfied with the time of medicine delivery “There is no proper coordination between transport department and other departments dealing with pharmaceutical supply chain, this make some delays to deliver medicines”.

Discussion

In case of mRDT as indicated in Table 1, the binary regression analysis indicates that the ordered quantity of mRDT by OMRMD from CMS is statistically significant predictor factor of stock out of mRDT with \( p = 0.03 \). The odds of stockout of mRDT occurring are defined as the ratio of the probability that stockout will occur to the probability that stockout will not as given by the equation. The ratio of the odds of stockout of mRDT when there is no quantity of mRDT ordered by OMRMD from CMS and there is quantity of mRDT ordered is 1.00. When the quantity of
mRDT ordered by OMRMD from CMS changes from not available to available the odds of stockout of mRDT is 1 times higher if all other variables stay the same with the correct prediction rate of 93.3%. This finding is supported by various literature which show that ordering of medicines can influence the stockout of medicines.\textsuperscript{7,8} This quantitative finding was also supported by the findings from qualitative which show that more than 60% of the key informants from all levels of the supply chain said ‘lack of proper knowledge of ordering from health facilities has resulted to the shortage and wastage of medicines’.

Conclusions

Pharmaceutical knowledge is needed in order to avoid stock out of diagnostic test kit like mRDT as it indicates that ordering of pharmaceutical items is a factor associates with stockout. Therefore, pharmaceutical training is needed especially to the nurses who are supervising health centers and clinics.

References