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NURSES INFECTION PREVENTION PRACTICES IN HANDLING INJECTIONS: A CASE OF RIFT VALLEY PROVINCIAL HOSPITAL IN KENYA
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NURSES INFECTION PREVENTION PRACTICES IN HANDLING INJECTIONS: A CASE OF RIFT VALLEY PROVINCIAL HOSPITAL IN KENYA

R.K. CHEMOIWA, V.K. MUKTHAR, A.K. MARANGA and S.J. KULEI

ABSTRACT

***Objective*: To analyse the infection prevention practices in handling of injections by nurses in Rift Valley Provincial Hospital in Kenya.**
***Design*: A cross-sectional observational study.**
***Setting*: Rift Valley Provincial hospital which is a level five health facility situated in Nakuru County, Kenya.**
***Subjects*: A sample of 386 injection procedures attributed to the nurses in Rift Valley Provincial Hospital was considered for this study**
***Results*: The study established that among all the injections administered in this study, 43.7% (386) adhered to aseptic techniques. Over seventy five percent (76.9%, n=386) of the observed injections procedures did not involve the hand-washing, 53.4% (n=206) did not involve swabbing of a vial rubber cap with alcohol swabs and 95.1%(n=263) involved using of multidose drug in more than one designated patient. Over ninety five percent (95.6%, n=364) of the observed procedures involved use of sterile the syringe bit of the devices only while the rest used either clean or contaminated syringes. Around forty percent (42.2%, n=316) of the injections preparation was done elsewhere (not at the patient bedside) before administration. Slightly over thirty five percent (36.6%, n=386) of the injections were administered immediately upon reconstitution(at the right time). The study also established the use of aseptic techniques to reconstitute and administer was significantly related to the number of nurses to patients ratio per shift ($X2(1) = 3.5$: $p = 0.04$).**
***Conclusion*: The findings of this study indicate that patient safety in public hospital is still relatively low. The adherence to basic infection prevention procedures/aseptic techniques in handling of injections by health workers is still a concern. The adherence to aseptic techniques in handling injections is significantly associated with the nurses to patients ratios. Therefore, it is imperative to improve nurse to patient ratio in public health facilities in Kenya.**

INTRODUCTION

Patient safety has been known to be a major public health problem by system failure. Adverse events in health care facilities resulting in unsafe practices has been shown by studies to affect a surprisingly high number of inpatients, with unintended harmful consequences occurring on average in 10% of acute admissions (Department of Health, 2000). Being a major threat to the safety of patient care, health care-associated infection has affected hundreds of millions of people worldwide, complicating the delivery of patient care, and has lead to patient disability and deaths and generated significant, additional health care expenditure (Pittet 2005).

Recent studies have shown that patient safety is a major public health problem resulting from systemic failures. Adverse events in health care facilities resulting in unsafe practices has been shown by studies to affect a surprisingly high number of inpatients, with unintended harmful consequences occurring on average in 10% of acute admissions. Health care-associated infections for example, has affected hundreds of millions of people worldwide,

complicating the delivery of patient care, and has lead to patient disability and deaths and generated significant, additional health care expenditure (Hutin *et.al*, 2003).

A review on the extent of unsafe practices found out that unsafe patient care is so common, that it is associated with significant morbidity and mortality throughout the world. From their review studies from the US suggested that approximately 3% to 4% of hospitalized patients suffered a serious adverse event, while studies from other developed nations revealed that between 8% and 16% of hospitalized patients suffered an adverse event which cause and as a result contributing to the deaths of tens of thousands of people in each of these nations (JHA *et al*, 2010).

Due to this recognition, the World Health Organization's World Alliance for Patient Safety commissioned an overview of the world's literature on patient safety research to better understand the extent and nature of the problem of unsafe care. Major patient safety topics were identified through a consultative and investigative process and were categorized into the framework of structure, process and outcomes of unsafe care. Lead experts examined current evidence and identified major knowledge gaps relating to topics in developing, transitional and developed nations. The report was reviewed by internal and external experts and underwent improvements based on the feedback and 23 major patient safety topics were identified and one of the major topics identified was harm to patients resulting from unsafe injection practices (WHO, 2010).

The estimated global burden of disease for the year 2000 from unsafe injection practices for these pathogens included; 21 million HBV infections (32% of new HBV infections); 2 million HCV infections (40% of new HCV infections); 260 000 HIV infections (5% of new HIV infections) (Hutin *et.al* 2003).

The reuse of injecting equipment in clinical settings is well documented in Africa and appears to play a substantial role in generalized HIV epidemics. According to Reid (2009), South Africa and Ethiopia has showed that many health workers considered an injection safe when the needle is changed but the syringe is reused. A survey done in South Africa for example, showed that health workers in public maternity and wards reused syringes under direct observation in 2005, and 30% of those surveyed did not see the need to use a new needle for each patient. In addition the World Health Organization estimates that in 2000 between 17–19% of injections performed in sub-Saharan Africa were administered unsafely (Reid 2009).

The World Health Report on health systems says that serious imbalances exist in many countries in terms of human and physical resources, technology and pharmaceuticals. Health staffs in many low-income nations are inadequately trained, poorly-paid and work in obsolete facilities with chronic shortages of equipment. The failings which limit performance do not result primarily from lack of knowledge but from not fully applying what is already known: that is, from systemic rather than technical failures. (W. H.O 2000).

The purpose of this research therefore was to analyse the nurses infection prevention practices/ adherence to aseptic techniques when the handling of procedures in a Kenyan public hospital. It wanted to determine if there is an association between the nurses' adherence to aseptic techniques when handling injections procedures with nurses level of education and nurses to patient ratio.

MATERIALS AND METHODS

Setting: The study was conducted at the Rift Valley Provincial Hospital, situated in Nakuru district, Rift valley province in Kenya. Provincial hospitals form a secondary level of health care for their location. They provide services to a geographically well-defined area. Provincial hospitals are an integral part of the provincial health system. They provide specialised care, involving skills and competence not available at district hospitals, which makes them the next level of referral after district hospitals. Their personnel include medical professionals, such as general surgeons, general medical physicians, pediatricians, general and specialized nurses, midwives, and public health staff (Muga et al 2005).

Study design: This study was a cross sectional observational study. where quantitative data was collected from the Out Patient injection room, and all the wards of the Rift Valley Provincial General Hospital- Nakuru.

Study population: The study population was injections procedures from the Outpatient department and General wards attributed to nurses which was approximately 10000 for a quarter of a year. The injection procedures were stratified into the wards/ departments and systematic random sampling used to identify the procedures to be observed from each stratum.

Sampling: The study used stratified random sampling procedure where the strata was patients receiving injectable antibiotics, patients receiving other injectable medication. Additionally in the study sites systematic random sampling was used to select the study subjects in each strata. A sample size of 307 injection procedures was calculated based on Fisher's formula as stated in Mugenda (2008) but the sample was deliberately increased to 400 to increase the quality of data and to take care of incomplete responses. Finally 96.5% (400) were considered valid

responses for analysis.

Study instrument and data analysis: Data was collected by research assistants using Observation Schedule adopted from the Ministry of Health policy on injection safety and from the Revised Injection Safety Assessment Tool from the World Health Organization (2008). Apart from the tool employed obtaining nurses infection prevention practices in handling injections, it also captured the nurses level of education and the number of nurses per shift to 40 patients as the exposure variables.

The observations were done anonymously in the nurses natural work setting. Data was analyzed using Statistical Package for Social Scientist(SPSS) version 13. Descriptive statistics such as frequencies and percentages of variables were determined. Chi Square Test of Significance was used to measure for significant association between categorical predictor variables and the categorical outcome variable at 95% confidence interval. Results are presented in text, figures and tables.

Variables: The outcome variable, use of aseptic techniques in handling injections, meant that an injection procedure involved all the following conditions: hand washing before and after the procedures, involved use of sterile needle and syringe, involved swabbing with alcohol/spirit swabs(for vials), the medication was not administered to more than a patient(for multidose vials),was prepared in a clean table, tray or medicine trolley and involved safe disposal of procedure wastes.

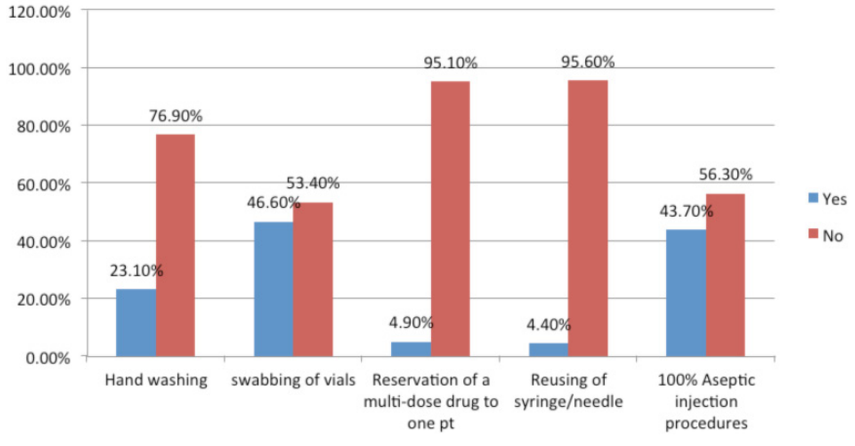
The two exposure variables of interest were the nurses level of education and the number of nurses per shift to 40 patients. Nurses level of education meant their current highest qualification which could be a certificate holder, a diploma holder or a Bachelor of Science in Nursing holder.

RESULTS

Injections handling procedure: In the study 386 injection procedures were observed during medication preparation and administration. The results indicate that the 23.1%(n = 386) of the observed procedures involved the hand-washing while 76.2%(n = 386) did not involve hand washing. With regard to the observed procedures that required swabbing of the rubber cap of the medication vial before withdrawing the drug, swabbing with a spirit/alcohol swab was done in 46.6% (n=206) and was not done in 53.4% (n= 206). In injection procedures observed, 4.9%, (n= 263) had a multi-dose reserved to one patient compared to 95.1%(n = 263) where multi-dose medication vials were shared among several patients.

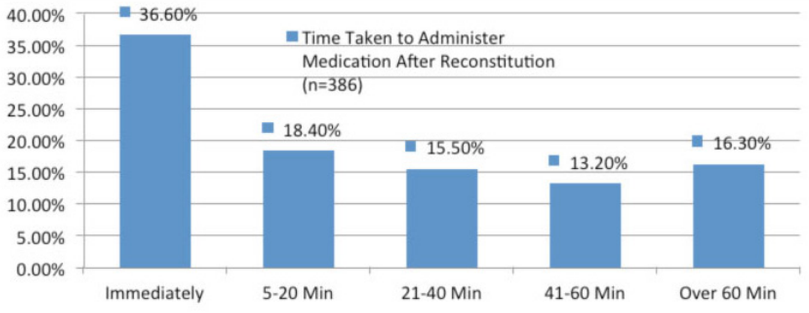
Over ninety five percent (95.6%, n=364) of the observed procedures involved use of sterile the syringe bit of the devices only while the rest used either clean or contaminated syringes. Over forty percent (43.8%, n=386) of the observed procedures met the threshold of the assessment tool to be considered aseptic procedures in preparing and administering a drug. Injections handling procedures have been summarized in the following Figure 1.

Figure 1
Proportions of infection prevention parameters in handling of injections



Injections giving within the right parameters: Over eighty five percent (86.0%, n=386) of injections observed used the standard disposable injection devices while the rest used the auto disable injection devices. Around fifty percent (47.8%, n=316) of the injections preparation was done at the patient bedside while 42.2% (n=316) were prepared elsewhere before administration. Slightly over thirty five percent (36.6%, n=386) of the injections were administered immediately upon reconstitution while the rest were administered up to an hour after reconstitution as shown in the following Figure 2.

Figure 2
Time Taken to Administer Medication after Reconstitution



Actual delivery of the injection medication to the patient: Among the patients who were due for injectable medication, 92.2%(n=386) received while 7.8%(n=386) did not receice their injectable medication as prescribed. This was majorly due to blockage or lack of intravenous lines (83%, n=30) while the other reasons were patient refusal and lack of the medication.

Association between variables: The association between the two categorical predictor variables (the number of nurses on duty to 40 patients and nurses level of education) against the categorical outcome variable (adherence of aseptic techniques in handling of injections) was measured using Chi Square Test of significance at 95% confidence interval.

The adherence of aseptic techniques in handling injection procedures was significantly related to the number of nurses to 40 patients ($X2(1) = 3.5$: $p = 0.04$). Among those who adhered to aseptic techniques in handling injections, 38.5% (n=169) was from one than three nurses to 40 patients per shift category and 61.5% (n=169) was from more than three nurses to 40 patients per shift category. The use of aseptic techniques to reconstitute and administer was not significantly related to the nurses level of education ($X2(2) = 10.4$: $p = 0.118$). The details of the association of variables are presented in the following Table 1.

Table 1
The Aseptic status of Injections by Number of Nurses in Comparable Wards and Level of Education

		Status of Injections procedures (Whether Aseptic or Not)		X^2	P Value	CI
		Yes	No			
No of Nurses per shift per 40 pts	1-3	65 (38.5%)	157 (72.3%)	3.5	0.04	95%
	≥3	104 (61.5%)	60 (27.7%)			
		169(100%)	217(100%)			
Nurses level of Education	Certificate	46 (27.2%)	82 (37.8%)			
	Diploma	82 (48.5%)	94 (43.3%)	10.4	0.118	95%
	BScN	42 (24.9%)	41 (18.9%)			
		169(100%)	217(100%)			

DISCUSSION

Nurses infection prevention practices in handling injections: Hand hygiene is a general term that applies to hand washing, antiseptic hand wash, antiseptic hand rub or surgical hand antisepsis. The first standard precaution to ensure a safe injection is to ensure that the Provider's hand hygiene is taken care of by either washing or disinfect hands prior to preparing injection material and giving injections (W.H.O 2010). The results indicate that the 23.1%(n = 386) of the observed procedures involved the hand-

washing while 76.2%(n=386) did not involve hand washing. This is consistent with the World Health Organizations findings in its review of evidence on hand hygiene in health care settings, where it reported that the adherence of health care workers to recommended hand hygiene procedures globally ranges from 5% to 89 % with an average adherence of 38.7% (W.H.O 2009). However, it is a cause of worry for the percentage to be close to the upper limit three years after the publication by the world health organization.

This study show that around 5%(n = 263) of injection procedures observed had a multidose reserved for one patient compared to around 95% (n=263%) where multidose medication vials were used by more than one patient. This is higher than the findings by Brown *et.al (*2008) who showed that use of multidose medication vials in selected U.S hospitals was at 65.6% . The importance of preserving a multidose vial for one patient is to reduce the chances of cross contamination whereas cleaning of the septum reduces the chance of introducing potential infection into the medication vial because of breaks in aseptic techniques. Pittet(2005) says that contaminated multidose vials commonly can be linked to a break in aseptic technique Contamination also can occur when needles are left in the diaphragm of the vial and the same syringe is used repeatedly to withdraw medication. One study in a teaching hospital in Iran by Motamedifar & Askarian (2009) put the actual rate of contamination of multidose vials at 27% while another in a veterinary hospital conducted by Brown et.al (2008) identified the rate to 18%. The high rate of using multidose vials to more than one patient in the hospital as per the study findings can be attributed to the relative cost effectiveness of many patients using one vial as compared to having one vial per patient

Over forty percent (43.7%, n = 386) of the observed procedures did not meet the threshold of the assessment tool to be considered aseptic procedures in preparing and administering a drug. This findings are consistent with the Study findings by Reason (2000) estimating that worldwide, 39.6% of injections are given with syringes and needles reused without sterilization or in the context of non-aseptic environment. WHO(2000) asserts that population attributable risks of all therapeutic injections given worldwide is estimated to be around 50%. This negative health indicator could attributed to poor work conditions, including but not limited to shortage of supplies and equipments coupled with overworked demoralized staff as asserted by FIDA(2008).

Over ninety five percent (95.6%, n = 364) of the observed procedures involved use of sterile the syringe bit of the devices only while the rest used either clean or contaminated syringes. The reuse of injection devices by nurses in the hospital can be attributed to findings in a report by the world health organization's Safe Injection Global Network (SIGN) meeting of 2010. The report says that, reuse of injection devices occurs when health care workers mistakenly believe that it is safe to reuse a syringe after changing a needle or that it is safe to reuse a needle or syringe on the same patient or even that it is safe to reenter a multi dose vial with a used needle or syringe (W.H.O 2010). This observation is also made by JHA*et.al* (2010) who say that in the U.S health care setting there is the belief that contamination is limited to the needle portion when a syringe and needle are used together as a unit. In addition there is an incorrect belief that the syringe does not become contaminated if the plunger is only ''pushed'' to inject medications and not ''pulled'' to aspirate or withdraw.

The study assessed the adoption of engineered technology in the provincial hospital and analysed the proportion of injections administered using the recommended injection devices. The results showed that 332 (86.0%) of injections observed used the standard disposable injection devices while 54 (14.0%) of injections administered used the recommended single use auto disable injection devices. The low rate of usage of AD syringes in the hospital, could be attributed to two main reasons; first is that most of donor support for injection safety in developing countries is geared towards immunization programs and secondly the low adoption of AD devices could due the high cost of this devices compared to the standard diposable types.

Around fifty percent (47.8%, n = 316) of the injections preparation was done at the patient bedside while 42.2% (n = 316) were prepared elsewhere before administration. This means that a significant proportion of patients would receive unsafe injections due to the fact that those preparing medication elsewhere were prone to making errors. This argument is brought to perspective by Garreth and Graig (2007) who argue that since medication administration is an increasingly complex process, it is influenced by the number of medications on the market, the number of medications prescribed for each patient, and the numerous policies and procedures created for their administration which include many tasks, including but not limited to, assessing the patient to obtain pertinent data, gathering medications, confirming the five rights (right dose, patient, route, medication, and time), administering the medications, documenting administration, and observing for therapeutic and untoward effects. Garreth & Graig(2007) therefore make a conclusion that disruptions that are associated with the nursing stations impact on the cognitive workload of the nurse, and create an environment where medication errors are more likely to occur.

Slightly over thirty five percent (36.6%, n = 386) of the injections were administered immediately upon reconstitution while the rest (63.4%, n = 386) were administered at the wrong time. This shows

that a majority of patients got their medication at the wrong time. This is consistent but slightly less than the findings in Balas et.al (2004), report that medication administration errors involving wrong time, omission, and wrong dose accounted for 77.3 percent of errors, while wrong drug and wrong patient accounted for 77.8 percent of near misses and the most frequent types of medication errors were wrong time. This differences in percentage could be attributed to time lapse between the two studies.

Among the patients who were due for intramauscular or intravenous medication, 92.2%(n=386) received while 7.8%(n=386) did missed their injectable medication as prescribed majorly due to blockage or lack of intravenous lines (83%, n=30) while the other reasons were patient refusal and lack of the medication. In a bid to assess the prevalence of missed medication doses of hospitalized patient in the U.S, Nettleman and Bock (1996) found out that the prevalence was 1.9%. Another review of the prevalence and causes of medication errors by Garreth and Graig (2007) showed that rate of omission ranged from 1.1% to 58% and the reasons for omitting medication was cited as patients unavailability, intolerance of the medication and a general perception by the health providers that the medication was not needed.

The association between aseptic techniques in handling injections with nurses workload and nurses level of education: The adherence of aseptic techniques in handling injection procedures was significantly related to the number of nurses to 40 patients ($X2(1) = 3.5$: $p = 0.04$). Among those who adhered to aseptic techniques in handling injections, 38.5% (n = 169) were from one than three nurses to 40 patients per shift category and 61.5% (n = 169) were from more than three nurses to 40 patients per shift category. These findings are consistent with several studies that have tried to nurse to patient ratios with health care associated infections. Friedkin *et.al* (1996), investigated factors for Venous Catheter associated infections in a hospital. They showed that the patient nurse ratio remained an independent risk factor for infections. They showed that an imbalance between workload and staffing levels leads to relaxed attention to basic control measures. In Brazil, overcrowding and understaffing were also documented as cause in the largest nosocomial outbreak attributable to salmonella (Pessa & Silva, 2002). Other investigators have also identified hospital wide predictors to recommended hygiene measures. Barriers to hygienic practices that are notable include, high workload, understaffing, lack of knowledge and insufficient time (Pitet *et.al* 1999). Nursing workload affects the time that a nurse can do various tasks. Under a heavy workload, nurses may not have sufficient time to perform tasks that can have direct effect on patient safety; it can also affect other nurses, health care workers and can have systemic organizational impact (Carayon & Gurses, 2008).

The adherence of aseptic techniques in handling of injections was not significantly related to the nurses level of education ($X2(2) = 10.4$: $p = 0.118$). This means level of education cannot be considered independently to explain nurses infection prevention practices and validates the view that there is need to examine the whole health systems in order to identify the contributing factors to substandard performance and find ways to better detect, recover from, or preclude problems that could result in harm to patients. (Ed. Hughes 2008).

CONCLUSION

The findings of this study indicate that patient safety in public hospital is still relatively low. Failure to adherence to basic infection prevention procedures or aseptic techniques in handling of injections by a trained health workers is a serious cause of concern. The study established that nurse to patients ratio(nurses' workload) is one of the factor that is significantly associated with use of aseptic techniques in the hospital settings and thus negatively impacts on patients' safety.

RECOMMENDATIONS

From this study there is need to increase nurses to patients ratios as much as evaluating the whole healthcare system to come up with system-focused strategies that can increase injection safety and infection prevention practices thus improving healthcare outcomes. The government and other health providers should invest in auto-disable injections to reduce the risk attributable to injections in healthcare setting.

Further prospective interventional research needs to be done in understanding the potential association between nurses' infection prevention practices/ aseptic techniques and nurses characteristics, working conditions/environment and medication errors.

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