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Original Article

Nurse training and completion of fluid balance chart documentation among patients with chronic kidney disease at Kiruddu National Referral Hospital.

A cross-sectional study.

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Abstract

Background:

Fluid overload is a common complication in CKD and requires accurate monitoring through fluid balance charts (FBCs). This study assessed the effectiveness of nurse training on completion of fluid balance chart documentation among patients with chronic kidney disease at Kiruddu National Referral Hospital.

Methodology:

A quantitative quasi-experimental (pre-post) study was conducted at Kiruddu National Referral Hospital. A total of 104 fluid balance charts were reviewed using convenience sampling. Data were collected using an audit checklist to assess documentation completeness before and after a nurse training intervention. Data were analyzed using descriptive statistics and a paired sample t-test to compare pre- and post-intervention results.

Results:

Pre-intervention findings showed poor documentation, with most variables scoring below 50%. Post-intervention results indicated significant improvement in documentation completeness. Patient identification details such as name and ward achieved 100% completion. Fluid intake improved from 0% to 88.5%, fluid output from 6.7% to 76%, and amount in milliliters from 40.4% to 94.2%. The paired t-test revealed a statistically significant improvement in documentation after training ($t(103) = 30.755, p < 0.05$).

Conclusion:

Nurse training was associated with improved completion of fluid balance chart documentation among patients with CKD. Structured training, clear guidelines, and continuous monitoring contribute to better documentation practices and enhanced patient care.

Recommendation:

Health facilities should implement regular nurse training, strengthen supervision, and institutionalize clinical audits to sustain improvements in documentation.

Keywords: Chronic kidney disease, fluid balance chart, nurse training, documentation, Kiruddu National Referral Hospital.

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Background.

Chronic kidney disease (CKD) is a global health burden with a high economic cost to health systems and is an independent risk factor for cardiovascular disease (CVD) (Hill, 2016). All stages of CKD are associated with increased risks of cardiovascular morbidity, premature

mortality, and/or decreased quality of life. Neuen, Chadban, Demajo, Johnson, and Perkovic (2018) found that CKD was the 12th most common cause of death, accounting for 1.1 million deaths worldwide with an increase of 31.7% over the last 10 years, making it one of the fastest rising major causes of death, alongside diabetes and dementia. Globally, the



estimated CKD prevalence varies from 7% in South Asia and 8% in Africa to as high as 11% in North America and 12% in Europe. A high prevalence of kidney disease has been identified in Sub-Saharan Africa (SSA) at 13.9% (Kalyesubula et al., 2017). Countries with a lower level of socioeconomic development and poorer access to quality health care experience a higher chronic kidney disease burden (Jha & Modi, 2018).

Fluid overload is a common phenomenon in patients with advanced CKD (Tsai et al., 2015; Hsiao et al., 2016; Esmeray, Dizdar, Erdem, & Gunal, 2018) and frequently occurs in association with other conditions, such as elevated arterial pressure, anemia, proteinuria, arterial stiffness, inflammation, left ventricular hypertrophy, and other cardiovascular complications (Esmeray et al., 2018). These patients are at risk for fluid-status abnormalities such as venous congestion, sympathetic nervous system dysfunction, renin-angiotensin-aldosterone system imbalances, and disruption of the hypothalamic-pituitary axis (Ekinici et al., 2016). There is progressive loss of renal function in CKD, leading to reduced sodium filtration and inappropriate suppression of tubular reabsorption that ultimately leads to volume expansion (Khan et al., 2016), putting one at increased risk for edema, heart failure, and hypertension. Volume overload develops early during the disease and plays a significant role in the development of complications, especially those related to cardiovascular disease.

Fluid balance charts are used to record all fluids of a patient's intake and output over a certain period, usually 24 hours. Intake refers to all fluids that go into the patient's body, comprising oral intake and intravenous intake. Oral intake includes water, milk, tea, gelatine, ice creams, soups, and other fluids, whereas intravenous intake refers to fluids administered into the bloodstream such as plasma, blood, and other intravenous solutions. Output refers to all fluids eliminated by the patient, such as urine, drainage from tubes or irrigations, vomitus, or feces. Fluid balance assessment on busy ward rounds or during general patient review requires clear documentation of fluid input and output. This allows an accurate assessment of a patient's fluid balance status, which is significant when reviewing intravenous fluid prescriptions or assessing early clinical deterioration or improvement. Keeping the patient euvoletic can reduce the risk of complications secondary to volume overload (Moore, Hsu & Li, 2018).

It is therefore the nurses' role to assess the fluid status of the patient by weighing the patient daily, limiting fluid intake to

the prescribed volume, documenting intake and output, and maintaining the fluid balance chart. Potential sources of fluids such as foods, medications, and fluids used to take or administer medications, both oral and intravenous, must be identified and monitored, as well as maintaining the fluid balance chart through proper documentation of fluid intake and output. This study assessed the effectiveness of nurse training on completion of fluid balance chart documentation among patients with chronic kidney disease at Kiruddu National Referral Hospital.

Methodology

Study Design

A quantitative quasi-experimental design was employed to describe the change in the documentation process of the FBC among patients with CKD. The design was selected because it is best for comparing variables between different groups or over time. The study involved an intervention and two groups of subjects observed before and after the implementation (Polit & Beck, 2018), and this involved reviewing patients' files for FBC documentation before and after the training intervention.

Training Intervention

It is an intervention that provides nurses with evidence-based educational information that enhances knowledge and competence in documenting patient care effectively (Obioma, 2017). A baseline audit was conducted retrospectively to evaluate the documentation process and create baseline information against which change in practice was evaluated after the intervention. This was followed by on-the-job training in which feedback was given on interventions agreed upon to improve nurse documentation. The interventions implemented introduced standard guidelines for FBC documentation, re-training, and supervision on the use of the fluid balance chart. After implementing these interventions, a re-audit was performed prospectively for three weeks, and the results were compared to those of the baseline audit.

The Study Setting

The study site was a state-funded referral hospital in Uganda. The hospital had three medical adult wards, each employing twelve full-time nurses and a few intern nurses. The study was conducted on one medical ward, which admitted patients with CKD. Both male and female patients from all over the country, including nearby countries, were

admitted to this ward. The nurse-patient ratio in the ward was 1:50. As a referral hospital, very complicated and critically ill patients like those with CKD who required specialized care were common. Nurses were challenged to comply effectively with documentation due to the high patient load.

Study Population

The study population consisted of all files of patients admitted with CKD on the medical ward during the study period, that is, three weeks before the intervention and three weeks after the intervention.

Sampling Design

Convenience sampling was used since this was an audit study involving review of all fluid balance charts of patients admitted with CKD on this admission unit, three weeks before and three weeks after training and introduction of standard guidelines for documenting the FBC. The study involved reviewing two groups of data: the first group was all data collected from the FBC retrospectively for three weeks before the intervention, and the second group was data collected prospectively for three weeks after the intervention. Convenience sampling entails using the most readily available elements as study participants (Polit & Beck, 2018). This sampling design was selected because all charts of CKD patients admitted within this period needed to be reviewed for auditing, and the target document was the fluid balance charts.

Inclusion Criteria

All the FBCs in the files of patients who were admitted with CKD during the study period were included. The study period was three weeks retrospectively and three weeks prospectively after the training intervention.

Exclusion Criteria

All the FBCs in the files of patients who did not have CKD were excluded from the study. Blank FBCs were also excluded.

Sample Size Determination

The study selected up to 104 respondents based on Yamane's formula of sample size selection.

(Yamane, 1967) accordingly.
$$n = \frac{N}{1+N(e)^2}$$

Whereby;

n – Sample size

N – Study population

e – Error term (0.05)

1 – As scientifically given in the formula

Every week, an average of 10 patients are admitted and usually stay on the ward for a minimum of one week. On average, there are at least 20 patients on admission on this ward every day since some are discharged and some die. One FBC is expected to be filled daily for each patient and put in the patient's file. Because an average of 20 patients is on admission each day for one week, this amounts to 140 FBC charts. That is $20 \times 7 = 140$

$$n = 140 / 1 + 140(0.05)^2$$

$$n = 140 / 1 + 140(0.0025) = 140 / 1 + 0.35$$

$$n = 140 / 1.35 = 103.703 \approx 104$$

$$\therefore n = 104 \text{ respondents}$$

Data Collection Instruments

The instrument used was the FBC audit checklist designed to audit the fluid balance charts for the amount of documentation on the FBC currently used in the study area for documenting fluid intake and output given to patients. This was audited to measure current practice based on standards. The checklist was used to retrospectively audit documentation of all files of patients admitted with CKD in the three weeks before the training, and results were analyzed and feedback given to nurses with set standards for improving practice. Practice was re-evaluated prospectively using the same checklist to re-audit all the files of CKD patients on admission three weeks after the implementation of the set standards. The audits assessed whether all important areas for documenting on the FBC were completed and provided a comparison of which charts were documented more thoroughly. The audit intended to address documentation of the FBC of patients admitted with CKD, and areas audited included the patient's name, prescription, date, time, fluid input/output, amount in milliliters, ward, bed number, and inpatient number, as indicated on the FBC.

Data Collection Methods

The study employed the observation method of data collection, observing documentation completeness of the FBC done by nurses working on this medical ward. In this study, documentation completeness of the FBC was observed.



Validity and Reliability

Validity was established for the instruments used in the study. A logical link was established between the objectives of the study and the content included in the research instruments, ensuring that the content covered all issues under investigation (Polit & Beck, 2018). The audit checklist included all areas for nurse documentation, and this helped assess whether documentation of the fluid balance chart improved after training nurses on the standards of documenting the fluid balance chart. Areas of nurse documentation included the patient's name, ward, inpatient number, date, time, type of fluid given or excreted, and amount in milliliters.

The fluid balance chart currently used at the study site was the tool audited, and it was kept in the patient's file. The audit scores were compared and analyzed to determine which charts were documented better in relation to corresponding fields. In terms of tool originality, the hospital had a fluid balance charting tool which was used in the study.

Reliability, defined by Polit and Beck (2018) as the degree to which a research instrument yields consistent results after repeated trials, was established using Cronbach's alpha for participant scores created through test and re-test. The checklist was used to audit patients' files admitted within three weeks before training and implementation of the set standards for documenting the fluid balance chart. The same checklist was used to audit files of patients on admission within three weeks after the training. Nurses who performed the documentation had similar characteristics and used the same fluid balance charting tool, though with added knowledge about documentation standards, accuracy, and completeness.

Data Collection Procedure and Timeline

This involved the pre-audit, the intervention, and the post-audit evaluation. A one-week pre-training visit was scheduled to undertake an audit on the status of FBC documentation within the medical ward of the study site. On days one and two, the status of nurse documentation completion of the FBC in patients with CKD in this ward was verified. Current documentation practice was measured, focusing on verification of entries, anomalies, and action points for the intervention phase. Day three and day four activities included analyzing findings and giving feedback to nurses. Set standards for improving practice were communicated and implemented in the form of training.

A one-hour intervention training program was conducted twice daily, in the morning and afternoon, for two consecutive days to reach all nurses working different shifts. The plan focused on training all nurses on documentation of the fluid balance chart using the existing documentation tool. After every training session, participants were introduced to the consent form and requested to provide informed consent. Two nurses were conveniently selected to follow up patients' files to ensure that FBCs were inserted daily and that those hanging at the bedside were filed appropriately instead of being discarded. One-to-one training continued throughout the study period during post-intervention data collection, which involved repeating an audit of all charts prospectively.

Data Analysis

Raw quantitative data for all variables generated from the pre- and post-implementation audits were summarized and computed. Univariate descriptive statistics were used to analyze each variable on the data collection tool separately. The analyzed data were presented in tables to facilitate easy interpretation and comparison. A paired t-test was used to detect differences in documentation before and after implementation of the training. The level of documentation pre- and post-audit was the dependent variable measured before and after the training. The paired t-test helped calculate the differences, determine the mean changes in documentation, and establish whether the differences between the audit means were statistically significant.

Ethical Considerations

Approval was obtained from the university ethics committee board. Permission was also granted by the ethics committee at the study hospital to conduct the study. All ethical principles, including informed consent, confidentiality, privacy, and anonymity, were upheld. Participants were given full information on the purpose and objectives of the study to enable informed decision-making regarding participation. All information concerning identity, documentation practices, and input of participants was treated with strict confidentiality. Data collected were used solely for the purpose of the research and to demonstrate the effectiveness of criterion-based clinical audit in improving documentation. Study results were presented to the hospital ethics committee to demonstrate the impact of the audit process.



Informed Consent

Nurses received a one-hour training module (“Teaching Plan”) on documentation standards of the FBC. The purpose and objectives of the study were clearly explained, and face-to-face informed consent was obtained. This ensured that participants understood the purpose, methods, risks, benefits, and alternatives, enabling voluntary participation (NIHCC, 2016). Patients did not receive direct intervention; therefore, patient consent was not required since FBC documentation is part of routine care.

Confidentiality

Confidentiality was maintained by omitting personal identifiers from the checklist. Information obtained from the FBC was recorded using coded checklists, with each patient file assigned a unique code. The FBCs remained in patient files, while completed checklists were securely stored under lock and key during and after data entry, and will be retained for up to seven years for reference. Aggregate data were entered into password-protected Excel spreadsheets accessible only to authorized personnel.

Results.

Table 1: Descriptive Results for FBC Usage Pre- and post-intervention test.

Table 1 describes a comparison of FBC documentation pre- and post-intervention. Generally, there was an improvement

Effectiveness of teaching.

The level of knowledge after intervention/education was

Variable(s)	Pre-intervention test n = 104			Post-intervention test		
	Fully Done F (%)	Partially Done F (%)	Not done F (%)	Fully Done F (%)	Partially Done F (%)	Not done F (%)
1. Patient's Name	41(39.4)	0(0.0)	63(60.6)	104(100)	0(0.0)	0(0.0)
2. Ward of admission	0(0.0)	0(0.0)	104(100)	104(100)	0(0.0)	0(0.0)
3. In Patient Number	0(0.0)	2(1.9)	102(98.1)	95(91.3)	0(0.0)	9(8.7)
4. Patient's bed Number	0(0.0)	0(0.0)	104(100)	19(18.3)	0(0.0)	85(81.7)
5. Doctor's Prescription	1(1.0)	0(0.0)	103(99.0)	2(1.9)	3(2.9)	99(95.2)
6. Date of observation	80(76.9)	1(1.0)	23(22.1)	83(79.8)	0(0.0)	21(20.2)
7. Time of observation	88(84.6)	14(13.5)	2(1.9)	103(99.0)	1(1.0)	0(0.0)
8. Patient's fluid intake	0(0.0)	69(66.3)	35(33.7)	92(88.5)	12(11.5)	0(0.0)
9. Patient's fluid output	7(6.7)	34(32.7)	63(60.6)	79(76.0)	25(24.0)	0(0.0)
10. Amount in mills	42(40.4)	57(54.8)	5(4.8)	98(94.2)	6(5.8)	0(0.0)

in the FBC scores, evidenced by an improvement in the column for fully done on the post-intervention side as compared to the similar column on the pre-intervention side. Specifically, the items, patient's name and ward of admission, had 100% post-intervention.

measured using a paired sample t-test on CKD patients among nurses at Kiruddu National Referral Hospital using mean, standard deviations, *t*-statistics, and *P*-values (significance of 2-tailed).

Table 2: Paired Sample Statistics comparing pre- and post-intervention documentation completion of the FBC

Paired Samples Statistics, N=104						
	Mean	Standard Deviation		Standard Error of the Mean		
Pre- intervention documentation completion of the FBC.	0.7798	0.22700		0.02226		
Post- intervention documentation completion of the FBC.	1.5748	0.10773		0.01056		
Paired Differences of Pre- and Post-intervention documentation completion of the FBC.	0.76346	0.25316		0.02482		
		95% CI of the differences				
		Lower	Upper	T	df	Significance (2-tailed)
		0.81269	0.71423	30.755	103	0.000

Source: Primary Data 2021

A paired-sample t-test was conducted to review documentation of the Fluid Balance Chart for Patients with chronic kidney disease as observed from the patients' files before and after the training intervention of the Nurses in Kiruddu National Referral Hospital Renal ward. There was a significant difference in the scores of post-training ($M=1.5748$, $SD=0.10773$) and pre-training ($M=0.7798$, $SD=0.10773$) about FBC documentation completion; $t(103) = 30.755$, $p = 0.000 < P=0.05$. The t-value obtained through the t-test helped to determine that the difference found between the two sets of scores is significant.

Discussion.

The effectiveness of training on the documentation completion of the FBC

The post-test scores were obtained from 32 files of CKD patients admitted prospectively three weeks after the intervention. The findings indicated that there was a significant positive difference in the scores for pre- and post-test FBC documentation completion with a $p=0.000$. This positive change in skill and practice acquisition manifested among nurses in the comparative scores that changed from 39.45 in the pre-test to 100% in the post-test for complete documentation of the patient's name. Documentation of the ward rose from 0% to 100%, and inpatient number from 0% to 91.3%. Date and time of documentation improved from 76.9% to 79.8% and from 84.6% to 99%, respectively. Fluid

intake improved from 0% to 88.5%, fluid output from 6.7% to 76%, bed number from 0% to 18.3%, doctor's prescription from 1% to 1.9%, and amount in milliliters from 40.4% to 94.2%.

The study findings indicated a big difference between the pre-test and post-test scores. They further imply that nurses demonstrated documentation completeness in almost all fields on the FBC after the training intervention by reaching the set target of 100% in three areas and above 70% in five areas. Availability of the FBC in patients' files also improved since almost all files audited after the intervention had more than three completed FBCs, compared to the 156 files audited in the pre-test where only four files had more than one FBC. This was a good indicator of improvement in documentation and record keeping. Therefore, there was a positive change in FBC documentation practice among nurses regarding documentation compliance as a result of training.

Many studies concur with these findings. For example, a study by Yang, Mu, Wu, and Curia (2019) showed that post-implementation audit data demonstrated significantly improved outcomes in fluid balance monitoring and documentation following staff education (from 53% to 100% compliance). Another audit study by Ling et al. (2017), which involved the introduction of a new FBC, showed a significant improvement in the compliance rate of documentation completeness from 63% to 88% pre- and post-implementation, respectively. In a related audit study,



818 and 1,058 charts were audited during the two phases, respectively, and compliance improved with the new chart (4%–14%) (Elliott et al., 2017).

The American Health Information Management Association (AHIMA) states that training programs are among the most effective ways to improve documentation processes (Tavakoli et al., 2015). An interventional study performed on 30 first-year emergency medicine residents found that documentation of essential information improved significantly after training (Vahedi et al., 2018). The study concluded that education can effectively improve documentation, especially with repeated and short training intervals.

Jeyapala et al. (2015) and BA (2016) found that auditing helps identify strengths and weaknesses in fluid balance charting and areas requiring improvement. It is a useful tool both before and after implementing change, enabling comparison of results and continuous monitoring of practice. This supports sustained improvement and helps meet quality and safety standards in patient care. Ramukumba and Amouri (2019) also acknowledged that auditing can identify gaps in documentation and improve patient care.

In Rwanda, Kamanzi et al. (2015) reported that compliance with clinical documentation standards improved significantly from 27% to 60% ($P=0.000$) following a clinical audit. Similarly, auditing documentation and assessing healthcare workers' knowledge can help reduce inadequate fluid balance charting (Vicent, 2015). An audit study by Obioma (2017) also showed significant improvement in nurse documentation following training, indicating practice change. These improvements may be attributed to increased awareness of the benefits of proper documentation and knowledge gained through training. Therefore, audit studies should be encouraged to identify gaps and guide improvement strategies.

A paired-samples t-test was conducted to compare documentation practices of the FBC before and after the training intervention. There was a significant difference in the scores following the training ($M=1.5748$, $SD=0.10773$) compared to before training ($M=0.7798$, $SD=0.10773$); $t(103)=30.755$, $p=0.000 < 0.05$. These results suggest that the training intervention had a significant effect. Specifically, they indicate that regular training improves FBC documentation practices. In conclusion, the training contributed to a positive change in ward culture, significantly improving the quality of fluid balance documentation completion.

Conclusion:

Nurse training was associated with improved completion of fluid balance chart documentation among patients with CKD. Structured training, clear guidelines, and continuous monitoring contribute to better documentation practices and enhanced patient care.

Limitations

Conducting an audit was time-consuming as it required both pre- and post-intervention audits conducted retrospectively and prospectively. It was not possible to obtain the required sample solely from files of CKD patients admitted three weeks retrospectively, as most files did not contain a single FBC. Additional files had to be retrieved from the records office to achieve the sample size, which was time-consuming and monotonous given the limited availability of records staff.

Training all nurses at once was not possible due to varying shifts and off-duty schedules. Training was conducted in small groups until a total of 14 nurses were reached, who were then encouraged to train others.

The data collection period was extended to five weeks to allow adequate time for training and ensure that patients admitted before training were discharged, enabling a fair comparison.

Time accuracy was a challenge due to the absence of wall clocks in the ward. Patients and relatives were cooperative but could not provide exact times due to lack of timekeeping devices.

There was scarcity of FBCs, leading nurses to improvise using other charts, which affected documentation accuracy. Measuring fluid output was also difficult for patients without urine bags, and oral intake was often missed since it was administered by relatives. Additionally, FBCs were sometimes discarded after discharge instead of being filed, giving the impression that documentation had not been done.

Recommendation:

Health facilities should implement regular nurse training, strengthen supervision, and institutionalize clinical audits to sustain improvements in documentation. Provision of adequate documentation tools and staffing support is also recommended to enhance compliance with fluid balance charting standards.



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List of abbreviations

AHIMA – American Health Information Management Association

CKD – chronic kidney disease

CI – Confidence Interval

CVD – cardiovascular disease

FBC – Fluid Balance Chart

HIV – Human Immunodeficiency Virus

NIHCC – National Institutes of Health Clinical Center

SD – Standard Deviation

SSA – Sub-Saharan Africa

UCU – Uganda Christian University

WHO – World Health Organization

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Conflict of interest.

There is no conflict of interest.

Availability of data.

Data used in this study are available upon request from the corresponding author.

Authors contribution.

HMMN designed the study, conducted data collection, cleaned and analyzed data, and drafted the manuscript, and GN supervised all stages of the study from conceptualization of the topic to manuscript writing and submission.

Authors biography.

Harriet Margaret Muganga Namuganga is a student of the Master of Nursing Science **degree** at the Faculty of Health Sciences, Uganda Christian University.

Dr. Grace Nakate is a research supervisor at the Faculty of Health Sciences, Uganda Christian University.

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