

Medication Error Disclosure and Attitudes to Reporting by Healthcare Professionals in a Sub-Saharan African Setting: A Survey in Uganda

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Abstract

Background Medication errors (MEs) are largely under-reported, which undermines quality improvement and medication risk management in healthcare.

Objectives To assess attitudes of Ugandan healthcare professionals (HCPs) towards ME reporting, and identify characteristics of HCPs who endorsed integration of ME and adverse drug reaction (ADR) reporting, valued patient involvement in ME reporting, disclosed having ever made potentially harmful MEs, or observed possibly harmful MEs committed by other HCPs.

Methods Healthcare professionals self-completed a questionnaire on their attitudes towards the occurrence and reporting of MEs in purposively selected Ugandan health

facilities (public/private) including the national referral and six regional referral hospitals representative of all regions. **Results** Response rate was 67 % (1345/2000). Most HCPs (91 %; 1174/1289) approved a national ME reporting system for Uganda and 58 % (734/1261) endorsed integration of ME and ADR reporting. Two-thirds (65 %; 819/1267) of HCPs valued patient involvement in ME reporting, one-fifth (18 %; 235/1310) disclosed that they had ever made potentially harmful MEs, while two-fifths (41 %; 542/1323) had ever identified possibly harmful MEs committed by other HCPs. Endorsing patient involvement in ME reporting was more likely by HCPs who valued root-cause analysis and reporting of both actual and potential MEs, or who conceded inadequate communication and lack of time. Self-disclosure of having ever committed potentially harmful MEs was more likely with the need for confidentiality, working in stressful conditions, and willingness to report ADRs. Identifying possibly harmful MEs committed by other HCPs was more likely by non-nurses and those who reported blame culture, stressful conditions, ever encountered a fatal ADR, or attachment to hospital-level health facility.

Conclusion A non-punitive healthcare environment and patient involvement may promote ME disclosure and reporting in Uganda and possibly other African countries.

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Key Points

Most Ugandan HCPs approved the establishment of a national ME reporting system.

Only one in five HCPs disclosed that they had ever committed potentially harmful MEs.

Two in three HCPs valued patient involvement in ME reporting.

1 Introduction

Medication errors (MEs) are the commonest preventable cause of patient harm [1] and have been associated with increased morbidity, mortality, and healthcare costs [2, 3]. Medication errors can arise at the prescribing, dispensing, or administration stages of the medication use process, and may or may not have adverse consequences [4]. The scope of pharmacovigilance (PV), defined as the science and activities related to the detection, assessment, understanding, and prevention of adverse drug reactions (ADRs) or any other drug-related problems [5], was broadened to incorporate the reporting of MEs [6, 7]. Through ME reporting systems, detection and root-cause analysis of MEs can identify individual and system weaknesses that should be addressed to improve patient safety [8]. However, MEs are largely under-reported [9], which undermines quality improvement and risk management in healthcare [10].

Studies conducted in the more developed countries have observed that the success of ME reporting systems relies on their ability to create a “no-blame-culture,” to encourage confidentiality of reported information, or to provide an option for reporter anonymity. The system should encourage ease of use, voluntary reporting, root-cause analysis of reported MEs, and giving timely feedback of error analysis results and recommendations to ME reporters [11, 12]. Fernald et al. [13] have observed that ME reporting systems that keep the identity of the reporter confidential receive higher quality ME reports when compared with anonymous ME reporting systems where the reporter does not reveal his/her identity. Furthermore, reporter anonymity has been reported to make follow-up difficult [14]. Healthcare professionals (HCPs) are a lynchpin in the effective functioning of ME reporting systems [12], both as a key source of ME reports and as users of the information arising from the analysis of these ME reports. In addition to promoting transparency and safe medication practices by HCPs, involving patients in their care is a crucial facet in promoting a safety culture in healthcare [15].

Globally, the World Health Organization–Uppsala Monitoring Centre (WHO–UMC) operates an international database, Vigibase, which receives spontaneous suspected adverse reaction reports from National Pharmacovigilance Centres (NPCs) from over 80 countries [16]. The database contained over 10 million reports by April 2015 and the oldest reports date back as early as 1968 [17]. The USA Institute for Safe Medication Practices, established over 35 years ago, is a voluntary ME reporting system for HCPs which can be accessed through an online platform [18]. Similarly, the European Medicines Agency (EMA), which started in 1995, operates a web-based system (Eudravigilance) to monitor medication safety reports within the

European Union (EU). Eudravigilance was established in 2001 and has since 2012 been empowered by EU legislation to receive information on ADRs resulting from MEs [19].

In African countries, ME reporting systems have hardly been embraced [20]. However, even when their establishment is scaled up, both existing and new ME reporting systems face the challenge of inherent weaknesses in African healthcare systems including but not limited to counterfeit and substandard medicines, unavailability of fundamental infrastructure, shortage of human resources for health, limited awareness or interest of HCPs in PV activities, weak medicines regulatory and PV systems, and scarce financial resources [7, 21]. Information is scarce on involvement of African HCPs in voluntary ME reporting systems, including HCPs' expectations of these reporting systems, and the likely disclosure of harmful MEs made either in person or by their colleagues. However, findings from medical audits conducted in Africa suggest that the extent of ME occurrence in these settings might even be a bigger problem than suspected ADRs, and that ME detection and prevention may be possible [22–24].

Uganda's NPC is yet to establish a formal ME reporting and evaluation system. A functional spontaneous ADR reporting system has been operational since 2005 with 14 regional pharmacovigilance centres [25, 26]. The Ugandan NPC's mandate has been extended to integrate ME reporting [27]. However, data on HCPs' readiness, their attitudes to, and characteristics associated with ME reporting in our resource-limited setting are lacking.

We assessed the attitudes and the personal and professional characteristics of Ugandan HCPs related to integration of ME and ADR reporting systems, patient involvement in ME reporting, and disclosure of having made potentially harmful MEs either in person or by other HCP colleagues.

2 Methods

2.1 Study Design and Sampling Procedure

From May 2012 to February 2013, HCPs anonymously self-completed a survey questionnaire on their attitudes towards the occurrence and reporting of MEs in purposively selected geographically representative public and private health facilities in Uganda. These facilities included the national referral hospital, six regional referral and district hospitals, health centres II to IV, and private health facilities within the catchment areas of the regional referral hospitals [26]. Eligible HCPs included those involved in the prescribing, transcribing, dispensing, and

administration of medications to patients. Trained research assistants obtained separately held written informed consent from the HCPs before inviting them to complete a self-administered questionnaire. The questionnaires did not capture respondent HCPs' identities but were tracked using serial numbers. Sampling frames (staff lists) in each selected health facility were not easily obtainable, therefore probability sampling of HCPs was not achieved. In addition, several contacts were made with willing but usually busy HCPs and delays to return completed questionnaires by those who accepted the invitation were common. Thus neither the refusal rate of invited HCPs nor the return rate of completed questionnaires by cadre were reliably recorded [26].

2.2 Data Collection and Management

The self-administered questionnaire elicited demographic and professional information, and attitudes of HCPs towards the occurrence and reporting of MEs in Uganda. Attitudes were measured using five items of a categorical nature (yes/no), and 17 statements on a five-point Likert scale with the categories: strongly disagree, slightly disagree, neutral, slightly agree, and strongly agree (see ESM Appendix).

All data were entered into a databank using EpiData 3.1.

2.3 Statistical Analysis

Questionnaire responses were summarized as frequencies and percentages.

We used Principal Components Analysis (PCA) and Exploratory Factor Analysis (EFA) techniques on the 22 variables primarily to identify and combine or drop multicollinear variables that would affect subsequent regression analyses. The data reduction PCA technique was employed to identify and combine redundant (highly correlated) variables into fewer uncorrelated components, of which none were identified. The structure detection EFA technique was used, in addition, to determine if there were underlying latent relationships between the variables on attitudes to ME reporting. However, EFA did not successfully extract any factor solution(s) that adequately represented sets of individual variables. Thus, individual variables were retained in subsequent regression analyses.

Likert scales were dichotomized into agree or other (disagree and neutral). We used binary logistic regression to assess demographic, professional, and attitudinal factors associated with four key variables, namely: "Integration of the ME and ADR reporting systems", "Patient participation in the reporting of MEs", "Disclosure by a respondent HCP that they had ever committed MEs that had the potential to harm patients", and "Having ever seen other

HCPs commit MEs that had the potential to harm patients".

Variables that were logically thought to measure similar constructs were not simultaneously fitted into the same regression models due to their inevitably high correlation. The following four variables were thought to measure similar fundamental facets of ME reporting: "Establishment of a national system for reporting Medication Errors (MEs)", "Integration of the ME and Adverse Drug Reaction (ADR) reporting systems", "Mandatory or voluntary reporting of MEs", and "Patient participation in ME reporting". Other pairs of variables thought to measure similar constructs were: "Having seen others commit medication errors that had the potential to harm patients" and "Having committed medication errors that had the potential to harm patients"; "Disruptions in continuity of patient care, such as shift changes, can be detrimental to patient care" and "Important issues are well communicated at shift changes"; "Personal details of the person who made an error should be reported" and "I may hesitate to use a reporting system for MEs because I am concerned about being identified"; and "I would recommend a non-disciplinary approach to encourage HCPs to report MEs" and "There is a culture of blame in healthcare".

Regression coefficients were expressed as odds ratios (ORs) with their 95 % confidence intervals (CIs) and were obtained using Stata 12.0 [28]. To take account of the multiplicity of potential covariates, we focused attention only on influential factors for which $P < 0.01$. We accounted for missing data using the missing-assigned approach where low-frequency missing data were meaningfully assigned to an existing category [26].

3 Results

3.1 Study Population

A total of 1345 HCPs self-completed the questionnaire, representing a response rate of 67 % ($n = 2000$). Mean age of HCPs was 32.4 years ($SD = 8.9$) and females were the majority (60 %; 804/1345). About three-fifths (58 %; 156/271; $n = 275$) of doctors reported that they had given verbal prescriptions to attending nurses in the previous year, and 54 % (376/693; $n = 792$) of nurses stated that they regularly transcribed prescriptions.

3.2 Attitudes to the Reporting of Medication Errors (MEs)

Most of the surveyed HCPs (91 %; 1174/1289) agreed that Uganda should have a national ME reporting system, 58 % (734/1261) agreed that the ME reporting system should be

integrated into the ADR reporting system, and 65 % (819/1267) stated that patients should participate in ME reporting (see Table 1).

Eighty-five percent (1125/1326) of HCPs agreed that reported MEs should be used to find the root causes of the MEs, while organizational leadership and support were needed in ME reporting according to 82 % (1081/1324) of respondent HCPs. Sixty-two percent (806/1308) of HCPs believed that there is a culture of blame within the healthcare system, with 33 % (436/1315) reporting that they would hesitate to use a ME reporting system due to concerns about being identified, and 31 % (412/1328) agreeing that personal details of the person who made an error should be reported (see Table 1).

3.3 Disclosure of MEs

Eighteen percent (235/1310) of HCPs disclosed that they had ever made MEs that had the potential to harm patients, while 41 % (542/1323) acknowledged that they had ever identified potentially harmful MEs that were committed by other HCPs (see Table 1) ($\chi^2 = 64.7$ (1 *df*), $P < 0.001$). Forty-seven percent (623/1327) of the HCPs had either disclosed that they had committed, in person, potentially harmful MEs or had witnessed the involvement of other HCPs. Thirty-nine percent (519/1315) of HCPs agreed that they were more likely to make MEs in tense or hostile (stressful) working conditions (see Table 1).

Table 1 Attitudes to medication error (ME) reporting by healthcare professionals, Uganda, 2013

Variable ^a	Yes, <i>n</i> (%)	No, <i>n</i> (%)	
Establishment of a national ME reporting system	1174 (91.1)	115 (8.9)	
Integration of the ME and ADR reporting systems	734 (58.2)	527 (41.8)	
Focus on fatal adverse events	312 (24.4)	965 (75.6)	
Patient participation in ME reporting	819 (64.6)	448 (35.4)	
Mandatory ME reporting system	946 (73.8)	336 (26.2)	
Statement ^a	Agree, <i>n</i> (%)	Neutral, <i>n</i> (%)	Disagree, <i>n</i> (%)
Reported MEs should be used to find the root causes of the MEs	1125 (84.8)	95 (7.2)	106 (8.0)
I would recommend a non-disciplinary approach to encourage ME reporting	917 (69.2)	191 (14.4)	218 (16.4)
There is lack of time for reporting MEs	336 (25.4)	208 (15.8)	777 (58.8)
There is a culture of blame within healthcare	806 (61.6)	216 (16.5)	286 (21.9)
There is a need for organizational leadership and support in reporting MEs	1081 (81.7)	133 (10.0)	110 (8.3)
Personal details of the person who made an error should be reported	412 (31.0)	221 (16.7)	695 (52.3)
The system should report both actual and potential MEs	907 (69.1)	220 (16.8)	185 (14.1)
Medication errors are handled appropriately in this setting	676 (51.8)	242 (18.5)	387 (29.7)
The culture in this health facility makes it easy to learn from the MEs of others	722 (54.6)	246 (18.6)	354 (26.8)
I am more likely to make MEs in tense or hostile situations	519 (39.5)	197 (14.9)	599 (45.6)
I have seen others make MEs that had the potential to harm patients	542 (41.0)	203 (15.3)	578 (43.7)
Disruptions in continuity of patient care can be detrimental to patient safety	678 (52.0)	235 (18.0)	391 (30.0)
I have made MEs that had the potential to harm patients	235 (17.9)	171 (13.1)	904 (69.0)
Important issues are well communicated at shift changes	868 (67.1)	187 (14.5)	238 (18.4)
I may hesitate to report MEs due to concerns about being identified	436 (33.2)	234 (17.8)	645 (49.0)
I should be financially rewarded for reporting MEs	348 (26.3)	244 (18.4)	732 (55.3)
Minor medication errors should not be reported	371 (28.0)	154 (11.6)	801 (60.4)

ADR adverse drug reaction

^a Variables have missing data

3.4 Characteristics of Healthcare Professionals (HCPs) Who Endorsed Integration of the ME and Adverse Drug Reaction (ADR) Reporting Systems

Older HCPs [at least 30 years old (OR = 1.5; 95 % CI: 1.15–1.87)] or those who had made suggestions on how to improve the ADR reporting system (OR = 1.5; 95 % CI: 1.11–1.93) were more likely to endorse integration of the ME and ADR reporting systems. However, integration was less likely to be promoted by non-nurses (OR = 0.5; 95 % CI: 0.39–0.65) and HCPs who had ever encountered a fatal ADR (OR = 0.6; 95 % CI: 0.43–0.80) (see Table 2).

3.5 Characteristics of HCPs Who Endorsed Patient Participation in ME Reporting

Healthcare professionals who valued root-cause analysis of reported MEs (OR = 1.6; 95 % CI: 1.11–2.18), those who reported inadequate communication at shift changes (OR = 1.4; 95 % CI: 1.10–1.87), or who agreed that both actual and potential MEs should be reported (OR = 1.4; 95 % CI: 1.10–1.88), and those who conceded that there is lack of time for reporting MEs (OR = 1.5; 95 % CI: 1.12–2.00) were more likely to endorse patient participation in ME reporting (see Table 3).

3.6 Characteristics of HCPs Who Disclosed that They had Ever Committed Potentially Harmful MEs

The need for confidentiality (OR = 1.6; 95 % CI: 1.14–2.14) and working in stressful conditions (OR = 2.0; 95 % CI: 1.47–2.77) were the characteristics of HCPs more likely to disclose that they had ever committed potentially harmful MEs. However, self-disclosure of MEs was less likely from HCPs who agreed that both actual and potential MEs should be reported (OR = 0.6; 95 % CI: 0.44–0.85) or those who were hesitant to report ADRs (OR = 0.6; 95 % CI: 0.47–0.87) (see Table 4).

3.7 Characteristics of HCPs Who Ever Identified Potentially Harmful MEs Committed by Other HCPs

Attachment to a hospital-level health facility (OR = 1.7; 95 % CI: 1.23–2.30), reporting that there is a culture of blame in healthcare (OR = 1.6; 95 % CI: 1.28–2.11) or working in stressful conditions (OR = 1.4; 95 % CI: 1.12–1.84); and being a non-nurse (OR = 1.5; 95 % CI: 1.15–1.92) or having ever encountered a fatal ADR (OR = 1.5; 95 % CI: 1.13–2.05) were associated with

having ever identified potentially harmful MEs committed by other HCPs (see Table 5).

4 Discussion

Nine in ten HCPs agreed that Uganda should have a national ME reporting system, suggesting their willingness to embrace this reporting system. However, eight in ten HCPs reported the need for organizational leadership and support in ME reporting, a systems approach that would likely enhance their readiness to report MEs [29]. Uganda is yet to establish a formal ME reporting system, though a well established spontaneous ADR reporting system, coordinated by the NPC, has existed since 2005 [25, 26]. Despite the HCPs' optimism for the establishment of a national ME reporting system, the national statistics for voluntary ADR reporting indicate that only 0.44 % of Ugandan HCPs report suspected ADRs annually [26]. Therefore ME under-reporting by HCPs might still be a major challenge. Moreover, voluntary ME and ADR under-reporting continue to be a healthcare system challenge worldwide [30, 31]. However, voluntary ME and ADR reporting systems are still a cornerstone to medication safety programs globally [30, 32].

Three in five HCPs agreed that the ME reporting system should be integrated with the ADR reporting system. Holmstrom et al. [20] identified Zambia as an example of an African country that operates an integrated national ME and ADR reporting system. Rwanda was another African country with a local ME reporting system but whose setting was not clearly defined [20]. The integration of ME and ADR reporting could save the resources otherwise needed to maintain separate systems, but might potentially compromise the quality of reporting [33] and overwhelm the existing voluntary ADR reporting system [26] in our resource-limited setting. Bencheikh et al. [34] have suggested that pharmacovigilance centers, poison control centers, and patient safety organizations may operate independently but work closely together with regulatory bodies to promote patient safety while avoiding duplicity of functions.

The study also identified the characteristics of HCPs who endorsed integration of the ME and ADR reporting systems. Older HCPs and those who suggested ways to improve the ADR reporting system were more likely to support integration of the ME and ADR reporting systems, and these two categories of HCPs were previously found to be ardent ADR reporters [26]. Non-nurses (doctors, pharmacists, pharmacy technicians, clinical officers, and others), however, were less likely to support the integration of the two reporting systems. Kiguba et al. [26] have reported that in Uganda non-nurses are more likely than nurses to

Table 2 Characteristics of 1261^a healthcare professionals (HCPs) who endorsed integration of medication error (ME) reporting into the existing adverse drug reaction (ADR) reporting system, Uganda, 2013

Factor	Endorsed integration of ADR and ME reporting		Crude analysis			Adjusted analysis		
	Yes (%)	No (%)	OR	95 % CI	<i>P</i> value	OR	95 % CI	<i>P</i> value
Level of health facility								
Other	264 (57.3)	197 (42.7)	1.0			1.0		
Hospital	470 (58.8)	330 (41.2)	1.1	0.84–1.34	0.607	1.2	0.85–1.61	0.333
Type of health facility								
Public	318 (58.0)	230 (42.0)	1.0			1.0		
Private not-for-profit	158 (60.5)	103 (39.5)	1.1	0.82–1.50	0.498	1.2	0.85–1.63	0.333
Private for-profit	258 (57.1)	194 (42.9)	1.0	0.75–1.24	0.762	1.1	0.78–1.51	0.628
Region of the country								
Central	343 (58.4)	244 (41.6)	1.0			1.0		
Eastern	212 (54.1)	180 (45.9)	0.8	0.65–1.08	0.178	0.7	0.52–0.98	0.038
Other	179 (63.5)	103 (36.5)	1.2	0.92–1.66	0.156	1.2	0.87–1.67	0.261
Professional cadre								
Nurse	461 (63.4)	266 (36.6)	1.0			1.0		
Non-nurse	273 (51.1)	261 (48.9)	0.6	0.48–0.76	<0.001	0.5	0.39–0.65	<0.001
Age (years)								
Less than 30	295 (53.4)	257 (46.6)	1.0			1.0		
30 or more	439 (61.9)	270 (38.1)	1.4	1.13–1.78	0.002	1.5	1.15–1.87	0.002
Department								
Medicine	351 (56.9)	266 (43.1)	1.0			1.0		
Surgery	57 (60.0)	38 (40.0)	1.1	0.73–1.77	0.568	1.0	0.62–1.63	0.980
Pediatrics, obstetrics and gynecology	115 (59.9)	77 (40.1)	1.1	0.81–1.57	0.462	1.1	0.76–1.56	0.637
Other	211 (59.1)	146 (40.9)	1.1	0.84–1.43	0.500	1.1	0.85–1.51	0.398
Patient load								
More than 30/day	353 (63.0)	207 (37.0)	1.0			1.0		
At most 30/day	381 (54.4)	320 (45.6)	0.7	0.56–0.88	0.002	0.8	0.60–0.98	0.036
Involved in medical research								
No	510 (57.2)	381 (42.8)	1.0			1.0		
Yes	224 (60.5)	146 (39.5)	1.1	0.90–1.47	0.279	1.3	1.00–1.69	0.054
Ever encountered fatal ADR								
No	611 (60.7)	396 (39.3)	1.0			1.0		
Yes	123 (48.4)	131 (51.6)	0.6	0.46–0.80	<0.001	0.6	0.43–0.80	0.001
Knows to whom to report ADRs								
No	371 (59.6)	252 (40.4)	1.0			1.0		
Yes	363 (56.9)	275 (43.1)	0.9	0.72–1.12	0.339	0.8	0.62–1.01	0.055
Suggested ways to improve ADR reporting								
No	160 (51.6)	150 (48.4)	1.0			1.0		
Yes	574 (60.4)	377 (39.6)	1.4	1.10–1.85	0.007	1.5	1.11–1.93	0.007
I would only report an ADR if I was sure that it was related to the use of a particular drug								
Other	268 (56.5)	206 (43.5)	1.0			1.0		
Agree	466 (59.2)	321 (40.8)	1.1	0.89–1.41	0.352	1.1	0.87–1.43	0.375
I do not know how the information reported in an ADR form is used								
Other	407 (58.5)	289 (41.5)	1.0			1.0		
Agree	327 (57.9)	238 (42.1)	1.0	0.78–1.22	0.830	0.9	0.71–1.14	0.381
Root-cause analysis of MEs								
Other	96 (52.5)	87 (47.5)	1.0			1.0		
Agree	638 (59.2)	440 (40.8)	1.3	0.96–1.80	0.089	1.2	0.83–1.66	0.375

Table 2 continued

Factor	Endorsed integration of ADR and ME reporting		Crude analysis			Adjusted analysis		
	Yes (%)	No (%)	OR	95 % CI	<i>P</i> value	OR	95 % CI	<i>P</i> value
There is a lack of time for reporting MEs								
No	544 (57.1)	409 (42.9)	1.0			1.0		
Yes	190 (61.7)	118 (38.3)	1.2	0.93–1.57	0.155	1.2	0.90–1.58	0.210
Need for organizational leadership and support in reporting MEs								
Other	117 (51.8)	109 (48.2)	1.0			1.0		
Agree	617 (59.6)	418 (40.4)	1.4	1.03–1.84	0.031	1.3	0.91–1.77	0.163
Personal details of the person who made a ME are to be reported								
Other	491 (56.0)	386 (44.0)	1.0			1.0		
Agree	243 (63.3)	141 (36.7)	1.4	1.06–1.73	0.016	1.2	0.93–1.58	0.157
System should report both actual and potential MEs								
Other	207 (52.8)	185 (47.2)	1.0			1.0		
Agree	527 (60.6)	342 (39.4)	1.4	1.08–1.75	0.009	1.2	0.93–1.58	0.160
I have made MEs that had the potential to harm patients								
Other	606 (58.1)	438 (41.9)	1.0			1.0		
Agree	128 (59.0)	89 (41.0)	1.0	0.77–1.40	0.798	1.1	0.82–1.54	0.464
Important issues are well communicated at shift changes								
Other	244 (55.2)	198 (44.8)	1.0			1.0		
Agree	490 (59.8)	329 (40.2)	1.2	0.96–1.53	0.112	1.0	0.76–1.26	0.863
I should be financially rewarded for reporting MEs								
Other	546 (58.2)	393 (41.8)	1.0			1.0		
Agree	188 (58.4)	134 (41.6)	1.0	0.78–1.31	0.940	1.0	0.74–1.28	0.854

^a The missing-assigned approach (missing data assigned to the “no” category) was used to account for missing data prior to commencing the model fitting procedures

recognize suspect ADRs, although no significant difference has been observed in ADR-reporting rates between the two HCP cadre-levels. The reasons for the lower than expected ADR reporting rate by non-nurses when compared with nurses might partly explain the observed lower likelihood of non-nurses to support integration of the ME and ADR reporting systems. Sarvadikar et al. [35] and Milch et al. [36] reported varying attitudes to ME reporting among different cadres of HCPs in the USA, with higher reporting rates being registered by nurses than by doctors. The nurse-cadre-targeted adverse event training campaigns conducted in the USA setting could explain the higher enthusiasm by the American nurses to report MEs, and highlights the benefits of training programmes [36]. However, in Uganda more investigations are needed to identify the reasons why Ugandan non-nurses, when compared with nurses, seem to have less enthusiasm for pharmacovigilance. HCPs who had ever encountered fatal ADRs did not favor integration of the ME and ADR reporting systems, probably for fear of litigation or punishment if reported fatal ADRs were linked to reported MEs committed by these HCPs [8]. Conducting multiple health facility-based interventions including sensitization and training campaigns that target all Ugandan

HCP-cadres could be beneficial. The interventions should address the needs of non-nurses and younger HCPs. In addition, a non-punitive organizational-level approach such as confidential ME reporting should be adopted.

Our research team drafted a ward-based ME reporting form and a tracking log that will be tested in a longitudinal study on hospitalized patients, in conjunction with a modified ward-tailored ADR reporting form developed for the same study [26].

Three-fifths of HCPs agreed that patients should participate in ME reporting. This is a laudable proportion of HCPs in support of the drive by the WHO World Alliance for Patient Safety to increase patient involvement in the promotion of a safety culture in healthcare [37]. Moreover, the first African regional patients for patient safety workshop was held in Uganda in 2011; this brought together patients, HCPs, and healthcare policy makers to share experiences of harm in healthcare [38]. Lack of time for ME reporting and inadequate communication, for instance at shift changes, were identified characteristics of HCPs who promoted patient participation in ME reporting. Possible explanations advanced for lack of time to report MEs include absence of perceived benefit, the extra burden

Table 3 Characteristics of 1267^a healthcare professionals (HCPs) who endorsed patient participation in medication error (ME) reporting, Uganda, 2013

Factor	Patient participation in ME reporting		Crude analysis			Adjusted analysis		
	Yes (%)	No (%)	OR	95 % CI	<i>P</i> value	OR	95 % CI	<i>P</i> value
Level of health facility								
Other	281 (61.5)	176 (38.5)	1.0			1.0		
Hospital	538 (66.4)	272 (33.6)	1.2	0.98–1.57	0.078	1.2	0.90–1.71	0.181
Type of health facility								
Public	353 (64.4)	195 (35.6)	1.0			1.0		
Private not-for-profit	177 (65.8)	92 (34.2)	1.1	0.78–1.44	0.697	1.2	0.84–1.62	0.367
Private for-profit	289 (64.2)	161 (35.8)	1.0	0.76–1.29	0.949	1.3	0.95–1.87	0.095
Region of the country								
Central	410 (68.6)	188 (31.4)	1.0			1.0		
Eastern	234 (59.9)	157 (40.1)	0.7	0.52–0.89	0.005	0.7	0.51–0.96	0.027
Other	175 (63.0)	103 (37.0)	0.8	0.58–1.05	0.101	0.8	0.60–1.15	0.268
Professional cadre								
Nurse	463 (63.5)	266 (36.5)	1.0			1.0		
Non-nurse	356 (66.2)	182 (33.8)	1.1	0.89–1.42	0.328	1.0	0.73–1.25	0.747
Age (years)								
Less than 30	354 (62.5)	212 (37.5)	1.0			1.0		
30 or more	465 (66.3)	236 (33.7)	1.2	0.94–1.49	0.161	1.2	0.91–1.50	0.227
Department								
Medicine	393 (64.0)	221 (36.0)	1.0			1.0		
Surgery	64 (68.8)	29 (31.2)	1.2	0.78–1.98	0.366	1.1	0.67–1.90	0.606
Pediatrics, obstetrics and gynecology	129 (65.2)	69 (34.8)	1.1	0.75–1.47	0.770	1.0	0.69–1.42	0.942
Other	233 (64.4)	129 (35.6)	1.0	0.77–1.33	0.910	1.0	0.72–1.28	0.777
Patient load								
More than 30/day	362 (64.8)	197 (35.2)	1.0			1.0		
At most 30/day	457 (64.6)	251 (35.4)	1.0	0.79–1.25	0.938	1.0	0.79–1.31	0.877
Involved in medical research								
No	574 (64.4)	318 (35.6)	1.0			1.0		
Yes	245 (65.3)	130 (34.7)	1.0	0.81–1.34	0.738	1.0	0.74–1.26	0.782
Ever encountered fatal ADR								
No	643 (63.7)	367 (36.3)	1.0			1.0		
Yes	176 (68.5)	81 (31.5)	1.2	0.93–1.66	0.150	1.1	0.78–1.48	0.647
Knows to whom to report ADRs								
No	400 (64.5)	220 (35.5)	1.0			1.0		
Yes	419 (64.8)	228 (35.2)	1.0	0.80–1.27	0.928	1.1	0.83–1.37	0.607
Suggested ways to improve ADR reporting								
No	191 (61.0)	122 (39.0)	1.0			1.0		
Yes	628 (65.8)	326 (34.2)	1.2	0.95–1.60	0.123	1.1	0.85–1.50	0.391
I would only report an ADR if I was sure that it was related to the use of a particular drug								
Other	312 (65.1)	167 (34.9)	1.0			1.0		
Agree	507 (64.3)	281 (35.7)	1.0	0.76–1.23	0.774	1.0	0.75–1.23	0.747
I do not know how information reported in an ADR form is used								
Other	457 (65.0)	246 (35.0)	1.0			1.0		
Agree	362 (64.2)	202 (35.8)	1.0	0.77–1.22	0.761	0.9	0.71–1.20	0.449
Root-cause analysis of MEs								
Other	100 (52.6)	90 (47.4)	1.0			1.0		
Agree	719 (66.8)	358 (33.2)	1.8	1.32–2.47	<0.001	1.6	1.11–2.18	0.011

Table 3 continued

Factor	Patient participation in ME reporting		Crude analysis			Adjusted analysis		
	Yes (%)	No (%)	OR	95 % CI	<i>P</i> value	OR	95 % CI	<i>P</i> value
There is a lack of time for reporting MEs								
No	600 (62.6)	358 (37.4)	1.0			1.0		
Yes	219 (70.9)	90 (29.1)	1.5	1.10–1.92	0.009	1.5	1.12–2.00	0.007
Need for organizational leadership and support in reporting MEs								
Other	123 (53.3)	108 (46.8)	1.0			1.0		
Agree	696 (67.2)	340 (32.8)	1.8	1.35–2.40	<0.001	1.4	1.02–1.97	0.038
Personal details of the person who made a ME are to be reported								
Other	548 (62.1)	334 (37.9)	1.0			1.0		
Agree	271 (70.4)	114 (29.6)	1.4	1.12–1.87	0.005	1.4	1.03–1.78	0.033
System should report both actual and potential MEs								
Other	222 (56.4)	172 (43.6)	1.0			1.0		
Agree	597 (68.4)	276 (31.6)	1.7	1.31–2.14	<0.001	1.4	1.10–1.88	0.008
I have made MEs that could harm patients								
Other	667 (63.5)	384 (36.5)	1.0			1.0		
Agree	152 (70.4)	64 (29.6)	1.4	0.99–1.88	0.054	1.3	0.94–1.84	0.107
Important issues are not well communicated at shift changes								
Other	517 (62.8)	306 (37.2)	1.0			1.0		
Agree	302 (68.0)	142 (32.0)	1.3	0.99–1.61	0.065	1.4	1.10–1.87	0.009
I should be financially rewarded for reporting MEs								
Other	623 (65.9)	322 (34.1)	1.0			1.0		
Agree	196 (60.9)	126 (39.1)	0.8	0.62–1.04	0.102	0.7	0.55–0.96	0.025

ADR adverse drug reaction

^a The missing-assigned approach (missing data assigned to the “no” category) was used to account for missing data prior to commencing the model fitting procedures

associated with reporting, lack of clarity on what to report, and severity of illness [39]. Fernald et al. [13] found that 71 % of the MEs in their setting were attributed to communication problems. Patients may help to bridge the communication gaps that arise in healthcare, especially at shift changes. However, patient-related factors such as lack of confidence or inadequate medical knowledge are potential barriers to their involvement in ME reporting [37]. That notwithstanding, Weingart et al. [40] demonstrated that patients identified adverse events that were unaccounted for in the medical records and/or were not covered in the hospital incident reporting system [40]. Valuing root-cause analysis and reporting of both actual and potential MEs were the other characteristics of HCPs more likely to promote patient participation in ME reporting. Ugandan health facilities should institute regular audits of medication use by patients to identify MEs. Harmful and potentially harmful MEs identified in the audits should be subjected to root-cause analysis [41]. The learning derived from root-cause analysis of both harmful and apparently minor MEs or near misses can foster system improvements and reduce the risks associated with

healthcare [14, 32]. In our planned cohort study, incident MEs among hospitalized patients will be assessed using root-cause analysis. We shall involve patients to obtain insight into their medication use experiences while in hospital.

One in five HCPs disclosed that they had committed potentially harmful MEs, while two in five reported that they had seen other HCPs make MEs that had the potential to harm patients. About half (47 %; 623/1327) of HCPs had either disclosed that they had ever committed potentially harmful MEs in person or had witnessed the involvement of other HCPs. Similar rates of ME disclosure by African HCPs have been reported in anesthesia practice in Nigeria (56 %; 24/43) [42] and in South Africa (39 %; 33/84) [43]. The willingness of HCPs in our setting to disclose both harmful and potentially harmful MEs merits further investigation. Currently, there is no protective legislation for reporting MEs in Uganda. Recognizing that a ME has occurred, irrespective of who is involved, is a first step in the ME reporting process. However, protective legislation for ME reporters if instituted may likely allay their fears of punitive action and promote ME reporting.

Table 4 Characteristics of 1310^a healthcare professional (HCPs) who disclosed that they had ever committed potentially harmful medication errors (MEs), Uganda, 2013

Factor	Ever made MEs with potential to harm patients		Crude analysis			Adjusted analysis		
	Agree (%)	Other (%)	OR	95 % CI	<i>P</i> value	OR	95 % CI	<i>P</i> value
Level of health facility								
Other	90 (18.4)	400 (81.6)	1.0			1.0		
Hospital	145 (17.7)	675 (82.3)	1.0	0.71–1.28	0.755	0.7	0.48–1.08	0.109
Type of health facility								
Public	115 (20.7)	442 (79.3)	1.0			1.0		
Private not-for-profit	42 (15.4)	230 (84.6)	0.7	0.48–1.03	0.073	0.8	0.51–1.18	0.235
Private for-profit	78 (16.2)	403 (83.8)	0.7	0.54–1.02	0.068	0.8	0.51–1.17	0.218
Region of the country								
Central	117 (19.6)	481 (80.4)	1.0			1.0		
Eastern	66 (16.2)	342 (83.8)	0.8	0.57–1.11	0.172	1.0	0.69–1.56	0.866
Other	52 (17.1)	252 (82.9)	0.8	0.59–1.22	0.371	1.0	0.66–1.50	0.979
Professional cadre								
Nurse	124 (16.2)	644 (83.8)	1.0			1.0		
Non-nurse	111 (20.5)	431 (79.5)	1.3	1.01–1.78	0.044	1.1	0.76–1.47	0.750
Age, years								
Less than 30	108 (18.7)	469 (81.3)	1.0			1.0		
30 or more	127 (17.3)	606 (82.7)	0.9	0.69–1.21	0.515	0.8	0.62–1.14	0.277
Department								
Medicine	123 (19.3)	516 (80.7)	1.0			1.0		
Surgery	19 (18.6)	83 (81.4)	1.0	0.56–1.64	0.882	0.9	0.53–1.70	0.859
Pediatrics, obstetrics and gynecology	34 (17.1)	165 (82.9)	0.9	0.57–1.31	0.495	0.9	0.59–1.48	0.778
Other	59 (16.0)	311 (84.0)	0.8	0.57–1.12	0.189	0.8	0.59–1.23	0.386
Patient load								
More than 30/day	112 (19.0)	477 (81.0)	1.0			1.0		
At most 30/day	123 (17.1)	598 (82.9)	0.9	0.66–1.16	0.359	0.9	0.65–1.20	0.421
Involved in medical research								
No	153 (16.5)	773 (83.5)	1.0			1.0		
Yes	82 (21.4)	302 (78.6)	1.4	1.02–1.85	0.039	1.2	0.88–1.68	0.231
Ever encountered fatal ADR								
No	172 (16.4)	879 (83.6)	1.0			1.0		
Yes	63 (24.3)	196 (75.7)	1.6	1.18–2.28	0.003	1.6	1.10–2.28	0.014
Knows to whom to report ADRs								
No	136 (20.8)	519 (79.2)	1.0			1.0		
Yes	99 (15.1)	556 (84.9)	0.7	0.51–0.90	0.008	0.8	0.55–1.03	0.074
Suggested ways to improve ADR reporting								
No	53 (16.1)	276 (83.9)	1.0			1.0		
Yes	182 (18.6)	799 (81.4)	1.2	0.85–1.66	0.318	1.3	0.88–1.80	0.206
I would only report an ADR if I was sure that it was related to the use of a particular drug								
Other	110 (22.2)	385 (77.8)	1.0			1.0		
Agree	125 (15.3)	690 (84.7)	0.6	0.48–0.84	0.002	0.6	0.47–0.87	0.004
I do not know how information reported in an ADR form is used								
Other	125 (17.1)	605 (82.9)	1.0			1.0		
Agree	110 (19.0)	470 (81.0)	1.1	0.85–1.50	0.388	1.1	0.81–1.48	0.556
Root-cause analysis of MEs								
Other	41 (20.5)	159 (79.5)	1.0			1.0		
Agree	194 (17.5)	916 (82.5)	0.8	0.56–1.20	0.306	0.8	0.54–1.25	0.353

Table 4 continued

Factor	Ever made MEs with potential to harm patients		Crude analysis			Adjusted analysis		
	Agree (%)	Other (%)	OR	95 % CI	P value	OR	95 % CI	P value
There is a lack of time for reporting MEs								
Other	165 (16.9)	814 (83.1)	1.0			1.0		
Agree	70 (21.2)	261 (78.8)	1.3	0.97–1.81	0.079	1.2	0.89–1.72	0.214
There is a culture of blame within healthcare								
Other	79 (15.3)	438 (84.7)	1.0			1.0		
Agree	156 (19.7)	637 (80.3)	1.4	1.01–1.83	0.043	1.2	0.87–1.66	0.269
There is a need for organizational leadership and support in reporting MEs								
Other	42 (17.0)	205 (83.0)	1.0			1.0		
Agree	193 (18.2)	870 (81.8)	1.1	0.75–1.56	0.671	1.1	0.72–1.71	0.637
System should report both actual and potential MEs								
Other	91 (22.0)	322 (78.0)	1.0			1.0		
Agree	144 (16.1)	753 (83.9)	0.7	0.50–0.91	0.009	0.6	0.44–0.85	0.003
I am more likely to make MEs in tense or hostile situations								
Other	105 (13.1)	694 (86.9)	1.0			1.0		
Agree	130 (25.4)	381 (74.6)	2.3	1.69–3.00	<0.001	2.0	1.47–2.77	<0.001
Important issues are well communicated at shift changes								
Other	97 (21.5)	354 (78.5)	1.0			1.0		
Agree	138 (16.1)	721 (83.9)	0.7	0.52–0.93	0.015	0.8	0.56–1.05	0.096
I may hesitate to use a reporting system for MEs because I am concerned about being identified								
Other	130 (14.8)	748 (85.2)	1.0			1.0		
Agree	105 (24.3)	327 (75.7)	1.8	1.39–2.46	<0.001	1.6	1.14–2.14	0.005
I should be financially rewarded for reporting MEs								
Other	166 (17.1)	803 (82.9)	1.0			1.0		
Agree	69 (20.2)	272 (79.8)	1.2	0.90–1.68	0.199	1.3	0.92–1.80	0.137

ADR adverse drug reaction

^a The missing-assigned approach (missing data assigned to the “no” category) was used to account for missing data prior to commencing the model fitting procedures

Three-fifths of doctors reported that they gave verbal prescriptions to nurses and more than half of nurses reported that they regularly transcribed prescriptions (a responsibility for doctors and pharmacists in Uganda). Thus, more opportunities for MEs may arise from doctors' verbal prescriptions and from nurse-transcriptions. Therefore both practices ought to be discouraged.

HCPs who preferred confidential ME reporting and those who agreed that they had a higher likelihood to commit MEs in stressful situations were more likely to disclose that they had previously committed potentially harmful MEs. A highly stressful work environment for HCPs can arise from emergency situations and low staffing levels, thus leading to excessive workloads and fatigue, among others, all of which may promote error-prone working conditions [44]. The situation in sub-Saharan Africa is compounded by the shortage of human resources for health, with nine physicians per 100,000 population and

55 nurses/midwives per 100,000 population: 64 HCPs (physicians/nurses/midwives) per 100,000 population when combined, which is far below the WHO target of at least 228 HCPs per 100,000 population [45]. Whereas healthcare systems that create less tense or non-hostile working conditions for HCPs might lower the incidence of harmful MEs, reporting systems that foster confidentiality of reported information and/or those that have an option for anonymity of the ME reporter might encourage increased participation of HCPs in healthcare quality improvement and risk management systems [12]. It is worth noting, however, that confidential ME reports seem to provide higher quality information than anonymous ME reports [13]. Healthcare professionals who agreed that the system should report both actual and potential MEs were significantly less likely to admit that they had committed harmful MEs. Hesitancy might explain this finding given that diffident ADR reporters [26] were also less likely to admit

Table 5 Characteristics of 1323^a healthcare professional (HCPs) who ever identified potentially harmful medication errors (MEs) committed by their colleagues, Uganda, 2013

Factor	Ever identified potentially harmful MEs made by others		Crude analysis			Adjusted analysis		
	Agree (%)	Other (%)	OR	95 % CI	<i>P</i> value	OR	95 % CI	<i>P</i> value
Level of health facility								
Other	156 (31.5)	340 (68.5)	1.0			1.0		
Hospital	386 (46.7)	441 (53.3)	1.9	1.51–2.41	<0.001	1.7	1.23–2.30	0.001
Type of health facility								
Public	257 (45.9)	303 (54.1)	1.0			1.0		
Private not-for-profit	115 (42.1)	158 (57.9)	0.9	0.64–1.15	0.305	0.9	0.66–1.26	0.573
Private for-profit	170 (34.7)	320 (65.3)	0.6	0.49–0.80	<0.001	0.9	0.68–1.32	0.751
Region of the country								
Central	275 (45.5)	330 (54.5)	1.0			1.0		
Eastern	141 (34.1)	272 (65.9)	0.6	0.48–0.81	<0.001	1.1	0.82–1.54	0.453
Other	126 (41.3)	179 (58.7)	0.8	0.64–1.12	0.235	1.2	0.89–1.67	0.221
Professional cadre								
Nurse	268 (34.5)	509 (65.5)	1.0			1.0		
Non-nurse	274 (50.2)	272 (49.8)	1.9	1.53–2.39	<0.001	1.5	1.15–1.92	0.002
Age (years)								
Less than 30	245 (42.2)	336 (57.8)	1.0			1.0		
30 or more	297 (40.0)	445 (60.0)	0.9	0.73–1.14	0.432	0.8	0.64–1.04	0.095
Department								
Medicine	255 (39.4)	392 (60.6)	1.0					
Surgery	40 (39.2)	62 (60.8)	1.0	0.65–1.52	0.970	0.8	0.49–1.25	0.302
Pediatrics, obstetrics and gynecology	79 (39.7)	120 (60.3)	1.0	0.73–1.40	0.942	0.8	0.57–1.16	0.247
Other	168 (44.8)	207 (55.2)	1.2	0.96–1.61	0.092	1.1	0.84–1.48	0.450
Patient load								
More than 30/day	254 (42.9)	338 (57.1)	1.0			1.0		
At most 30/day	288 (39.4)	443 (60.6)	0.9	0.69–1.08	0.197	0.9	0.70–1.14	0.350
Involved in medical research								
No	360 (38.5)	574 (61.5)				1.0		
Yes	182 (46.8)	207 (53.2)	1.4	1.10–1.78	0.006	1.3	1.02–1.71	0.034
Ever encountered fatal ADR								
No	401 (37.7)	663 (62.3)	1.0			1.0		
Yes	141 (54.4)	118 (45.6)	2.0	1.50–2.60	<0.001	1.5	1.13–2.05	0.006
Knows to whom to report ADRs								
No	280 (42.4)	381 (57.6)	1.0			1.0		
Yes	262 (39.6)	400 (60.4)	0.9	0.72–1.11	0.303	0.9	0.73–1.18	0.541
Suggested ways to improve ADR reporting								
No	145 (43.8)	186 (56.2)	1.0			1.0		
Yes	397 (40.0)	595 (60.0)	0.9	0.67–1.10	0.225	0.8	0.62–1.07	0.144
I would only report an ADR if I was sure that it was related to the use of a particular drug								
Other	197 (39.7)	299 (60.3)	1.0			1.0		
Agree	345 (41.7)	482 (58.3)	1.1	0.87–1.36	0.474	1.1	0.84–1.36	0.586
I do not know how information reported in an ADR form is used								
Other	293 (39.9)	441 (60.1)	1.0			1.0		
Agree	249 (42.3)	340 (57.7)	1.1	0.88–1.37	0.386	1.0	0.82–1.32	0.719
Root-cause analysis of MEs								
Other	71 (34.6)	134 (65.4)	1.0			1.0		
Agree	471 (42.1)	647 (57.9)	1.4	1.01–1.88	0.045	1.1	0.75–1.51	0.717

Table 5 continued

Factor	Ever identified potentially harmful MEs made by others		Crude analysis			Adjusted analysis		
	Agree (%)	Other (%)	OR	95 % CI	<i>P</i> value	OR	95 % CI	<i>P</i> value
There is a lack of time for reporting MEs								
Other	399 (40.3)	591 (59.7)	1.0			1.0		
Agree	143 (42.9)	190 (57.1)	1.1	0.87–1.43	0.397	1.1	0.85–1.46	0.446
There is a culture of blame within healthcare								
Other	164 (31.4)	358 (68.6)	1.0			1.0		
Agree	378 (47.2)	423 (52.8)	2.0	1.55–2.46	<0.001	1.6	1.28–2.11	<0.001
There is a need for organizational leadership and support in reporting MEs								
Other	74 (29.5)	177 (70.5)	1.0			1.0		
Agree	468 (43.7)	604 (56.3)	1.9	1.38–2.49	<0.001	1.3	0.91–1.81	0.147
System should report both actual and potential MEs								
Other	148 (35.2)	272 (64.8)	1.0			1.0		
Agree	394 (43.6)	509 (56.4)	1.4	1.12–1.81	0.004	1.2	0.89–1.52	0.257
I am more likely to make MEs in tense or hostile situations								
Other	283 (35.1)	524 (64.9)	1.0			1.0		
Agree	259 (50.2)	257 (49.8)	1.9	1.49–2.34	<0.001	1.4	1.12–1.84	0.005
Important issues are well communicated at shift changes								
Other	184 (39.9)	277 (60.1)	1.0			1.0		
Agree	358 (41.5)	504 (58.5)	1.1	0.85–1.35	0.569	1.1	0.88–1.47	0.309
I may hesitate to use a reporting system for MEs because I am concerned about being identified								
Other	335 (37.6)	557 (62.4)	1.0			1.0		
Agree	207 (48.0)	224 (52.0)	1.5	1.22–1.94	<0.001	1.3	0.97–1.61	0.084
I should be financially rewarded for reporting MEs								
Other	383 (39.2)	594 (60.8)	1.0			1.0		
Agree	159 (46.0)	187 (54.0)	1.3	1.03–1.69	0.028	1.3	0.99–1.69	0.061

ADR adverse drug reaction

^a The missing-assigned approach (missing data assigned to the “no” category) was used to account for missing data prior to commencing the model fitting procedures

that they had committed MEs that were potentially harmful to patients.

Respondent HCPs who acknowledged that they had ever seen others commit potentially harmful MEs were more likely to be non-nurses or to have ever encountered a fatal ADR. At the organizational level, they were more likely to be attached to hospital-level health facilities, to have cited that there exists a blame culture in healthcare, or to have reported working in stressful working conditions. Organizational-level factors have been reported to dominate over individual-level factors as major contributors to the occurrence of MEs [46]. Rather than blame or penalize individual HCPs, employing a “no-blame” systems approach could reduce the incidence of MEs and stimulate HCPs’ participation in ME reporting initiatives [29], hence promoting delivery of safer healthcare to Ugandan patients.

This study had limitations. First, HCPs may have provided socially desirable responses on sensitive questions such as being less likely to disclose that they had ever

committed potentially harmful MEs. Since we used anonymous self-administered questionnaires, this bias might have been diminished. Second, some variables measured similar attitudinal constructs and may have presented challenges of multiplicity during data analysis; however, we did not fit logically similar variables into the same regression models, and we focused attention only on influential factors for which $P < 0.01$. In addition, factor analysis and principal components analysis techniques were employed to identify any groups of variables that could be combined into single factors or components, respectively, although none were identified. Third, probability sampling was not practicable; however, the large sample size is a key strength of this study. Fourth, we did not pose open-ended questions or conduct qualitative interviews to triangulate these research findings. Accepting the invitation to complete an anonymous self-administered questionnaire was received with much apprehension, especially when potential respondent HCPs noticed the

section on MEs. Due to the sensitivity of this subject, and to encourage HCPs' participation in this survey, we structured the MEs section to contain only closed-ended questions. However, we believe that the results of this study have generated hypotheses that can be investigated further using different or similar methods of inquiry.

5 Conclusions

Most Ugandan HCPs approved the establishment of a national ME reporting system. However, as the program is implemented, sensitization and training of HCPs on how to identify and report MEs will be necessary. A non-punitive healthcare environment and patient involvement may promote ME disclosure and reporting in Uganda and possibly other African countries.

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Authors' contributions RK conceived and implemented the study, and drafted the manuscript. RK and CK participated in the design, statistical analysis, and drawing of inferences. PW and HBN participated in the drawing of inferences and in manuscript writing. All authors read and approved the final submitted version of the manuscript.

Compliance with Ethical Standards

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Conflicts of interest RK, PW, HBN, and CK report that they have no conflicts of interest to declare.

Ethical approval We obtained ethical approval from the School of Medicine Research and Ethics Committee, Makerere University College of Health Sciences, and the Uganda National Council for Science and Technology.

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