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Use of Mobile Phones for Monitoring Adverse Drug Reaction in Pharmacy and Drug Stores in Ishaka, Uganda - a Pilot Assessment of Willingness to Report

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Authors' contributions

This work was carried out in collaboration between all authors. Authors AAA, JB, ON, OAT and DK designed the study, wrote protocol and participated in the data collection and manuscript preparation. Authors AGO, JOCE and AAG participated in data collection and analysis. Authors JN, CPA, CB, SY and MVC managed literature search, analysis of the data and manuscript preparation. All authors read and approved the final manuscript.

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ABSTRACT

Aim: We investigated reporting of Adverse Drug Reaction (ADR) following use of drugs purchased from open system pharmacy (OSP) and drug stores, and the effectiveness of mobile phones for reporting drug reactions and detection of drug interactions.
Study Design: The study was descriptive and inceptional.
Place and Duration of Study: Selected Pharmacies and drug stores in Ishaka Municipality, Bushenyi, Uganda, between January and April 2012.
Methodology: A total of 190 participants purchasing prescription and non prescription drugs in the drug outlets were enrolled and drug purchases documented. Structured interviews were used to assess any existing system of ADR tracking. Possible interactions were assessed using electronic checkers software on drug combinations prescribed or purchased. Mobile phone calls were used to monitor the reporting potential, use of medication and events or reactions following drug use for ADRs.
Results: No formalized pre-study system was found for tracking ADR in the OSP and drug stores studied. Participants purchased 420 different medications with 55.8% without prescription. Antibiotics, analgesics and antimalarials ranked most purchased medications. All participants carried at least a functional mobile phone and demonstrated interest to report ADRs. Mean Effective Mobile Phone Contact Ratio (MEMPCR) for ADR monitoring was 0.91±0.2 and follow-up was 96% (n=183) and 89.5% on days 0 and 4 respectively. Interactions predicted were in 24.8% (31). Significant reporting of at least one of 404 reactions occurred within 72hr compared to 96-120hr (P=0.003). Two participants had reaction leading to discontinued use of Cotrimoxazole.
Conclusion: Use of mobile phones and drug interaction checker software may avail early detection of ADR and reporting. Facilitated toll free- call service may be an effective means of extending the scope of ADR tracking in addition to Yellow Card scheme, and augment involvement of pharmacists and consumers in safe use of drugs.

Keywords: Adverse drug reaction; mobile phone; reporting; pharmacies; drug stores; drug safety.

1. INTRODUCTION

Adverse drug reactions (ADRs) are significant causes of morbidity and mortality and have continued to cause many hospitalizations leading to large economic burdens to patients and to society [1,2,3]. Since pharmacovigilance (PV) plays an essential role in the outcome of therapy, its evolution and importance as a science are critical for effective clinical practice and public health science [4]. Post marketing surveillance of drugs has been used to ensure understanding of their safety profile in the general populace [5,6]. Aside hospital based ADR monitoring systems put in place in response to International regulation on drug use, established system of reporting reactions to drugs purchased from outside the hospital pharmacy; open system pharmacies (a system that admit clients and allow unrestricted access to the place where drugs are prepared or sold, except in case of controlled drugs) and drug stores is missing.

Community pharmacies and drug stores play a significant role in the Health system of a nation [7,8] and are important source of medicines and health care close to people's homes [9,10,11], contributing to drug distribution, availability and utilization. They could also serve as fronts from where pharmacovigilance can be carried out. These community pharmacies, in some parts of the world, have been reported playing significant role in reporting ADRs with over-the-counter (OTC) products [12]. However, little is known about the contribution in poor resource communities.

The Yellow Card scheme and prescription event monitoring rely in part on the patient spontaneously reporting symptoms to health care professionals [13,14,15,16], but difficult to accomplish in hard to reach and resource poor communities of Africa. The availability of a simple, friendly and accessible system for surveillance from private drug outlets may constitute a useful tool to improve pharmacovigilance tracking of ADR. Given the extended use of mobile phone technology [17], we hypothesized that an easy –to- use software for mobile phones can allow ADR monitoring in less privileged community. This study was designed to assess the reporting system available to register new information about ADR of medication dispensed to patients in open system pharmacies and drug stores. It aimed also to evaluate willingness to report and possible use of mobile phone to track adverse drug reaction. In addition, we assessed the relationship between mobile phone ADR monitoring activities, predictable drug interactions and effectiveness of patient based reporting of ADRs or events.

2. METHODOLOGY

The study was descriptive and inceptional [18], involving active follow-up of patients using mobile phones and monitoring of drug purchases as well as events following use in the selected centers in Ishaka, Uganda between January –April 2012.

2.1 Study Setting

Ishaka is located in Igara County, Bushenyi District, in Western Uganda. It is located approximately 12 kilometers west of Bushenyi district. The Ishaka municipality has an estimated population of 26,300. The community is served by a university, hospitals (primary health care centers, private and tertiary hospitals), banks and hotels.

2.2 Selection of Study Location

Drug outlets were identified and selected from the list of registered pharmacies and drug stores compiled by the Department of Pharmaceutical Services in Bushenyi District office. There were 2 pharmacies and 11 drug stores listed in the official records. From the 13 drug outlets, seven (two pharmacies and five drug stores) were randomly selected using computer generated randomization. Consent of the selected pharmacies and drug stores was sought following careful explanation of the rationale for the study and their participation.

2.3 Sample Size Determination

From all the 7 drug outlets, each with approximately 30 clients who purchased drugs per day, a total population of 270 gave a sample size of 159 determined at an expected frequency of 50%, assuming a 50% proportion of response of all who enrolled in the study and a confidence interval of 95%. A dropout rate of 15% was estimated and made up in the population size. Thus a minimum of 183 clients was expected.

2.4 Study Population

The study population was recruited from a pool of patients coming to the drug outlets to purchase drugs. A total of 190 participants were enrolled in the study. To avoid selection bias, 27 participants were recruited from the individuals attending each study center. The following criteria had to be fulfilled for enrolment in the study; residence in the area of study for not less than one year, absence of chronic or severe illness requiring admission, willingness to buy drugs from the selected drug outlet and consent to participate. One in every ten patronage per day was selected. The demographic data of patients to whom the drugs purchased were going to be administered was recorded including age, weight and sex were recorded. The customers purchasing on behalf of patients out of reach were excluded from participating in the study. A drug-data chart was designed to capture information on category of drugs purchased. Drugs were allocated a category based on pharmacological activity and class of the drug. The vulnerable group at risk of drug use in the population studied, in this case the pregnant women, were also recorded to assess proportion with risk of purchase of drugs from open system pharmacy. Also polypharmacy was also assessed in the population studied by obtaining prescription or list of drugs presented to the pharmacy for purchase and oral confirmation of intention to use for a particular ailment.

2.5 Assessment of Reporting System Available for ADR Monitoring

The drug outlets were assessed for existence of any reporting system for ADRs associated with drugs purchased by patients and their willingness to participate in ADR monitoring. The Pharmacists or drug dispensers at the selected centers were interviewed and a checklist was completed by our research team members (JB and ON). The checklist had items to inquire if patients were returning with information on how they feel when they took the medication they purchased, especially when they feel uncomfortable with their health following drug use, if there was record system for such complaints in the drug outlet, if there was a phone service to which patients are encouraged to call in case of ADR, if the location of the pharmacy or drug store is readily accessible to patients in case of any complaint, if the dispensary/pharmacy service provider is willing to provide assistance when such complaints are lodged, if they will be willing to call their clients or would like the client to call back to their centre using mobile phones in case of any complaint about the drugs following use. This assessment was carried out before the study on patients was conducted. Drug purchased were recorded daily to monitor routine sales. The data on drugs was collected daily from the community pharmacies/drug outlets for the study period and transferred into a computer database.

2.6 Assessment of Potential for Uptake of Use of Mobile Phone for ADR Tracking

All participants enrolled in the study and the drug outlet pharmacists and dispensers were assessed for uptake potential of use of mobile phone for ADR tracking, and responsibility to call to or call back respectively, when it seem that a patient for whom the drug bought is used is feeling uncomfortable with seeming drug reaction or adverse event. The total number of participants carrying at least one mobile phone with network provider connection was determined. In addition, the population from participants loss to follow-up on mobile phone contact was recorded per day and mean population lost to follow-up determined. Effective mobile phone contact ratio (EMPCR) was calculated as the fraction of the total

number of participants monitored with response to phone contact in the two week follow-up periods.

2.7 Willingness to Participate and Monitoring of Adverse Events and ADR

The willingness of the participants in Ishaka community to participate in pharmacovigilance (PV) through mobile phone monitoring of adverse drug reactions was evaluated in the 190 subjects who presented at the study sites to purchase drugs, volunteered to participate and provided information via mobile phones over a period of two weeks following purchase of medicine. The mobile phones were used to collect information on any reaction or side effects to drug experienced following ingestion of the drugs. In order to receive the information a call is made to the patients by two pharmacists in the research team (BJ and ON), acting for the pharmacists and dispensers, who had had training in effective communication to patients. Prior to enrolment in the mobile phone ADR monitoring, the objective of study was explained to each of the subjects after drug purchase and informed consent obtained. Since the study was a pilot experiment in open system pharmacy, all classes of drugs were included in the study.

2.8 Tracking the Events Following Drug Purchase and Use

The mobile phone numbers of the participants was obtained with permission and entered into a registration form. A call was made to validate correctness of entry and connectivity. A pre-tested series of questionnaire was used to inquire from all participants about any complaint or reactions observed by the subjects to whom the drug is administered if adult, or a caregiver when subject is a child.

Each participant was called from mobile phone designated for the exercise at specified times to record their conditions at time of use of drug, 6-10hours on day 0 and 24 hourly from day 1 to day 7. Since allergic reaction(s) to first time exposure to a drug may take around 10 days to appear [18], the participants were again called on day 14 (336hr), to obtain information on any events that occurred in the previous 7 days. All complaints or observations were recorded. Memory recall tests were performed by asking the participant, following few sentences into the conversation, to repeat what he/she had mentioned was(were) the reactions observed. Following compilation of mobile phone interaction with patients or caregivers, each complaint or observation was examined and determined qualified for ADR or not. A complaint or response to inquiries on phone was categorized as ADR from a patient if it qualifies to be ‘any response to the drug which is noxious and unintended, and that occurs at doses normally used in man for prophylaxis, diagnosis, or therapy of diseases or modification of physiological function’; and an adverse event if ‘any untoward medical occurrence present in a patient administered the medicine and which does not necessarily have to have causal relation with the treatment”.

2.9 Determination of Possible Drug Interactions

Participants who purchased more than one drug were recorded with the number of drug purchased and were categorized based on whether the participant carry prescription for the drug or not. After the purchase of drugs, a list of the purchased drugs was prepared and possible drug interactions were obtained using Medscape software checker (www.reference.medscape.com/drug-interactionchecker) for identifying drug interactions and classifying them as minor or significant. An outcome is minor when small or no clinical effect

was expected from the combination of two or more drugs and significant when the potential drug interaction could lead to permanent damage or risk of death.

2.10 Data Entry and Analysis

All data collected, including generic names, brand names, pharmacological classifications, collection centre, date of collection and day of study were entered into a database. The data generated were analyzed using SPSS Version 16.0 for windows. Parametric values are expressed as mean ± SD. The chi – square analysis was used to compare proportions.

3. RESULTS AND DISCUSSION

3.1 Results

The study was carried out between January-April 2012 and a total of 190 subjects were randomly selected from 250 patients that presented to the two pharmacies and five drug stores within the period of study. In the present study, none of the community pharmacies or drug stores had a system in place for ADR monitoring. Interviews with the management of the drug outlets showed that there was rarely any complaint received before the study period. The clients were reported to purchase drugs and went without returning to report any side effect or adverse reaction to the drugs.

3.1.1 Demographic data

Table 1 shows the demographic data of the patients who were enrolled in the study. The mean age of the patients was 28.2±1.3 years. There were more females (58.9%) who purchased drugs from the drug outlets than males. Of these 112 females, eight presented with pregnancy and were in the first and second trimesters purchasing drugs for themselves (n=5) and for their children (n=3) but without prescription. All patients enrolled (100%) carried at least one mobile phone.

3.1.2 Drug sales

Table 2 shows the distribution of drugs commonly purchased and assessed for ADRs in patients attending the pharmacies and drug stores and known adverse drug reactions for the class. A total of 420 drugs were purchased during the period of the study. Of the 420, antibiotics (35%) analgesics (20.5%) and antimalarials (7.1%) had the highest frequencies of the purchased drugs at the retail outlets in the study. The number of participant who presented prescriptions to the drug outlets and those who did not have prescriptions were compared. Participant without prescriptions had the highest frequency of 106 (55.8%) compared to the 84(44.2%) who presented with prescriptions to the drug outlets.

3.1.3 Assessment of potential for uptake of use of mobile phone for ADR tracking

Most participants were reachable through calls to their mobile phones. In few cases, the unavailability of network service was a factor for no contact at the time of call. The mean population of participants failing to follow-up by mobile phone contact was 16±5 subjects, with the least numbers on days 0 (7), 1 (9) and 2 (13). The number loss to follow-up from day 3-14 of the study was between 13 and 21 subjects from the 190 enrolled. The Mean Effective Mobile Phone Contact Ratio (MEMPCR) was 0.91±0.02.

Table 1. Demographic data of 190 clients enrolled in the study

Parameters	Value
Age (yr)	
Mean ± SD	28.2±1.3
Range	4 -75
Gender	
Males	78 (41.1)*
Females	112 (58.9)
No. with pregnancy	8 (7.7)
-Trimesters	
1	4
2	4
3	0
Level of education	
No formal Education	2
Primary	47
Secondary	127
Tertiary	34
Carriage of mobile phones	190 (100)

**All data in parentheses are proportions*

3.1.4 Multiple drugs purchase pattern and detection of drug interactions from medication obtained from drug outlets

The purchase of multiple drugs for same indication (polypharmacy practice) from both prescription and non-prescription drugs purchased in the drug outlets was documented. Out of the 84 prescriptions presented to the drug outlets by clients, 51 (60.7%) had at least 3 drugs prescribed for an indication. Twenty-nine patients (34.5%) had at least 3 drugs in prescriptions and was more common than other combination of drugs.

For drug purchases without prescriptions, 24 (22.6%) out of 106 had at least 3 drugs for an indication and 53 (50%) clients had the most purchased drugs as single drug

The analysis of possible interactions of drugs purchased in the outlets using the software (drug) interaction checker in 125 (66%) of 190 who purchased more than one drug showed that 94 (75.2%) prescriptions had no drug interactions whereas 31(24.8%) had interactions. Nineteen of the 31 (61.3%) drug purchases that had drug interactions were minor and 10 (32.2%) were significant. Two (6.5%) drug purchases had both minor and significant interactions. The software interaction checker outcome of selected purchases is presented in Table 3.

3.1.5 Response to phone calls and ADR report

The response to phone call was highest on day 0 (96%) with 183 participants and declined gradually to 89.5% (170) on day 4. Of the clients who responded to the phone calls, 86(47%) reported reactions to drugs on day 0 with the highest number of 97(53.6%) reporting on day 2. The mean population reporting side reactions to drugs was 76±26 (range= 46-97) between day 0-2, and 14±9 (range= 5-23) between days 3-5; only one participant reported on day 6. The difference in the means was significant (P= 0.003). There were no drug reactions reported on day 7 and day 14.

Table 2. Distribution of drugs commonly purchased from the community pharmacies and drug stores by participants enrolled in the study and known adverse effects

Pharmacological classification	Number of drugs purchased	% of the class	Known adverse effects
Anti-malarials	30	7.1	nausea, vomiting, heartburn, pruritus, mouth ulcer, epidermal necrolysis, Steven Johnson Syndrome, Gastrointestinal upset, blurred vision, Q-T prolongation with ventricular arrhythmia [19]
Antibiotics	147	35	urticaria, laryngospasm, bronchospasm, hypotension, Q-T prolongation with ventricular arrhythmia, acute renal failure, anemia, leukopenia and agranulocytosis, Stevens-Johnson syndrome, ototoxicity [20]
Analgesics	86	20.5	Hepatotoxicity, ulceration of GIT, sedation, dizziness, nausea, vomiting, headache
Antiulcers	14	3.3	(Very rare) headache, giddiness, dizziness, fatigue, constipation and diarrhea [21]
Antihypertensives	5	1.2	dizziness, ankle swelling, headache, fatigue, chest discomfort and cough [22]
Antifungals	20	4.8	Fever, chills, vomiting, muscle spasm, bone marrow toxicity, hepatitis, urticaria [23]

3.1.6 Reported drug reactions

Four hundred and four (404) incidences of different reactions to drugs were reported by participants who were followed up using mobile phone (Table 4) with all being common side effects of drugs. None qualified for a new information or unknown side effects except in three cases. Gastrointestinal (GIT) disturbances were the most frequently reported reactions to drugs accounting for 44.1 %, followed by central nervous system (CNS) effects with 31.2%. Among the GIT reactions reported, abdominal pain had the highest frequencies with 44.4%, followed by nausea (34.7%) and diarrhea (10.2%). The most frequently reported CNS effects were headache (42%), followed by drowsiness (40.3%) and sedation (17.6%). Other reactions that were reported by the participants included body weakness (11.7%), followed by dry mouth (2.2%) and metallic taste (2.2%).

3.1.7 Post –treatment assessment

Of the 170 respondents who were accessible for post treatment follow-up, 167 (98.2%) self reported adherence to treatment with exception of 3 (1.8%). There were reports of improved

clinical condition in 163 (85.8%) participants. One patient was referred to the health centre due to persistent rash as a result of taking co-trimoxazole. Two (1.1%) participants discontinued their medication; cotrimoxazole and cough linctus due to persistent rash and abdominal pain respectively. These reactions were not different from already known information about drugs taken.

3.2 Discussion

In the present study, the readiness to report and use mobile phone technology for monitoring ADRs, in communities exposed to relatively high patronage or consumption of numerous medications, is demonstrated feasible. Therefore, given the necessary system support, patients or drug users centered reporting approach may enhance pharmacovigilance on the one hand and complement reporting of ADRs using the existing hospital based yellow form tracking methods on the other.

It is noteworthy that the population studied, typical of small communities in disease endemic areas, purchased antibiotics, analgesics and antimalarial respectively at high rates from the outlets and more frequently than other drugs, with or without prescription. This is not surprising as the observation was similar to that reported in the study conducted in Nigeria [17]; perhaps a peculiarity of disease endemic regions where malaria and other bacterial infections are prevalent.

Monitoring adverse drug reaction from the link existing between the clients purchasing drugs and open system pharmacies/ drug stores that are distributed widely to the reach of many in the near and far communities in Africa [24] may be additional frontier to existing Pharmacovigilance mechanism. These drug outlets has remained more accessible for consultation and purchase of drugs for disease conditions in African setting and posit ready structure within health system to monitor adverse reaction to old or new drugs in consumers/ patients. Although purchase of drug from these outlets (uncontrolled) may not be the norm, the numerous challenges found in the health facilities of lack of drugs, costs of transportation, distance to health facility and poor staffing may be contributory. These also could add to reasons why many presenting at the drug outlets to purchase drugs do not carry prescription notes. The carriage of mobile phone of the all participants studied is indication of the convenience of communication and importance in day to day activities of the people in the study area. This may not be too surprising as Sub-Saharan Africa has for decades recorded increase in use of mobile telephony, despite poor road, water and electricity supply [25]. The mobile telephony has brought new possibilities on the continent, connecting individuals to individuals, information, market and services. Previously, in several studies, effective use of mobile phone to improve health care service have been reported, for example, use of mobile phone to remind HIV and AIDS patients to take their medicine in Malawi, and to report violent confrontations in Kenya, Nigeria and Mozambique [20]. Of recent, the advocacy for use of mobile phone text messaging has been stepped up for malaria control in Africa [26]. Therefore, mobile phone technology may, in Uganda, provide a medium to support the reporting of effects of drugs administered outside the hospital setting and un-supervised by medical experts, with notable high contact ratio.

Table 3. Interaction checker software generated outcomes of drugs purchased in randomly selected participants from the drug outlets

Code	Age/Sex	Diagnosis	Medication purchased	Drug interaction report	Classification of interaction	Description of events (Self reported)
001	32/M	Hypertension	i. Propanolol ii. Albendazole iii. Amoxicilin iv. Imipramine v. Cimetidine	Cimetidine will increase level and effect of Imipramine affecting CYP1A2 and CYP2D6 metabolism and hepatic/intestinal CYP3A4 metabolism	Significant	Abdominal Pain and drowsiness
003	60/M	Abdominal pain/ candidiasis	i. Gentamicin ii. Ofloxacin iii. Doxycycline iv. Tinidazole v. Ranitidine vi. Omeprazole vii. Cefriaxone	Ofloxacin will increase level and effect of ranitidine by basic drug competition for renal tubular clearance	Minor- Not significant	Nausea, palpitation
005	58/M	Peptic ulcer Disease and fungal infection	i. Magnesium trisilicate ii. Omeprazole iii. Ketoconazole	Omeperazol decreases level or effect of ketoconazole by increasing gastric pH	Significant	Drowsiness
010	34/F	Malaria and abdominal pain	i. Coartem ii. Ciprofloxacin iii. Ibuprofen	ibuprofen + ciprofloxacin- Increase risk of CNS stimulation and seizures with high doses of fluoroquinolones. ciprofloxacin plus artemether/lumefantrine both increase QTc interval.	Significant (require monitoring) Significant	Headache, stomach ache
015	30/F	phleobitis	i. Amoxicillin ii. Tetracycline	Tetracycline decreases the level of amoxicillin by pharmacodynamic antagonism	significant	Nil
029	30/F	Stomach pain	i. Diclofenac ii. Metroxidazole	Metronidazole increases level of diclofenac	minor	Nil
063	22/F	Headache insomia	i. Amitriptylin ii. Vitamin B complex iii. diclofenac	Nil	Nil	Nil
160	18/F	Typhoid	i. Ciprofloxacin ii. Paracetamol	Nil	Nil	Abdominal pain

Table 4. Different side effects or drug reactions reported by patients on follow-up using mobile phone

Reactions	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 14	Total	(%)
Abdominal pain	30	31	10	3	3	2	-	-	-	79	19.6
Nausea	19	21	15	7	-	-	-	-	-	62	15.3
Drowsiness	15	20	11	2	2	1	-	-	-	51	12.6
Headache	20	15	12	6	-	-	-	-	-	53	13.1
Tiredness/Weakness	10	12	7	4	2	-	-	-	-	35	8.7
Diarrhea	-	10	5	3	-	-	-	-	-	18	4.5
Anorexia	1	4	-	-	-	-	-	-	-	5	1.2
Irritation	2	3	1	-	-	-	-	-	-	6	1.5
Joint pain	1	-	-	-	-	1	-	-	-	2	0.5
Sedation	3	10	3	2	2	2	-	-	-	22	5.5
Sweating	-	-	6	-	-	-	-	-	-	6	1.5
Vomiting	3	3	-	-	-	-	-	-	-	6	1.5
Rash	-	3	1	1	2	1	-	-	-	8	2
Dry mouth	5	4	-	-	-	-	-	-	-	9	2.2
Local pain	1	-	-	-	-	-	-	-	-	1	0.2
Flatulence	4	3	-	1	-	-	-	-	-	8	2
Fatigue	-	7	5	-	-	-	-	-	-	12	3
Metallic taste	-	1	4	4	-	-	-	-	-	9	2.2
Tinnitus	-	3	-	2	2	-	-	-	-	7	1.7
Swollen gums	-	-	-	1	1	1	1	-	-	4	1
Lacrimation	1	-	-	-	-	-	-	-	-	1	0.2
Total	115	150	80	36	14	8	1	0	0	404	100

The uptake of mobile phones network provision for service may depend on several factors. A preliminary inquiry in this study showed that both pharmacists/dispensers and the patients and medicine consumers purchasing drugs want to be facilitated to be able to use their mobile to report any reactions to drugs. The finding is synonymous to earlier reports of pharmacists expressing interest to be engaged in ADR but receive financial incentive for such [27,28], and that with toll free call to mobile, pharmacovigilance can be more friendly and facilitated, especially in the case of report from consumers of drugs [17]. Being most currently diffused Information Communication Technology [29], mobile phones usage make convenience to obtaining information from participants who purchase and or use the drugs on the events following the use of the drugs, including adverse reaction, and may potentiate detection of such in hard to reach areas. The achievement of ADR monitoring using mobile phones may benefit from the Cooperate Social Responsibilities (CSR) of available network provider to support health systems.

Treatment is frequently initiated at home, often with drugs purchased from shops, which is a common practice across Africa [30,31,32,33]. In the present study, the practice of monitoring only prescription drug was extended to accommodate non prescription purchases due to increasing rate of self medication [34,35] and report suggesting the need to document appropriate use of drugs purchased in pharmacies and prevent possible offensive outcome [36]. The purchase of the drugs from outlets with high poly-pharmacy practice in the population studied provides basis for concern on drug interaction that may be minor or significant. The present study showed that purchase of drugs in the drug outlets included those who purchased drug without prescription and pregnant women, who purchased drugs for themselves or their babies. This suggests expanse covered of the categories of participant at risk of drug interaction or adverse reactions in open system with less strict regulation. Although little has been recorded of the consequences of drug interaction in African population [24], it forms an important concern as many of the drugs purchased in this study were self prescribed with over 50% of drugs purchased presenting significant interaction. Given that in Uganda, earlier reports have shown that drugs are often obtained for initial treatment from drug shops and services of a trained health worker are only sought if an illness does not improve [37], it may be important therefore that more studies are conducted to track health and economic cost of avoidable drug interaction and possible far from innocuous outcome from self medication.

The response to mobile phone monitoring of ADRs was highest in the first 24 hours (day 1) and remained relatively high by day 4 (89%). This was far much higher than that recorded in an earlier study in Nigeria [17] and not unexpected given the numerous adaptation to which mobile phones have been put in East Africa, including mobile money, distribution of fertilizers or banking services [24]. It may imply that there is increased readiness for utilization of mobile phone amongst the studied people for health concerns.

Spontaneous reporting systems such as the UK's Yellow Card depend on voluntary reporting of suspected reactions by health professionals and under-reporting is a major problem [38,39]. In the present study, the high response rate would suggest a complementary support that the mobile phone use may provide through direct reporting from the patients themselves. However, the decision to categorize true adverse drug reactions would remain with medical experts.

The reporting of ADR by the participant in this study was significantly higher in the first two days compared to day 4 but the reason(s) is (are) not clear. There are several considerations that may explain this; most adverse events took place within 48hrs, low

occurrence of observable reactions, out of danger or less agitation about the disease condition on the side of participants, declining interest to continue reporting since there was no problem, busy schedule or return to work and shift of attention. It is possible, given the list of reported events over time in the present study, to interpret that new exposure to drugs that could possibly lead to reporting reactions as late as between days 7 and 14 was absent. However, the phenomenon of using mobile phone connect to patients may not be undermined. A more elaborate study may be required to explain this observation and implication further. In addition, the list of self reported claims of effects is presented in this study to express the sorts of responses, perception or opinion of participants about what they know as drug effects. This may help expert drug reaction analysts to understand what participants in such exercise may report as drug effects and guide systematic analysis in future studies.

Except for two cases reported that required discontinuation of drugs and admission in the hospital, common adverse reactions to the drugs used were those reported by participants in the present study and causality is not systematically determined having taken note that the signs were not present prior to use of drug, and the study being a pilot proof of concept. More studies are required to validate this concept in a much larger population. Such studies should include proper assessment of causal relationship. However, the findings from this pilot revealed that the participants were clearly willing to report ADRs and therefore the monitoring of adverse reactions to new or existing drugs can be further extended in Africa to the remote hard to reach areas through mobile phone technology, encouraging facilitated self reporting.

One of the limitations of patient self-reporting is that data are obtained from patient perceptions or interpretation of events and recollections. While patients may not be regarded as able to discriminate effectively between reactions which are attributable to individual drugs or diseases, there are similar problems among health professionals [40]. Also the incompleteness and potential inaccuracy of data provided by patients on concomitant therapy and diseases may contribute to difficulties in attributing reactions appropriately. However despite these limitations, recall test was used to ascertain the report of a participant in the present study which was done when the phone conversation was ongoing. The findings suggest that most of the reactions reported by patients were potentially drug-related and there were no new ADRs reported. This is similar to a research conducted in the USA that reported common, well-known ADRs in a similar trial [41].

4. CONCLUSION

Overall, our findings suggest use of mobile phone technology with incorporated drug interaction checker software and toll free call service as a mean of extending the scope of existing monitoring devices or tools for ADRs.

CONSENT

Informed consent was obtained from participants before they were enrolled for this study. Consent for the participation of the community drug outlets was obtained from the management of the community pharmacy/ drug stores.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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