



**KNOWLEDGE OF NURSES IN THE EARLY DETECTION AND
MANAGEMENT OF ACUTE KIDNEY INJURY IN A SELECTED
HOSPITAL IN RWANDA**

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MANAGEMENT OF ACUTE KIDNEY INJURY IN A SELECTED
HOSPITAL IN RWANDA**

by

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June, 2017

DECLARATION

I, DUSHIMIYIMANA Violette, declare that this thesis entitled "Knowledge of nurses in the early detection and management of acute kidney injury in a selected hospital in Rwanda" is my original work and did not submitted elsewhere. The references are identified as sources information at the end of the thesis.

DUSHIMIYIMANA Violette

Date:

DEDICATION

To my husband, DUSENGUMUKIZA Aloys

To my son BYISHIMO Nobel Messi

For your love and motivation.

ACKNOWLEDGEMENT

I hereby recognize the effort from different areas for this Masters Program and fulfilment of the dissertation.

Almighty, God for His protection and guidance.

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ABSTRACT

Background

Acute kidney injury (AKI) is a worldwide and a serious condition. It increases the length of hospital stay, mortality rate and cost for both patient and health care system. Health care professionals with adequate knowledge support the system by controlling and prevention of risk factors. By the use of simple measures such as monitoring input and output, treat and prevent the infection, withhold nephrotoxic drugs, control diabetes and hypertension among others lowered the incidence of AKI. Globally, AKI affects 13 millions of people per year; a larger number of them (85%) are located in low and middle income countries where Rwanda is included as well. Most literatures highlighted inadequate educational and training sessions on AKI compared to other priority health conditions.

Aim: To assess the level of knowledge of nurses on the early detection and management of AKI in a Referral Hospital in Rwanda.

Method:

Quantitative approach and descriptive cross sectional design were used. The study was conducted in Centre Hospitalier Universitaire de Kigali (CHUK) in the internal medicine, surgical, emergency and trauma, paediatric, and intensive care units. Data was collected from 165 nurses using self administered questionnaire. Descriptive and inferential statistics were used to generate the meaning from collected data. Chi-square was used to determine the relationship between study variables and the early detection and management of AKI.

Results and conclusion:

The findings revealed that only 5.4% have high knowledge in the early identification of AKI while 8.5% have high knowledge on the management of AKI. Receiving hospital in service training was associated with increased knowledge on the early detection and management of AKI. There is a need to organize regular sessions on AKI to improve the knowledge of AKI among nurses.

LIST OF THE ABBREVIATIONS

ACE: angiotensine converting enzyme

AKI: acute kidney injury

A0: Bachelor degree

A1: Diploma certificate

A2: Enrolled certificate

BUN: blood urea nitrogen

CKD: chronic kidney disease

ECG: electrocardiograph

E&A: Emergency and Accident

F: Fischer

ICU: intensive care unit

n: sample size

N: population

NSAIDs: non steroid anti-inflammatory drugs

p: p value

LMICs: low and middle income countries

RRT: renal replacement therapy

sCr: serum creatinine

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CHAPTER ONE: INTRODUCTION TO THE STUDY

I.1. INTRODUCTION

Acute kidney injury (AKI) is a serious clinical manifestation that arises from various causes; it is responsible for prolonged hospitalization and high mortality rate (Mehta,2014). AKI can be seen both in the community and in the hospital settings. Sepsis is the most common cause of AKI in critical patients and is associated with higher severity, increasing risk of death and hospital admissions, compared to non-septic patients (Roseli et al, 2016). International statistics presented its incidence at 7-18% in the general patients and 17-35% in ICU (Ponce, 2016; Bernardina *et al.*, 2008)

The deficiency in qualified professionals can delay the timely identification and management including the referral to specialized services, leading to the worsening of the condition(Evans *et al.*, 2015).The nurses' effort is vital for the health multidisciplinary team to intervene at the immediate scene so that risk factors and early diagnosis, immediate intervention and planning for invasive procedure according to the package of activities for the hospital or refer to competent institution are taken into account.

I.2. BACKGROUND OF THE STUDY

Acute Kidney Injury (AKI) is a worldwide health problem which is causing morbidity and mortality even though it can be also preventable (Hulse, 2015a). AKI is said when there an abrupt decline in renal function characterized by inadequate urine output of less than 0.5ml/kg/ hour in six hours or increased level of serum creatinine $\times 26.5$ mol/l in 48 hours or increased of serum creatinine to $\times 1.5$ to 1.9 times baseline in the previous 7 days(Count, 2015). If it is recognized very soon, the management will be non invasive, so that the health of our patient is improved. This will be possible when nurses, as the majority in health care providers, will be able to timely identify and initiate immediate management to patients presenting AKI and being able to recognize at risk patients. Numerous studies have evidenced that severity and duration of AKI justify the outcome, where dialysis, renal function recovery and survival were taken into account(Lewington and Cerdá, 2014). "There is increasing recognition both of the effect of AKI on the individual patient, and the resulting societal burden ensuing from its long term effects, including development of chronic kidney

disease (CKD) and end stage renal disease (ESRD) requiring dialysis or transplantation (Mehta, 2014 p.1-2).

Globally 7% to 18% of client hospitalized or critically ill develop AKI as a complication. With all commodities available, AKI related mortality remains at 40% in critically ill clients (Dirkes, 2015). AKI affects more than 13 million per year and 85% of them are located in low and middle income countries (Ponce, 2016). In the developing world, limited resources in regard to diagnosis, treatment, trained health professionals influence the burden of the condition. Thanks to International Society of Nephrology, aimed to initiate a 50% reduction in death by 2025 due to preventable AKI. This program is hindered by lack of epidemiological data, poor resources to identify and manage AKI includes medications, equipment as well as trained health care workers (Ponce, 2016)

AKI is a common and harmful condition affecting one in five emergency admissions of adults, when confirmed mortality rate is estimated at 25-30% (Hulse, 2015). Early detection (a way of offering sooner care to stop progression of the condition) and management could prevent up to 30% of hAKI (Hulse, 2015). Some special conditions may aggravate the occurrence of AKI, in all surgeries, AKI can be present at a rate of 1% but frequencies may be raised compared to the type of operation done; where cardiac, vascular and intra-abdominal manifest up to 10-30% cases of AKI (James *et al.*, 2014). AKI is observed at 5% - 7% in all hospitalized patients, while in ICU the number ranges between 17% - 35%. Confirmed cases of AKI in ICU, 49% to 70% require dialysis and 50% to 90% of them end up by death (Bernardina *et al.*, 2008).

AKI is named according to the time it happens to the patient; hospital acquired AKI (h-AKI) is said when it occurs as a complication during hospital stay while community acquired AKI (c-AKI) is said when evidenced during admission process or prior to hospitalization. The causes of h-AKI in urban area of high income countries (HIC) and low and middle income countries (LMIC) are the same, though the management differs due to the recourses. Hospital acquired AKI affects most frequently older adult due to other comorbidities. On the other hand, the etiologies of community acquired AKI (c-AKI) differ. In LMICs, AKI is common in young people as a result of infection or toxins which lead to hypovolemia and diarrhea. Infectious diseases like malaria is also included, obstetrical complication (sepsis abortion)

and HIV disease, intoxication by use of traditional herbs or households products ingestion contribute a lot in the occurrence of AKI (Lewington, Jorge, Cerdá, 2014).

In a study done in Malawi, AKI could be prevented by simple measures like fluid replacement; treating underlying causes; avoid the use of nephrotoxic agents and the removal of urine obstruction (Evans *et al.*, 2015). In the same study, participants agreed that they met cases of AKI often but they are not confident on its management and prevention. Some factors are known to trigger the AKI: older than 65 years, having other comorbidity such as hypertension, diabetes, heart failure, sepsis and significant shift of fluids like in case of vomiting, diarrhea, bleeding, burn or under nephrotoxic medication such as aminoglycoside (Lewington, Jorge, Cerdá, 2014). The awareness of these risk factors would allow bedside practitioners to identify who is vulnerable to develop AKI then immediate measures are applied to limit kidney insult and stop related complications.

The knowledge of a nurse in early detection and management of AKI is primarily based on the patient assessment. First of all, a nurse has to get relevant information on whether the patient is suffering AKI or CKD. Urine output has to be monitored as it reflects GFR and then kidney functioning. In addition, urine output is useful to know how much urine was excreted for a given period so that < 0.5 ml/kg/hr for 6 hours will be taken as a sign of AKI (Murphy and Byrne, 2010). From here, a nurse will highlight any change in intake or output and some other modifications in patient weight. Symptoms arising in urinary system such as hematuria, dysuria, polyuria, or dribbling, incontinence, urgency have to be taken into account as they may originate from prostate hyperplasia which may occlude urine pathway and then provoke post-renal AKI(Murphy and Byrne, 2010). Nurses also have to consider any positive urine dipstick for blood or protein as an indicator for possible renal problem if there isn't any known or suspected infection or trauma. If AKI is suspected, a nurse has to report the case to a doctor right away, and serum creatinine is evaluated. Or for hospitalized clients with long term urinary catheter, make sure they are no obstruction in urine flow because it could result in AKI (Hulse, 2015).

Nurses also may play a role in intra and post operative period by monitoring patient's hemodynamic status and make sure it is clearly documented. Low blood pressure, history of

dizziness, drowsiness, orthostatic hypotension point out a decrease in circulating intravascular volume which lead to pre-renal AKI. Every source of loss has to be identified whether it is bleeding, vomiting, and diarrhoea and managed accordingly. On the other hand, presence of edema, periorbital swelling, and weight gain signify fluid retention and need to be evacuated to prevent the effect of volume overload (Murphy & Byrne, 2010).

Nurses must be aware of patient medication to assess for nephrotoxic reactions (example: antibiotics from the group of aminoglycoside), others allow fluid retention (example: NSAIDs), and decrease in renal blood flow (example: ACE, ARB). Infection has to be managed appropriately as it is responsible for hypovolemia a prerenal cause of AKI (Murphy & Byrne, 2010).

In order to detect AKI, nurses have to be aware of urine output and serum creatinine. A decreased urine output at a level of <0.5 ml/kg/hr for 6 hours or more is an evident sign of AKI. Decreased urine output and increased concentration are the signs of deshydration which is responsible for prerenal AKI. We can also identify other preliminary signs of deshydration such as: thirst, poor drinking, diarrhea, vomiting, and raised temperature all may increase risk of developing AKI (Hulse, 2015).

While serum creatinine (sCr) will indicate AKI at a level of $\times 0.3$ mg/dl (26.5 mol/l) from the baseline within 48 hours or when there is an increase of sCr up to 1.5mg/dl from baseline known or suspected to happen in a period of 7 days. It is better for at risk clients, nurses have to monitor hourly fluid balance especially for hospitalized patients. Oliguria and increased serum creatinine results have to be reported immediately to a doctor for an appropriate management(Hulse, 2015).

In Evans et al (2015), deficiencies in knowledge were observed in all healthcare workers included in the study. Participants were nurses, medical assistants and physicians; they are known to have different trainings and job descriptions unfortunately all showed inadequate knowledge while they are used to care for patients with AKI. 100% of nurses who participated in the study presented a need for educational sessions on the management of AKI.

In Rwanda, nephrology is on its growing stage. The majority of this team are medical doctors mostly interested in risk factors, incidence, diagnosis, prevalence and outcomes of AKI. This is the first article addressing at which extent nurses participate to timely identify and support the overall management of AKI. The researcher aimed to assess the level of knowledge of nurses in Rwanda in relation to the early detection and management of AKI. In fact, nurses occupy a larger number compared to other health care providers; their knowledge would bring an impact to the individual patient, community, health care system as well as the whole country in regards to AKI.

1.3. PROBLEM STATEMENT

AKI is a worldwide health problem with more severe impact in low and middle income countries (LMICs) where health care services are difficult to access and expensive. As many risk factors are modifiable, nurses would play a vital role to limit AKI by fluid expansion in case of dehydration; assessment and anticipation of hypotension; treat and prevent infection; regular check up of urine output and avoid any obstruction in flow of the urine, close monitoring of medication metabolized or excreted in the kidney (Evans *et al.*, 2015).

A study conducted in two Rwandan intensive care units highlighted that 39.5% of their patients had AKI (Buregeya et al, 2016). In Rwanda we are facing all risk factors to AKI in addition to limited resources in terms of materials and health care providers where nurses are concerned and would play an important role in the early detection and management of AKI. In addition to findings of other studies done in LMICs, all nurses participated in the study agreed to a lack of enough knowledge for timely identification, diagnosis and treatment of AKI while they met these types of patients during their professional activities(Evans et al. 2015). Nurse's knowledge in the early detection and management of patients at high risk or presenting with AKI is not known and has not been assessed in Rwanda. This study, therefore, aims at assessing knowledge of nurses in Rwanda in early detection and management of patients at high risk or presenting AKI.

I.5. OBJECTIVES OF THE STUDY

I.5.1. MAIN OBJECTIVE

To assess the knowledge in the early identification and management of acute kidney injury (AKI) among nurses at CHUK (Centre Hospitalier Universtaire de Kigali; a referral hospital) located in Nyarugenge district, Kigali city, Rwanda.

I.5.2.SPECIFIC OBJECTIVES

- To assess the knowledge of nurses in the early identification of acute kidney injury.
- To assess the knowledge of nurses in the management of acute kidney injury.
- To explore factors that influence nursesø knowledge in the early detection and management of acute kidney injury.

I.6. RESEARCH QUESTIONS

- What is the level of knowledge that nurses have in the early detection of AKI?
- What is the level of knowledge that nurses have in the management of AKI?
- Which factors that influence nursesø knowledge in the early detection and management of AKI?

I.7. SIGNIFICANCE OF THE STUDY

The results from this study may be used to improve health care practice as they can be important to identify the level of knowledge guiding nursesø every day work, so as to plan remedial education and training to improve their practice. They will also be valuable to plan for education in nursing by providing them with appropriate information in early detection and management of AKI. This study is also a useful step in relation to nursing research, as it is a mirror for nurses and their knowledge regarding early detection and management of AKI.

I.8. DEFINITION OF THE KEY TERMS:

a. Acute kidney injury: is an abrupt decline in renal function characterized by increased level of serum creatinine at a level of 0.3mg/dl or 26.5 mol/L greater than the baseline and decreased urine output of less than 0.5ml/kg/hr (Koza, 2016).

b. Nurse: is a trained health personnel to promote, protect and maximize the wellbeing; enhance capacity by prevention of illness and trauma, facilitate healing, lower suffering by investigating and treatment of human response, and advocate for the care of individuals, families and community (American Nurse Association, 2016).

c. Knowledge: transforming experience into cognitive approaches which change the person thought and behaviour (Likso and OøDell, 2000)

d. Early detection: activities done to give sooner care to a patient (Hulse, 2015)

e. Management: all the activities to get a good outcome from a patient with AKI (Hulse, 2015)

I.9. CONCLUSION

AKI is an individual and public health concern, joining different efforts and expertise may lower its incidence. Globally, AKI is posing severe morbidity and increased mortality rate, considering the infrastructure and other related means that are invested in the health sector of LMICs; we can predict how heavy AKI is a burden. Nurses as the majority of health care team are taken into account in this study, as we intended to identify their knowledge in the early detection and management of AKI. We believe that nursesø knowledge could be beneficial to identify at risk and actual patients with AKI and contributing in its management.

CHAPTER TWO: LITERATURE REVIEW

2.1. INTRODUCTION

Modifiable risk factors to AKI could be anticipated with equipped health care professionals including nurses. As this study is targeting the knowledge of nurses in the early detection and management of AKI, almost all the activities of a nurse in case of pre-renal, intra-renal and post-renal are identified after consulting different literatures. Phases of AKI are mentioned also to allow readers to understand the process through which the condition happens in. Lastly, Benner's conceptual framework was chosen to present steps by which nurses pass through to be able to deliver a smart service to his/her patients.

2.2. THEORETICAL LITERATURE

2.2.1. DEFINITION OF ACUTE KIDNEY INJURY (AKI)

AKI is defined as a rapid decline in renal functioning evidenced by increased level of serum creatinine by $\times 0.3$ mg/dl ($\times 26.5$ mol/l) within 48 hours; or an increase in serum creatinine to $\times 1.5$ times baseline, which is known or supposed to have happened within the preceding 7 days; or a urine volume < 0.5 ml/kg/h for 6 hours (Koza, 2016). AKI is a broad but appropriate term as it includes mild renal injury to the severe ones which require renal replacement therapy (RRT). Previously, acute kidney failure was the term used but in these days, it stands for only these critical cases which needs RRT (Sedgewick, 2011).

AKI can be community or hospital based, within clinical settings there is no specific area where cases of AKI are located. This is the reason why all nurses have to be knowledgeable enough to identify clients with risk factors, early signs and symptoms, be ready to intervene according to the prescription (Becky Ali, 2011). Because the process of developing AKI is silent, impending diagnostic measures, if it is not identified timely serious conditions may arise due to renal cell damage. Nurses assistance is crucial from isolating cases of AKI, implementing evidence based care so that AKI is reversed (EDTNA/ERCA, 2012).

2.2.2. PREVALENCE OF ACUTE KIDNEY INJURY

AKI is seen in all countries and every setting, individual characteristics and health care system capacity both affect the outcomes. Global statistics showed that 13.3 million cases are reported each year with 11.3 million of them located in LMICs, this condition cause 1.4 million of death per year (Daniela Ponce, 2016). AKI is at a rate of 7-18% in hospitals while in the community it varies between 20-200 per million of population. In sub Saharan Africa, the situation is worse at a level of 66% and 70% of affected children and adults respectively need dialysis. Then only 64% of children and 58% of adult got dialysis when needed(Olowu *et al.*, 2016).

A similar study in Uganda demonstrated that patients hospitalized for sepsis developed AKI at 16.3%, while in Rwanda a study done on incidence, risk factors and outcomes of Acute Kidney Injury in two Rwandan Intensive Care Units revealed 39.5% cases of AKI; where being female, being in need of emergency surgery and presenting peritonitis were highly linked. In the above mentioned study, mortality were pronounced when AKI occurred in the first 24 hours of admission(Buregeya et al, 2016).

2.2.3. CAUSES OF ACUTE KIDNEY INJURY

The causes of AKI are categorized in relation to the kidney itself. All the situations which affect appropriate level of blood to reach the kidney are called prerenal causes, all the events affecting the kidney parenchyma are named intrarenal or intrinsic causes while the dysfunctions compromising the area just below the kidney to the urine exit are termed as postrenal causes (Counts, 2015).

a. PRERENAL ACUTE KIDNEY INJURY

Prerenal causes are responsible for 35% cases of AKI. We may list possible causes which lead to reduced blood flow to the kidneys such as: hypovolemia, deshydration, severe bleeding be it from trauma, surgery and as obstetrical complications; burn, heart failure, the

use of drugs which harm renal blood flow like ACE and NSAIDs (Counts, 2015). The kidney is not getting enough fluid to filter at the same time it is unable to fulfill its usual activities waste excretion, maintaining blood pressure, electrolyte and fluid balance the following step will be the occurrence of signs and symptoms of AKI(Becky Ali, 2011).

b. INTRARENAL ACUTE KIDNEY INJURY

It occurs when an injury goes directly and damages the renal tissue; it is seen in about 50% of all cases of AKI (Counts, 2015). Known conditions such as untreated prerenal factors cause ischemia in the kidney which results in intrarenal AKI. Other causes are infection, use of nephrotoxic drugs and presence of a primary renal diseases(Becky, 2011).

c. POST RENAL ACUTE KIDNEY INJURY

Post renal causes are responsible of 5% to 10% of AKI, it is less common compared others categories but is more frequent in the old age (Counts, 2015). Postrenal AKI arise from obstacle in the flow of the urine. Any condition which stops the pathway of the urine will allow the latter to go back to the kidney and produce increased pressure, decreased GFR and kidney damage(Becky Ali, 2011). Different condition can be highlighted such as pelvic tumour, calculi, stricture, trauma, pregnancy (Counts, 2015).

2.2.4. STAGES OF AKI

AKI pass though expected clinical steps, conditions like severity of the insult, complexity of the kidney damage, the required period for the kidney to regain normal functioning, and the degree of complications may differ widely among patients. The clinical manifestation of AKI passes in 4 phases as follow:

a. INITIATION OR ONSET PHASE

Initiation period happens from the installation of the injury up to the time of reduction of renal functioning. At this point, a health care provider knowledgeable enough on the risk factors can slow or stop the progression of the condition by managing early signs such as hypotension (Becky, 2011). Regular monitoring and assessment of other risk factors such as

the use of nephrotoxic medications, having chronic medical conditions like heart failure, diabetes and hypertension, signs of dehydration all lead to AKI if no one took attention to them.

b. OLIGURIC PHASE

The oliguric phase starts between 1 to 7 days after the kidney insult and take 10 to 14 days. It is characterized by decreased level of urine output of $<0.5\text{ml/kg /hour}$. For some cases, oliguric phase lasts for weeks or month. It can happen to have non oliguric AKI, this event inhibit early identification and management then results in increased mortality(Becky Ali, 2011). In oliguric phase, there is a likelihood of presenting hyperkalemia, fluid excess, hyponatremia as a result of impaired renal reabsorption capacity and dilutional hyponatremia, metabolic acidosis, elevated BUN and creatinine as a sign of build up of nitrogenous waste (Becky Ali, 2011). When this phase lasts for weeks, there is disturbance in the endocrine system where erythropoietin decreases; the patient is at high risk of bleeding and developing infection. In this period, the kidney will start to heal in a way that the renal basement membrane is being replaced by scar tissue and the nephron being blocked or filled by inflammatory stuff (Nicola Thomas, 2014).

c. DIURETIC PHASE

During the diuretic phase, the kidney maintains healing process at a point of recapture of almost all the function which had lost. Doing so will depend on the intensity of the original insult. The clinical feature of the primary disease will are disappearing and the urine output is within normal range reaching at 3 litres per a day and even 4 litres per a day (Thomas, 2014, and Becky Ali, 2011). Because the patient is losing too much fluid, he/she experiences hypovolemia, hypotension, hypokalemia, and prolonged hyponatremia due to loss of sodium in the urine. As diuretic phase keeps on, there will be normalization of acide-base, electrolyte imbalance and improvement in BUN and creatinine. It may happen for 1 to 3 weeks(Becky, 2011).

d. RECOVERY PHASE

Recovery phase can take some months to a year. During this phase, the kidney's basement membrane resumes its normal structure at the same time scar tissue remain there without causing any harm. At this point, the kidney is able to manage regulatory and excretory function (Nicola Thomas, 2014). For some patients their kidneys do not heal completely this results in persistent elevated BUN and creatinine whereas others will progress to chronic kidney diseases (CKD) which require long term management(Becky, 2011).

2.3. LITERATURE FRAMEWORK

2.3.1. KNOWLEDGE OF NURSES IN THE EARLY DETECTION OF AKI

The European Dialysis and Transplant Nurses Association (2012), reported that the knowledge a nurse would use to timely detect and deal with AKI is based on the assessment. A nurse must conduct a precise and complete assessment at the same time managing life threatening conditions such as hypotension, respiratory distress, hyperkalemia while discovering the real cause of kidney impairment and manage related complications. During this assessment, a nurse has to review the current clinical status of the patient, patient health history, medication history including over the counter medication and herbal products, and lastly social history.

On the review of current clinical status, a nurse looks on signs and symptoms like malaise, lethargy, confusion as signs of uremic encephalopathy, muscle weakness and twitching due to metabolic acidosis, and change in urine volume. Urine output may indicate a state of oliguria (<400 ml of urine per 24 hours), anuria (<100ml of urine per 24 hours), and nonoliguria characterized by excessive and diluted urine. Urine color has to be also considered; commonly seen characteristics are haematuria, pyuria, bilirubinuria, and myoglobinuria. Unexpected fluid loss such as hemorrhage, diarrhea and vomiting, excessive wound exudate has to be considered as they affect fluid balance.

It has been documented that 20 to 25% of cardiac output is received by the kidneys every minute (Becky Ali, 2011). Any disturbance or pathology to the heart will directly affect the kidneys, some conditions like dysrhythmias from electrolyte imbalance or heart failure, abnormal pulse rate, abnormal blood pressure and cardiac friction rub all affect negatively

cardiac output (European Dialysis & Transplant Nurses Association, 2012).

If cardiac output reaching the kidneys does not meet kidney demand, this is what we call hypoperfusion which result in prerenal AKI. In Dirkes 2015, pre-renal AKI represents all the conditions that cause hypoperfusion to the kidney that result in decreased GFR. Kidneys usually receive 25% of all cardiac output, any cause responsible for volume depletion or volume shift will decrease the amount of blood to the kidneys. These are: dehydration (from any origin), hemorrhage, myocardia infarction (MI), heart failure, cardiogenic shock, sepsis, burns, adverse effect to some drugs (ACE inhibitors and NSAIDS), pancreatitis and liver diseases like cirrhosis as they are responsible for fluid shift in the abdomen.

Abnormal skin change such as dryness, oedema, pallor, bruising, pruritis ; costal vertebral angle pain, groin pain or flank pain; evident local or systemic infection; abdominal distention may be from enlargement of the bladder or obstruction in the urine pathways, uremic signs such as nausea, vomiting, pulmonary oedema, metallic unpleasant taste may be present to the patient.

A nurse has to assess also past medical history of his/ her patient and identify precursor to AKI. Different conditions are responsible to disturb physiology of the kidneys like cardiovascular diseases (hypertension, heart failure, atherosclerosis), diabetes mellitus, immunological disturbance, allergies like in case of incompatibility of blood transfusion, recent surgery and renal stones.

National Clinical Guideline Centre (2013) confirmed that a nurse has to verify all medications the patient is taking, some are known to be nephrotoxics such as contrast agents, aminoglycoside antibiotics, example: gentamycin. Diutetics allow fluid depletion, antihypertensive such as angiotensine converting enzyme (ACE) inhibitors, angiotensine receptor blockers (ARB) decrease renal blood flow. Cardiac glycosides like digoxin, antiarrhythmias drugs, electrolyte replacement therapy, immunosuppressive such as corticosteroids, cyclosporine. Lastly analgesic anti-inflammatory drugs like aspirin and ibuprofen induce vasoconstriction and therefore decreased renal blood flow.

Finally, social history has to be taken into account, because everyday's living condition, level of activity and exercise, social connection, eating and drinking habit will affect the wellbeing of someone accordingly (European Dialysis & Transplant Nurses Association, 2012).

In Dirkes (2015) agreed that bedside nurses are focal point to identify someone how is prone to develop AKI by regular monitoring of urine output and effective communication with the physicians. The author listed risk factors to AKI such as elderly where U.S.A people with more than 70 years old have kidney dysfunction at 15%. If old age is combined with any comorbidity like hypertension, heart failure, diabetes mellitus risks to AKI are increased.

In Dirkes (2015), timely urine output measurement can allow early detection and even immediate management of AKI. Urine output monitoring is an important variable to predict AKI. This is the reason why we need to assess urine volume every hour for 4 to 6 hours following postoperative admission. In another literature, the assessment would emphasize on urine output and serum creatinine level. Then obtained results have to be presented immediately to a doctor so that early management is initiated (Hulse, 2015). According to National Clinical Guideline Centre 2013, AKI is preventable. For that reason, health care providers have to identify susceptible patients to be able to prevent unnecessary AKI.

2.3.2. KNOWLEDGE OF NURSES IN THE MANAGEMENT OF AKI

The management of AKI includes first of all the treatment of the primary cause (for example withhold nephrotoxic medications when they are the ones identified to lead to intrarenal AKI or remove any urinary obstruction when the cause is post renal), and then restoring fluid and electrolyte balance, prevent infection, provide appropriate nutrition, treat systemic effects of uremia and reassure the patient as well as the family (Murphy and Byrne, 2010).

In National Clinical Guideline Centre (2013) close monitoring of acutely ill patient during their hospital stays and respond to any deteriorating condition is evident to initiate an immediate management and even a timely prevention of AKI. For children and young adults it is necessary to record their physiological status at the admission and continue to monitor as described in their local protocol. These groups, in case of AKI suspicion: monitor urine output, record weight twice a day for fluid balance assessment, evaluate urea, creatinine and electrolyte then plan for controlling lactose, blood glucose and blood gas. If an adult is at

risk of developing AKI, it is very important to timely detect and respond to oliguria (urine output less than 0.5ml/kg/hr) as it indicates the level of kidney function.

Fluid management aimed at restoring renal perfusion, stop prolonged ischemia which and prevent the occurrence of intra renal AKI. Nurses play a great role in the management of hypovolemia or hypervolemia. In case of hypovolemic status, crystalloids are of first choice (example: normal saline), colloids or blood products can be used after depending of the clinical evolution of the patient. Whereas for hypervolemic patient, a daily input of 500ml in addition to an amount equals to the urine output of the previous day (Murphy and Byrne, 2010).

The most critical and challenging electrolyte during AKI is potassium, hyperkalemia is said when blood potassium is greater than 6.5mmol/L. Hyperkalemia interacts with normal contractility of the heart, this is the reason why regular ECG is needed to control the functioning of the heart (Murphy and Byrne, 2010). Intravenous infusion of insulin with glucose is used to drive back potassium into the cells. Another important role of a nurse is to keep blood glycemia within normal range. Sodium bicarbonate is also another treatment used to shift potassium to the cells at the same time controlling metabolic acidosis. The administration of Calcium gluconate or Sodium chloride to inhibit effect of hyperkalemia on the myocardium and to prevent dysrhythmias. Refractory hyperkalemia is said when all treatment options fail to control potassium, the next step is dialysis (Ali et al, 2011).

Infection is more common in AKI with patients; the health care team must apply meticulous hand washing prior to any contact with the patient and make sure visitors are restricted (Murphy and Byrne, 2010). Regular vital sign taking is a crucial point to consider, abnormal temperature and unusual respiration may be the early signs of infection to be taken into consideration. Any suspected secretion must be taken for culture and sensibility to ruler out an infection such as wound, sputum, urine and blood. For patients with AKI, the use of indwelling urinary catheter is not recommended, even when it is used, better to remove it as early as possible to prevent urinary tract infection (Ali et al, 2011). Adequate nutritional support is another concern to be taken into account to minimize protein-caloric malnutrition associated with increased mortality in AKI patients. Murphy and Byrne (2010) recommend the use of enteral feeding rather than parenteral one.

2.3.3. FACTORS CONTRIBUTING TO NURSES' KNOWLEDGE IN THE EARLY DETECTION AND MANAGEMENT OF AKI

AKI is seen as a worldwide health concern; both health care professionals and the public are invited to know risk factors, prevention and the management. Literatures proved that educational sessions were effective to sensitize against CKD all over the world where diabetes and hypertension were the top most subjects (Lewington et al, 2014). The same process is needed especially for health care providers, to be educated on AKI during their respective class sessions. The awareness of AKI by the whole team would improve the early recognition of all suspected and real cases of AKI on a timely basis.

In Evans (2015), participants of AKI symposium revealed inadequate educational and training on AKI. Fortunately, at the end, they went back to their respective work place confident and knowledgeable to handle cases of AKI. In another study, the majority of nurses were poorly score in regard to their knowledge in the early identification of AKI, therefore, plan to develop and strengthen educational and in service training is an imperative for all health care workers in order to improve their competences and skills to prevent, timely identify and manage appropriately cases of AKI (Roseli et al, 2016).

2.4. CONCEPTUAL FRAMEWORK

2.4.1. THEORETICAL AND RELATED CONCEPTUAL FRAMEWORK OF BENNER'S FROM NOVICE TO EXPERT

Benner's model from novice to expert represents the whole process through which nurse practitioners are passing. The model illustrates phases by which professionals are stepping just before arriving to the top and brilliant place appropriate to handle patient conditions. They believed that practice is informed by theoretical knowledge, the process of nursing care delivery brings risks to both the patient and the nurse, this is the reason why a well equipped educational program is required (Waldner and Olson, 2007). This brings emphasize on the importance of a strong education. Nurses will work effectively due to the level of knowledge received throughout different ways. Gaining knowledge depends on the learner; facilitator

and learning process in place, some learners can be more comfortable with one method rather than another. In these days, they prefer using human simulators (manikins) to imitate the real patient in the hospital. This method presented the effectiveness because, it allowed learners to arrive at critical thinking point, be able to take decision, and control stress (Likso and OoDell, 2000). According to Benner's model of skills acquisition, a nurse practitioner passes through 5 stages to be able to deal with clinical of community health problems. These stages are: novice, advanced beginner, competent, proficient and expert.

Novice:

A novice or a beginner is someone new in a profession. He/she lacks experience on what is going to do. While performing a procedure, is characterised by lack of confidence, seniors keep reminding what to do by verbal or physical demonstration. The new comers in the profession are also characterised by taking a longer period to do perform any task (Addison-Wesley, 2011).

Advance beginner:

An advanced learner has a basic acceptable level of knowledge due to the exposure to previous similar situation. She is skilful and efficient while performing nursing activities, only some remarks from the supervisor are needed as she keeps developing the knowledge (Addison-Wesley, 2011).

Competent:

Competence is detected for a nurse on job for two to three years. During this period the nurse is working with no supervision. They have perception and planning capacity guided by efficiency and organization. At this level, a nurse combines both scientific knowledge and analytical approach to respond to clinical circumstances. They demonstrate also sense of responsibility (Oshvandi *et al.*, 2016).

Proficient:

The proficiency goes with the capacity to notice significance change in the clinical status of a patient. Whereas others use guidelines and protocols, a proficient nurse reads, analyses and

take an appropriate decision on their actions(Oshvandi *et al.*, 2016). In fact, they understand a situation as a whole and remain focusing on long term goals(Addison-Wesley, 2011).

Expert:

An expert nurse has an intuitive understanding and considers the problem without losing time in another possible diagnosis or solution because they have the reasons. They work from a deep a wide range of situational analysis based on vast experience and act accordingly. Their sense of responsibility is more developed and takes into account the impact of the environment and other health care providers(Oshvandi *et al.*, 2016)

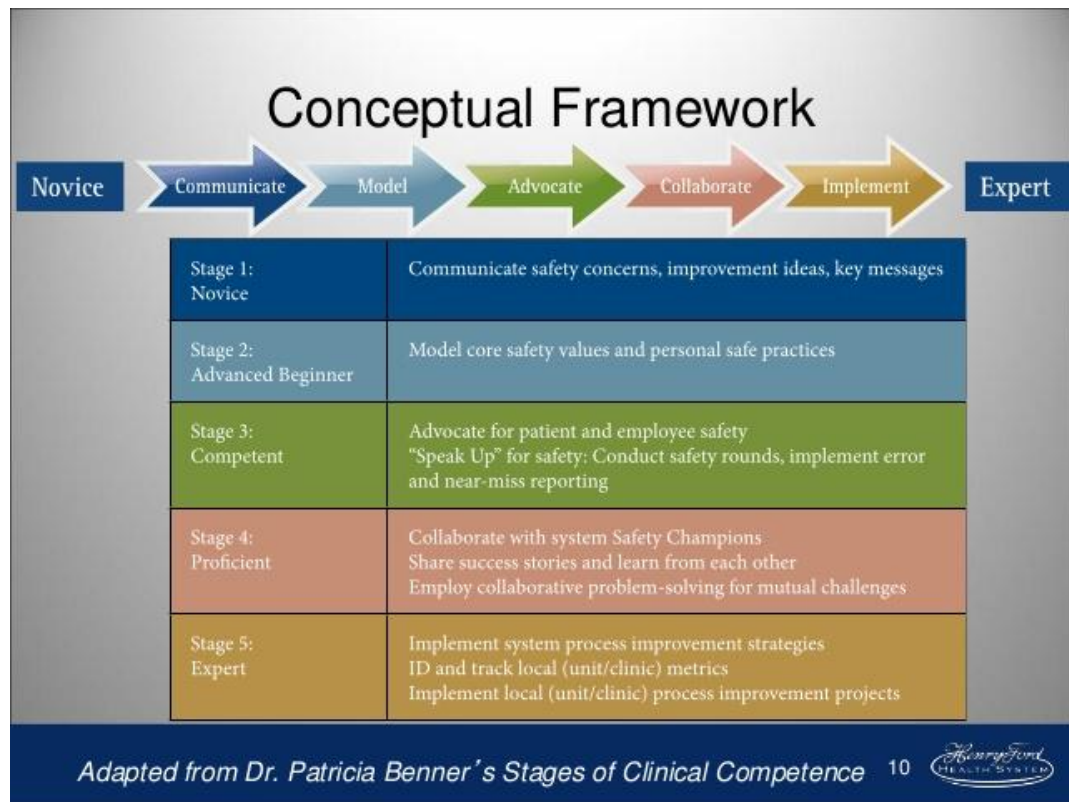


Figure 1 Represents Benner's model of clinical competency

2.4.2. RELATIONSHIP BETWEEN THE CONCEPTUAL FRAMEWORK AND VARIABLES OBSERVED IN THIS STUDY

Starting on social demographic data; level of education, years of experience and the unit a nurse is working in, educational and in-service training could bring influences to the knowledge of nurses in the early detection and management of AKI. Depending on the above mentioned variables, the assessment on level of knowledge in the early detection and in the management by specific questions. Knowledge is based on learned materials, be it in classroom or in-service, nurses need some level of exposure to get an appropriate knowledge. A group of questions such as definition of AKI, causes, risk factors, normal level of serum creatinine, oliguria, nephrotoxic medication were prepared to rate the level of knowledge of nurses in the early detection of AKI. Another set of questions on fluid resuscitation, Priority nursing action during hyperkalemia, common electrolyte imbalance in AKI, priority nursing assessment in case of complication due to AKI, the use of dopamine to increase renal perfusion in critically ill patient, identification of complications related to AKI were prepared

to assess the knowledge of nurses on the management of AKI. This study will also identify factors influencing the knowledge of nurses in early detection and management of AKI. Beneficial factors will allow nurses to perform accordingly to the needs of the patients whereas inhibiting factors to get appropriate knowledge will lead nurses to inadequate or poor service delivery.

Considering Benner's model of knowledge acquisition, the majority of nurses working at CHUK last for a longer period as bedside nurses, which would allocate them in the higher rating category of the model. The root of their knowledge is based on pre-service (what they gained in their respective nursing school) and on the refresher sessions while being at work (in service training). Empowering educational and in service training will enhance nurses' knowledge and keep them growing from advanced beginner to competent, then to proficient and lastly to expert. This process of stepping within these phases will be beneficial to the patient because he/ she will be identified and managed appropriately, to the nurse as he will be confident on his contribution to save lives, and to the health care system by reducing the burden of AKI and related complications as well as its cost.

To conclude, AKI is an abrupt reduction in kidney function happening in 48 hours where serum creatinine is increased and urine output is reduced. Pre-renal, intra-renal, and post-renal causes are seen both in the community and clinical settings. They are specific interventions according to the phase of AKI: in onset phase, nurses are asked to identify risk factors and mitigate the cause; in oliguric phase, they treat the life threatening conditions such as hyperkalemia, fluid overload, systemic manifestation of uremia as well as the root cause. For the diuretic phase, as the patient is at high risk of dehydration due to excessive urination, strict control of fluid balance is required; whereas the recovery phase goes with normalization of fluid and electrolyte but for some patients, this phase doesn't happen, the condition ends up by chronic kidney disease which needs continuous RRT.

2.5. CONCLUSION

From different readings, we believe that nursing actions will originate in the patient assessment. By the guidance of critical thinking, would go in deep during the assessment so that he/she comes up with relevant information which is useful in preserving the health of the patient. While doing so, life threatening conditions as well as the cause of AKI are being managed accordingly. Hopefully, nursing profession is growing for the benefit of it members to gain expertise and increased knowledge on the overall care of the patients with AKI

CHAPTER THREE: METHODOLOGY

3.1. INTRODUCTION

This chapter stands for the whole process from knowing the study area, study population, study approach and study design, ways to motivate and recruit participants. The reliability and validity of the used tool are clarified. It describes also how data was managed up to the analysis by keeping confidentiality of the respondents.

3.2. STUDY AREA

This study was conducted in Centre Hospitalier Universtaire de Kigali (CHUK) located in Nyarugenge district, Kigali city. It is a large and the most known public referral hospital in Rwanda. The study was done on nurses in different services including internal medicine, surgical ward, emergency and accident, paediatric, and intensive care unit. The researcher was be able to get almost all the information as this hospital has a large number of nurses; actually they are 412 nurses including 303 working in the above mentioned unities.

3.3. STUDY DESIGN AND STUDY APPROACH

This study used a quantitative approach and descriptive cross sectional design which are suitable to discover the level of knowledge that nurses have in early detection and management of AKI. The design is relevant to express what exist, determines nurses level in the overall management of AKI by using categories and percentages and mean(Sousa *et al.*, 2007). Data was collected once in the period of data collection to the respondents with willingness to participate.

Quantitative study: is a numerical representation and manipulation of variables with the aim of describing and explaining a phenomenon by considering what these variables stands for (Suphat Sukamolson, no date)

Descriptive design: is a way of inquiry used when little is known about a particular concept, the investigator describes, observes and documents different aspect of the of that concept (Sousa *et al.*, 2007)

Cross sectional study: is said in a study when data will be collected only once to the participants during the period of data collection (Sousa *et al.*, 2007).

3.4. STUDY POPULATION

The population for this study were nurses in emergency and accident, internal medicine, surgical, intensive care unit and paediatric services in CHUK with at least 3 months of experience. A total of 303 nurses are now located in these five services where by 100 nurses in surgical wards, 67 in paediatric wards, 65 in interne medicine, 40 at the emergency and trauma, then 31 in ICU. These 5 services were selected because they are known to admit patient for a longer period and nurses are with them along the hospitalization course. The researcher specified the above mentioned 3 month period for any bedside nurse to be familiar with his/ her unit.

Study population: means all the individuals, items or the events the researcher wants to study (Burns and Grove, 2007).

3.5. SAMPLE AND SAMPLING PROCEDURE:

Convenient non probability sampling: it is a way of getting participants to a study where by the researcher decides ways to get candidate meeting inclusion criteria (Sousa *et al.*, 2007). The convenient non probability sampling strategy was applied by picking bedside nurses in the above mentioned units and considers the total number in each service so that there is an equal representation.

Sample: is a part of the population to be used as participants in a study to show the reality of the whole population (Burns and Grove, 2007).

Depending to the sample size calculation according to Slovin's formula, a study population of 303 bedside nurses in the above mentioned services with a confidence interval of 95% and margin of error 0.05 resulted to a sample size of 172 candidates.

$$n = \frac{N}{1 + N(e)^2}$$

$$e = 0.05$$

$$n = \frac{303}{1 + 303(0.05)^2}$$

$$= \frac{303}{1.7575}$$

$$= 172.40$$

$$= 172$$

Sample size (n) equals to 172 participants (Tejada and Punzalan, 2012).

3.6. INSTRUMENT

The instrument used in this was developed by the researcher to respond to the objectives and research questions. By the assistance of two supervisors who are affluent in research, one of them is a PhD holder and lecturer in Nephrology track, the second was my direct supervisor and lectures in Pediatric track both in masters of nursing. Their searching capacity and expertise together brought about a questionnaire divided into two sessions which are demographic form and AKI questionnaire. The AKI questionnaire had a total of 18 questions (5 true or false and 13 multiple choice). Both questionnaire forms were translated from English to French, a common language among the study participants.

Demographic survey form: contained seven statements to identify bio demographic characteristics of the respondents. It included gender, age, level of education, years of nursing experience, which service the participant is working in by the time of data collection, being exposed to educational session of AKI at school and receiving in-service training on AKI.

AKI questionnaire: was made of different statements aimed to assess the level of knowledge on the early detection and management of AKI. A number of 18 questions which equals to 18 points because every question was scored one point.

- a. Eleven questions on early detection of AKI was on the definition, risk factors, causes, nephrotoxic drugs, oliguria and normal level of serum creatinine.
- b. Seven questions on the management of AKI targeted appropriate IV infusion in case of septic shock, treatment options of AKI, the most common electrolyte imbalance, the use of dopamine in critically ill patient to increase renal perfusion, if pulmonary edema is not a complication to AKI, priority assessment in case of dyspnea related to AKI, priority activity to a patient with hyperkalemia in AKI.

Reliability: The questionnaire was pretested with ten nurses prior to administration to evaluate its level of consistency. By doing so, each of these ten nurses responded to it two times with an interval of two weeks. The results were compiled to bring about a correlation equals to $r = 0.73$.

Validity: The validity of the tool was tested by matching objectives with the statements on the questionnaire. We applied content validity as we were looking if the tool was measuring all relevant elements a nurse is supposed to have to be able to make an early detection and management of AKI. Content validity is also important while assessing knowledge aspects.

Table 1. Relationship between objectives and the questionnaire

Objectives	Related questions
1. To assess the knowledge of nurses in early identification and of acute kidney injury.	<ul style="list-style-type: none"> - Nonsteroidal anti-inflammatory drugs (NSAIDs), vancomycin, and contrast agents have been shown to cause AKI. - AKI is uncommon in critically ill patients - AKI is preventable, treatable and reversible if identified early - Definition of AKI - AKI caused by poor blood supply

	<ul style="list-style-type: none"> - AKI caused by obstruction in the flow of urine - AKI caused by direct damage to the renal paranchyme - Highlight a nephrotoxic drug - Normal range of serum creatinine - Identification of AKI risk factors - Definition of oliguria
2. To assess the knowledge of nurses in management of acute kidney injury.	<ul style="list-style-type: none"> - Dopamine may be used at low doses to increase renal perfusion in critically ill patients. - Pulmonary edema is not a complication of fluid overload. - Common electrolyte imbalance in AKI - Treatment options in AKI - Appropriate infusion in case of septic shock - Priority nursing assessment in case dyspnea due to AKI. - Priority action in case of hyperkalemia
3. To explore factors that influence nursesø knowledge and the early detection and management of acute kidney injury.	<ul style="list-style-type: none"> - Gender - Age - Level of education - Years of experience - The unity of the participant - Studied AKI at school - Received in service training on AKI

3.7. DATA COLLECTION PROCEDURE:

Data was collected by distributing questionnaires among nurses. The willingness to play a part in this research was sufficient and necessary way to recruit registered nurses from

different unity working in above mentioned hospital (CHUK) to be participants. Anonymous questionnaires will be utilized and the participants will be ensured that the results will not be used for any other purpose unless in this study. Every participant will respond from his or her understanding without any external influence. Then answered questionnaires were kept by respondents for the return of the researcher on the same day or the following one.

3.8. DATA ANALYSIS

Data was analysed using descriptive statistic; percentage, mean, median, mode, standard deviation and some graphical representations to highlight the significance from data. The SPSS was included also to analyze data and looking on the relationship between variables by the use of Chi-square test.

3.9. ETHICAL CONSIDERATION

The researcher proposal received an approval from the Ethical Committee of the University of Rwanda/ College of Medicine and Health Science for approval (Appendix 2) prior to data collection. After getting the approval, the process to request permission for data collection at CHUK (study area) started and accepted (see the appendix 3). Informed consent was used during selection period to all participants accepted to be recruited (Appendix 4). Both demographic and AKI questionnaire were anonymous for the purpose of confidentiality.

3.10. DATA MANAGEMENT

The management of data was maintained by collecting all the questionnaires and keep the information from them in an individual computer with key. Before data collection we ensured participants that the information received for the study would be used only for the purpose of the same study, this is and will be respected to fulfil promise and build a good rapport. A 3 digit numerical code instead of participant's name was on all data collected.

3.11. PROBLEMS AND LIMITATIONS

Limitations: The study was conducted on nurses working in a referral hospital where means, information and update are easier to get compared to other settings in the remote areas. Working with only one hospital could also affect the generalisation of the findings due to lack diverse experiences, but as the hospital is large with over four hundreds nurses, the researcher believes that almost all the aspect of nursesø knowledge in regards to AKI was represented.

Problems: Some participants were excusing because they had other questionnaires to answer. The questionnaire was translated from English to French as most of participants were French speakers. To overcome the fact of losing the meaning, someone with experience and knowledge in linguistics translated the questionnaire from English to French.

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

4.1. INTRODUCTION

The purpose of this study was to assess the knowledge in the early detection and management of acute kidney injury among nurses in Rwanda. The study was conducted at CHUK in five units including the ICU, internal medicine, surgical ward, paediatrics, and emergency department. The period for data collection was from the 15th March- 20 April, 2017. Self administered questionnaires were distributed to participants. Of the 172 nurses, five questionnaires were not returned; therefore, the response rate was at (96%) which is equal to 165 participants. The target population was nurses in the above mentioned services. Research results are categorized according to the sections of the data collection instrument which are: demographic data, nurse's knowledge in the early detection of AKI and their knowledge in the management of AKI. The results of the study are categorized below.

4.2. DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

Table 2. Demographic data of the participants (n=165)

Variables	Frequency	Percentage (%)
Age of the participants		
21- 30 years	31	18.8
31- 40 years	91	55.2
41- 50 years	36	21.8
More than 50 years	7	4.2
Sex of the participants		
Male	31	18.8
Female	134	81.2
Level of education		
Master's Nurse	0	0
A0 Nurse	24	14.5
A1 Nurse	130	78.7

A2 Nurse	11	6.7
The unit where the participant is working		
Internal Medicine	37	22.4
Surgery	55	33.3
Emergency and Accident	19	11.5
Pediatric	37	22.4
Intensive Care Unit	17	10.3
Years of nursing experience		
Less than 5 years	26	15.8
5-10 years	71	43
10-15 years	43	26.1
More than 15 years	25	15.2

Table 2. summarizes the demographic data of the participants. The results indicate that the majority of the participants were female (81.2 %,) while only (18.8 %) were male. The dominant age group was between 31-40 years (55%). Regarding level of education, 78.7% participants were diploma holders (A1) with only 14.5% at bachelor level (A0) level. The nurses working in the surgical unit (33.3%), internal medicine unit (22.4%), paediatrics (22.4%), Emergency and Trauma department (11.5%) and ICU (10.3%).Forty-three percent of nurses had five to ten years of nursing experience. Finally, 93.3% reported not to have any in service training on AKI, participants who agreed to be trained are the ones working in Haemodialysis service (a small branch of Internal Medicine) where patients with AKI and CKD are used to come for haemodialysis sessions.

4.2.1. AKI EDUCATION

a. STUDYING AKI IN HIS OR HER NURSING SCHOOL

The image below represents the AKI education received by participants. More than half (55.2%) did not receive AKI education in their nursing schools; a number which is equal to 44.8% reported that they had sessions of AKI in their respective schools. Probably, participants could have been confused from differentiating AKI among other renal conditions which leads to a lack of specificity and reflection on the most common and critical side of AKI.

Participants who received teaching on AKI during nursing program

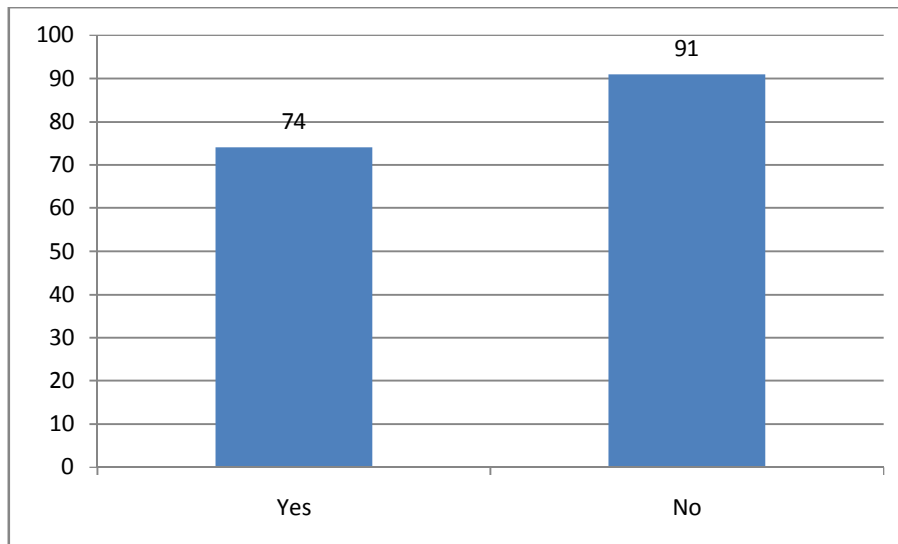


Figure 2 Shows at which extent participants studied AKI in their nursing program.

b. IN SERVICE TRAINING ON AKI

The following figure represents the responses of the participants on the hospital in-service training on AKI. The majority (93.3%) did not receive hospital in-service AKI training in the past five years. Participants who agreed to be trained could be the ones working in the haemodialysis unit because there is training for a period of two weeks priority to be allocated in the above mentioned unit.

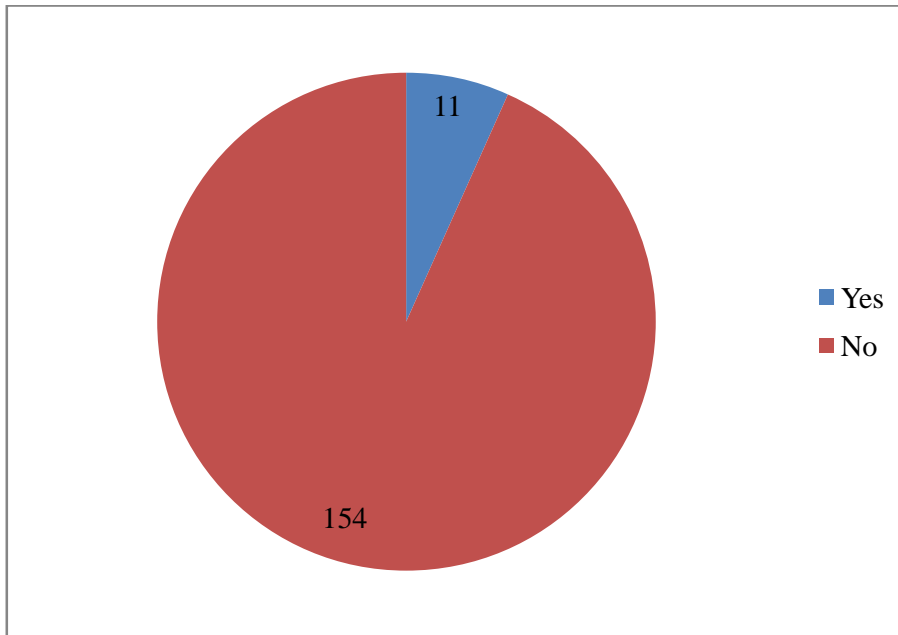


Figure 3. Illustrates participants and receiving in-service training.

4.3. KNOWLEDGE IN THE EARLY DETECTION OF AKI (n=165)

To assess the level of knowledge in the early detection of AKI, the used questions were “True or False” and “Multiple choice” questions. The results regarding the knowledge on the early detection of AKI are presented in the Table 4.2. It is showing frequencies and related percentages of the participants “responses”. We can see that 76% of the participants correctly responded “True” to the question number 1 which was asking if NSAIDs, vancomycine and contrast agent can cause AKI. At 72%, participants confirmed that AKI is preventable, treatable and reversible if identified as soon as possible; they accepted that Gentamycine is a nephrotoxic drug; on the question number three and eight respectively. Within the same table, participants wrongly answered the question number 11, which was asking to identify the false statement regarding oliguria, only 27% got the right answer.

Table 3. Represents the knowledge of nurses in the early detection of AKI (n=165)

Items	Correct	%	Incorrect	%
1. NSAIDs, vancomycine and contrast agents cause AKI	125	76%	40	24%
2. AKI is uncommon in critically ill patients	89	54%	76	46%
3. AKI is preventable, treatable and reversible if identified early.	118	72%	47	28%
4. AKI in defined as an abrupt reduction of kidney function evidenced by increased serum creatinine and decreased urine output.	84	51%	81	49%
5. AKI caused by impaired blood supply to the kidney:	65	39%	100	61%
6. All are risk factors of AKI are except:	100	61%	65	39%
7. AKI caused by obstruction in urine outflow	35	21%	130	79%
8. Nephrotoxic drug	118	72%	47	28%
9. AKI caused by damage to the renal tissue:	56	34%	109	66%
10. Normal value of serum creatinine:	97	59%	68	41%
11. Right statement about oliguria except:	44	27%	121	73%

REPRESENTATION OF THE TOTAL KNOWLEDGE SCORE OF NURSES IN THE EARLY DETECTION OF AKI

The instrument used in this study did not precise how to categorize score and rank of the participants, but referring to other literatures about knowledge of nurses, score which is above 80% is considered high and adequate for nurse practitioners (Mc Donald, 2002 in Humaun Kabir Sickder, 2010).

Scores (%)	Level of knowledge/ Practice
< 60.00	Very low
60.00-69.99	Low
70.00- 79.99	Moderate
80.00- 89.99	High
90.00- 100.00	very high

Table 4. Level of knowledge on the early detection and corresponding score

Knowledge score of all the participants	% knowledge score	Level of knowledge	Frequency	Percentage
1	9%	Very low	1	0.6%
2	18%	Very low	5	3%
3	27%	Very low	7	4.2%
4	36%	Very low	26	15.8%
5	45%	Very low	41	24.8%
6	55%	Very low	39	23.6%
7	64%	Low	26	15.8%
8	72%	Moderate	11	6.7%
9	82%	High	5	3%
10	91%	Very high	3	1.8%
11	100%	Very high	1	0.6%

The table 4, clearly gives details of the obtained score and related level of knowledge. The greater part is ranked with less than 60% which equals to very low knowledge 119 (n=165), the following range between 60-69.99% taken as low knowledge is held by 26 (n=165). Moderate knowledge ranging between 70-79.99% was observed to 11(n=165) respondents, high knowledge was from 80-89.99%, this category kept five respondents while very high knowledge ranging between 90-100% was obtained by only four participants.

Table 5. Summarized score of the nurses knowledge in the early detection of AKI

Nurses knowledge in the early detection of AKI	Frequency	Percentage
Poor knowledge	145	87.8
Moderate knowledge	11	6.7
High knowledge	9	5.4
Total	165	100.0

This table illustrates compiled findings on the early detection of AKI. The majority was rated with low knowledge at 87.8%, with 6.7% of moderate and only 5.4% categorized of having high knowledge towards early detection of AKI. By taking into account these findings, the majority of the participants have deficient knowledge in the early identification of AKI. Finally, poor knowledge would affect the overall patient care.

4.4. KNOWLEDGE OF NURSES IN THE MANAGEMENT OF AKI (n=165)

While assessing the knowledge of nurses in the management of AKI, the researcher used 'True or False' and 'Multiple choice' questions. The Table 4.3 presented below includes the findings which aimed to assess the knowledge of nurses in the management of AKI. Regarding on the results, on the question number 15; 73% of the participants correctly circled offering infusion of normal saline to a patient presenting septic shock, 61% believed that pulmonary oedema is a complication to AKI for the question number 13. The use of dopamine to increase renal perfusion in critical ill patients and the treatment options of AKI both were correctly answered at 53% on 12th and 16th questions respectively. On the other hand, only 27% were able to choose the right response to the question number 18 which was about priority action to be taken in case of a patient with AKI presenting hyperkalemia. Among participants, 41% reported that hyperkalemia is a common electrolyte imbalance.

Table 6. Demonstrates the level knowledge of nurses in the management of AKI

Items	Correct	%	Incorrect	%
12. Dopamine use to increase renal perfusion in critically ill patients	87	53%	78	47%
13. Pulmonary edema is not a complication of AKI	101	61%	64	39%
14. Common electrolyte imbalances in AKI	68	41%	97	59%
15. IV fluid to give in case of septic chock	120	73%	45	27%
16. The treatment option of AKI includes	88	53%	77	47%
17. Priority physical assessment to patient with AKI presenting edema, nausea, dyspnea of 30cycles/ min	72	44%	93	56%
18. Priority nursing action to a patient with AKI presenting hyperkalemia of 7mmol/L	45	27%	120	73%

Depending on above mentioned results, assessing the nurses knowledge on the management of AKI, indicated inadequate knowledge on the management of AKI.

Table 7. Level of knowledge on the management of AKI and corresponding score

Knowledge score of all the participants	% score	knowledge Level of knowledge	Frequency	Percentage
0	0%	Very low	1	0.6%
1	14%	Very low	9	5.5%
2	26%	Very low	29	17.6%
3	43%	Very low	48	29.1%
4	57%	Very low	38	23%
5	71%	Moderate	26	15.8%
6	86%	High	10	6.1%
7	100%	Very high	4	2.4%

Depending on the scoring and ranking process of Mc Donald (2002), table 7 gives all the details on the knowledge of nurses on the management of AKI. The largest percentage 125% (n=165) was located in very low (a score of less than 60%) level of knowledge. Moderate level of knowledge estimated between 60-69.99% was obtained by 26 (n=165), high level of knowledge scored from 80-89.99% was identified to 10 participants (n=165), while very high knowledge ranging from 90-100% received by only four participants.

Table 8. Summarizes the level of knowledge of nurses on the management of AKI

Knowledge on management of AKI	Frequency	Percentage
Low knowledge	125	75.8
Moderate knowledge	26	15.8
High knowledge	14	8.5
Total	165	100.0

The above mentioned table gives the brief significance of the knowledge of nurses on the management of AKI. Only 8.5% of the respondents had high knowledge whereas 75.8% showed a low knowledge.

Table 9. Factors affecting nurses' knowledge in the early detection and the management of AKI

Characteristics of	Knowledge on early detection of AKI	Total	X ²	Df	p- value
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the participants, n (%)						/F		
		Poor knowledge	Moderate knowledge	High knowledge				
Sex	Male	31(100%)	0	0	31(100)			
	Female	114(85.1)	11(8.2%)	9(6.7%)	134(100)			
	Total	145(87.9%)	11(6.7%)	9(5.5)	165(100%)	4.5(F)	1	0.078
Age	21-30 years	30 (96.8%)	0	1(3.2%)	31(100%)			
	31-40 years	79(86.8%)	8(8.8%)	4(4.4%)	91(100%)			
	41-50 years	29(80.6%)	3(8.3%)	4(11.1%)	36(100.0%)			
	more than 50 years	7(100%)	0	0	7(100%)			
	Total	145(87.9%)	11(6.7%)	9 (5.5%)	165(100%)	5.6	6	0.389
Level of education	A ₀	20(83.3%)	1(4.2%)	3(12.5%)	24(100%)			
	A ₁	115(88.5%)	9(6.9%)	6(4.6%)	130(100%)			
	A ₂	10(90.9%)	1(9.1%)	0	11(100%)			
	Total	145(87.9%)	11(6.7%)	9(5.5%)	165(100%)	3.0	4	0.460
Unit	Internal >medicine	31(83.8%)	2(5.4%)	4(10.8%)	37(100%)			
	Surgery	46(83.6%)	6(10.9)	3(5.5%)	55(100%)			
	E&A	19(100%)	0	0	19(100%)			
	Pediatric	34(91.9%)	2(5.4%)	1(2.7%)	37(100%)			
	ICU	15(88.2%)	1(5.9%)	1(5.9%)	17(100%)			
	Total	145(87.9%)	11(6.7%)	9(5.5%)	165(100%)	12.4	7	0.065
Years of nursing experience	1-5 years	26(100%)	0	0	26(100%)			
	6-10 years	60(84.5%)	6(8.5%)	5(7.0%)	71(100%)			
	11-15 years	38(88.4%)	2(4.7%)	3(7.0%)	43(100%)			
	>16 years	21(84%)	3(12%)	1(4%)	25(100%)			
	Total	145(87.9%)	11(6.7%)	9(5.5%)	165(100%)	5.4	6	0.459
Receptive teaching on AKI	Yes	60(81.1%)	8(10.1%)	6(8.1%)	74(100%)			
	No	85(93.4%)	3(3.3%)	3(3.3%)	91(100%)			
	Total	145(87.9%)	11(6.7%)	9(5.5%)	165(100%)	-	-	0.68
Receptive training on AKI	Yes	6(54.5%)	2(18.2%)	3(27.3%)	11(100%)			
	No	139(90.3%)	9(5.8%)	6(3.9%)	154(100%)			
	Total	145(87.9%)	11(6.7%)	9(5.5%)	165(100%)	16.4	1	0.049

Almost all factors which could affect the knowledge of nurses in the early detection of AKI such as age, sex, level of education, years of nursing experience, the unit a participant is

working in, studying AKI in his/her respective nursing school were not associated. To receive in service training on AKI was associated with nurses' knowledge in the early detection of AKI, ($\chi^2=16.4$, $p=0.049$).

Table 10. Factors affecting nurses' knowledge in the early detection and the management of aki

Characteristics of the participants, n (%)		Knowledge on the management of AKI			Total	X ² /F	Df	p- value
		Poor knowledge	Moderate knowledge	High knowledge				
Sex	Male	24(77.4%)	3(9.7%)	4(12.9%)	31(100%)			
	Female	101(75.4%)	23(17.2%)	10(7.5%)	134(100%)			
	Total	125(75.8%)	26(15.8%)	14(8.5%)	165(100%)	1.8	2	0.393
Age	21-30 Years	24(77.4%)	5(16.1%)	2(6.5%)	31(100%)			
	31-40 Years	68(74.7%)	14(15.4%)	9(9.9%)	91(100%)			
	41-50 Years	28(77.8%)	5(13.9%)	3(8.3%)	36(100%)			
	>50 years	5(71.4%)	2(28.6%)	0	7(100%)			
	Total	125(75.8%)	26(15.8%)	14(8.5%)	165(100%)	12.4	7	0.065
Level of education	A ₀	16(66.7%)	4(16.7%)	4(16.7%)	24(100%)			
	A ₁	100(75.9%)	20(15.4%)	10(7.7%)	130(100%)			
	A ₂	9(81.8%)	2(18.2%)	0	11(100%)			
	Total	125(75.8%)	26(15.8%)	14(8.5%)	165(100%)	2.9	4	0.527
Unit of the participant	Internal medicine	26(70.3%)	6(16.2%)	5(13.5%)	37(100%)			
	Surgery	40(72.7%)	11(20%)	4(7.3%)	55(100%)			
	E&A	16(84.2%)	2(10.5%)	1(5.3%)	19(100%)			
	Pediatric	32(86.5%)	4(10.8%)	1(2.7%)	37(100%)			
	ICU	11(64.7%)	3(17.6%)	3(17.6%)	17(100%)			
	Total	125(75.8%)	26(15.8%)	14(8.5%)	165(100%)	7	8	0.508
Years of experience	1-5 years	20(76.9%)	5(19.2%)	1(3.8%)	26(100%)			
	6-10 years	50(70.4%)	13(18.3%)	8(11.3%)	71(100%)			
	11-15 years	36(83.7%)	3(7%)	4(9.3%)	43(100%)			
	>16 years	19(76%)	5(20%)	1(4%)	25(100%)			
	Total	125(75.8%)	26(15.8%)	14(8.5%)	165(100%)	6.4	3	0.074

Receive teaching on AKI	Yes	49(66.2%)	16(21.6%)	9(12.2%)	74(100%)			
	No	76(83.5%)	10(11%)	5(5.5%)	91(100%)			
	Total	125(75.8%)	26(15.8%)	14(8.5%)	165(100%)	6.67	2	0.035
Receive AKI training	Yes	5(45.5%)	2(18.2%)	4(36.4%)	11(100%)			
	No	120(77.9%)	24(15.6%)	10(6.5%)	154(100%)			
	Total	125(75.8%)	26(15.8%)	14(8.5%)	165(100%)	8.9	2	0.008

Considering all possible factors tested to affect nurses' knowledge on the management of AKI, both studying AKI in nursing school and receiving in service training on AKI were associated with nurses' knowledge on the management of AKI ($F= 6.67, p=0.035$ and $F=8.9, p=0.008$) respectively.

CHAPTER FIVE: DISCUSSION

5.1. INTRODUCTION

The results of this study showed that the majority of the participants were female within the middle age. About the level of education, most participants are diploma certified nurses, this is explained by the effort of the Government of Rwanda which aimed to stop with enrolled nursing program which offered A₂ certificate to empower three year undergraduate nursing program, at the same time nurses with enrolled certificate attended similar program through distance learning mode and bridging program to be qualified as registered diploma nurses (A₁) in addition to a 4 year nursing program offering bachelor's degree (A₀) (Harerimana et al, 2015).

The finding highlighted that nurses have inappropriate knowledge regarding early detection and management of AKI. We find out that studying AKI during educational nursing program was associated with knowledge of nurses in the early detection of AKI while being exposed to the in service training was associated with the knowledge of the nurses on both the early detection and management of AKI.

5.2. NURSES KNOWLEDGE IN THE EARLY DETECTION OF AKI

The overall score of the participants in relation to early detection of AKI was low. A number of 94.5% (156) graded with less than 80% of the total score in the early detection of AKI only 5.4%(9) demonstrated high knowledge for the early identification of AKI. Considering updated literatures, nurses are responsible to identify patients with risk factors to AKI; such as hypovolemia, hypotension, severe trauma, excessive bleeding, dehydration, use of nephrotoxic drugs, heart failure and others. A nurse is also the focal point to monitor serum creatinine and urine output as these finding are standing for the actual renal functioning. The abnormal finding is reported immediately to the physician so that a quick and appropriate action is taken(Hulse, 2015). Depending on the above mentioned results, they are reflecting at which extent nurses predicts the occurrence of AKI, while their role was to identify exposed people to AKI (Sedgewick, 2011; Roseli A., et al, 2016). The participants got a score ranging from 50% and above on seven questions out of eleven questions deserved to the

section of early detection.

These questions are number 1, 2, 3, 4, 6, 8, and 10 which directly pointed the definition, risk factors, nephrotoxic medication, normal range of serum creatinine. Whereas on questions number 5, 7, 9 and 11 which was asking on the causes of AKI and oliguria were scored with less than 50%. We missed the literatures to be able to compare the level of knowledge of nurses on the causes of AKI, identification and management of signs and symptoms, prevention of the complications probably nurses are less concerned especially in front of complex condition like AKI, and just they are implementing physician orders. There is a study done to non- specialist medical staff revealed that less than 2% of participants correctly define AKI, 63% categorized the condition appropriately, 42% gave at least four factors leading to AKI(Muniraju et al, 2012). As we are targeting to improve the well being of all people at all age, with the effort of the governments and all the stakeholders, health care providers including nurses have to be knowledgeable enough to face health issues when they present and plan to mitigate them. In Lunyera et al (2016), because nurses are at the front desk in most of health facilities, they have to be properly equipped to improve early diagnosis of AKI.

5.2. KNOWLEDGE OF NURSES IN THE MANAGEMENT OF AKI

The management of AKI is complex and includes multidisciplinary team work. This condition brings burden to both individual and the community (Evans *et al.*, 2015). Depending on the results of this study, nurses are not comfortable in managing patients with AKI. Only 8.5% (14) were ranked with a score greater than 80% whereas 91.5% (151) were less than 80%, the latter is a cutoff point towards the knowledge for nurse practitioners (Humaun Kabir Sickder, 2010). Most health care providers will meet AKI in the daily work which is a complex and challenging disorder to manage. AKI is observed in different settings, which pose challenges for clinical teams who may lack the skills and knowledge to manage AKI appropriately(Sedgewick, 2011).

The responses from this study represented that 73% of participants confirmed to offer the infusion of normal saline to patients in septic shock, 61% of the participants knew that

pulmonary oedema as a complication of AKI. At 53% participants knew the treatment option to AKI, 44% reported manage dyspnea due to fluid overload during AKI, and 41% were able to identify common electrolyte imbalance in AKI. On the other hand, 27% (45) confirmed the use of regular electrocardiograph (ECG) while managing a patient with hyperkalemia. If a patient is having blood potassium level above 7 mmol/L (status known as hyperkalemia) regular ECG are recommended to control cardiac contractility(Koza, 2016).

Even in other settings, participants reported poor confidence while managing a patient with AKI. This have been mentioned by Evans et al (2015), where 100% of the participants wanted more support to manage patient with AKI. From published evidences, the overall management of AKI includes first of all to reverse the primary cause for example: withhold nephrotoxic drugs, fluid resuscitation in case of hypovolemia or dehydration, removing urinary obstruction. By doing so, health care workers have to restore or maintain fluid and electrolyte balance, prevent infection, assure optimal nutrition and reassure the patient (Murphy, 2010). It is up to the health professionals and even the public to be aware of risk factors and main strategies in the prevention and management of AKI (Lewington, Jorge, Cerdá, 2014). Another possible cause to the lack of knowledge to manage AKI could be; giving less priority to it in front of many other embarrassing conditions and shortage of specialist clinicians(Muniraju et al, 2012). In one study, 34% of the participants were not aware of haemodialysis(a procedure used to clear away excess fluid, electrolyte and nitrogenous waste in case of CKD and AKI when other measures are ineffective) services offered at Queen Elizabeth Central Hospital (Evans *et al.*, 2015). The lack of information could affect appropriate management including timely referral and result in delayed treatment leading to increased morbidity and mortality of the patient.

5.3. RELATIONSHIP BETWEEN IN- SERVICE TRAINING SESSIONS TOWARD KNOWLEDGE OF NURSES IN THE EARLY DETECTION AND MANAGEMENT OF AKI

In service training increases the knowledge of the practitioners. From the finding of this study, 6.7% (11) participants reported to have training in AKI, could be linked with a newly haemodialysis unit which is now operating in CHUK under the umbrella of internal medicine,

where every nurse in the haemodialysis unit had an intensive training of 2 weeks before being appointed as a team member in the unit. A study done on AKI in low resource settings aimed to rule out barriers to diagnosis, awareness and treatment and related strategies to mitigate these barriers underlined that inadequate training, lack of awareness of AKI and lack of clinical practice guideline for AKI were affecting the overall care of the patient with AKI (Lunyera *et al.*, 2016). Another study showed that both education and training are needed by health care providers to be able to face effectively cases with AKI (Evans *et al.*, 2015).

5.4. CONCLUSION

The finding of this study intended to assess the knowledge of nurses highlighted that they have inadequate knowledge in the early detection and management of AKI. In service training impacted positively both the early detection and management. In the other settings where similar studies have been conducted, they underlined poor knowledge across the health care team. With joint effort we can improve knowledge of nurses in the early detection and management of AKI so that the community and patients get appropriate service.

CHAPTER 6: SUMMARY, RECOMMENDATION AND CONCLUSION

6.1. SUMMARY OF THE STUDY

The current study was concerned with assessing the knowledge of nurses in the early identification and management of AKI, in one of big referral hospitals in Rwanda (CHUK). In order to accomplish this task, all bed side nurses working in the 5 unities (Internal Medicine, Surgery, Pediatrics, Emergency and Accident and ICU) were candidate to participate in the study. From the whole population, recruited participants filled the questionnaires which in turn we are referring to them to respond to the research questions.

6.1.1. TO ASSESS THE LEVEL OF KNOWLEDGE THAT NURSES HAVE IN EARLY DETECTION OF AKI?

For the results of the present study, respondents gave true responses to some statements and wrong answers to others. The overall score demonstrated that 5.4% of the participants had high score which is considered adequate for a practitioner to be able to timely recognize AKI and being able to prevent it to patients with risk factors. There is a literature which confirmed that a knowledge score of greater than 80% is high and appropriate to nurse practitioners (Mc Donald, 2002 in Humaun Kabir Sickder, 2010 p. 56). Deficit in knowledge is evident in this study because the majority of the respondents were scored with very low grade.

These results also support others studies which were assessing the level of knowledge among health care providers; health care assistants, nurses and in doctors were not competent in terms of early identification and the management of AKI (Evans *et al.*, 2015, Prata *et al.*, 2016;Muniraju et al, 2012). They believe that the health care team should be empowered with appropriate knowledge in regard to AKI.

6.1.2. TO ASSESS THE LEVEL OF KNOWLEDGE THAT NURSES HAVE IN THE MANAGEMENT OF AKI?

A set of 7 questions composed with true or false and multiple choice questions were used to assess the level of knowledge of nurses in the management of AKI. The majority of the participants were classified under low knowledge depending because their score were less

than cut off point. Only 8.5% of the participants got a score greater than 80%, the remaining percentage is categorized as having o poor knowledge.

Different literatures gave value to the role a nurse, regarding the management of AKI. They confirmed that as the nurse is the first health care provider at the frontline to the patients, so his/ her knowledge will impact the overall care of the patient (Lunyera *et al.*, 2016). In addition to the findings of others studies which affirmed low level on the management of AKI and requested empowerment in the academic qualification and in service sessions of AKI (Evans *et al.*, 2015, Prata *et al.*, 2016).

6.1.3. TO EXPLORE FACTORS THAT INFLUENCE NURSES' KNOWLEDGE ON THE EARLY DETECTION AND MANAGEMENT OF ACUTE KIDNEY INJURY.

For the purpose of this study, the used questionnaire had, on its part of demographic survey, statements which should influence the knowledge of nurses in the early detection and management of AKI. The findings revealed that in service training affect positively both the early identification ($p= 0.002$) and the management ($p=0.022$) of AKI. Although the overall score of a big number of nurses is not appropriate, it is important to emphasize on regular in service training as it is believed to be at the heart of nursesøknowledge on AKI.

6.2. RECOMMENDATIONS

The purpose of this study was to assess the level of knowledge of nurses in the early identification and management of AKI. The results found that nurses had poor knowledge in regards to AKI timely identification and management. This goes hands in hands with practice, education and research. We are going to clarify what is supposed to be done in the above mentioned entities so that nurseø knowledge is improved.

6.2.1. RECOMMENDATION TO THE NURSING PRACTICE

As we identified low knowledge in the early detection and management of AKI, evidently it

affects negatively prevention and appropriate management of AKI which can lead to severe morbidity and increased mortality rate. Health services managers are recommended to plan regular sessions of AKI for all health care team where nurses will be included. Referring to Evans et al, (2015), inadequate knowledge were determined in the whole team, this is the reason why to include every one, as there are standing for the interest of same patient. Availability of guidelines related to AKI is also another important activity to help every health professional on what to do and when to do it. Managers including matrons and service in charge have to clarify within nursing responsibilities or job description, at which level nurses have to intervene while having a patient with AKI.

6.2.2. RECOMMENDATION TO THE NURSING EDUCATION

By considering that around the half of the participants accepted to study AKI in their respective school of nursing at a rate of 44.8%, this is a good starting point. May be the remaining percentage have been confused from separating AKI among other renal conditions. It is for curriculum designers to plan and specify at which extent AKI will be concerned, while educators have to be updated on the prevalence and severity of AKI. If we value the impact brought by AKI on individual, community and even health care system such as longer hospitalization, expensive health care cost especially in case of dialysis, increased mortality rate and possible chronic renal condition which require lifelong treatment. These are indicators to base on and take AKI as a priority among others when educating nurses.

6.2.3. RECOMMENDATION TO THE NURSING RESEARCH

The present study was done within one referral hospital; an appropriate number of participants were recruited. Being in the city and at the same time working for a referral hospital give opportunities to nurses to get up to date information, we are not sure if nurses in other health facilities such as health centers, district hospitals and clinics at distance share same understanding on AKI. This is to welcome others interested researchers to investigate whether nurses knowledge in the early identification and management brings impact on the practice. In addition to a published article on the Incidence, Risk Factors, Outcomes of Acute Kidney Injury in 2 Rwandan ICUs highlighted a rate of 39.5% cases of AKI (E. Buregeya, Elisabeth D Riviello ,, Michael L. Beach , 2016). There is a need of a study on general

patients as it can orient even the country authorities in the strategic plan as we are targeting the well being of the whole population at all age.

6.3. LIMITATION OF THE STUDY

This study used structured questionnaire during data collection period. The toll was made by one of the supervisor who is affluent in research. We translated it from English to French because most of the participant requested so during pilot study. It is known that changing something from one language to another can affect the original meaning and being in different cultural context can exaggerate or inhibit the real significance of the concept. Another boundary we met is the inability to generalize the results to nurses working at the peripheral parts of the health care system because the study was conducted in a referral hospital.

6.4. CONCLUSION

AKI is a common and serious condition which needs an appropriate follow up. Prevention is the best way to control it, since it can lead to increased mortality rate. Especially in sub-Saharan Africa, due to shortage of resources and being exposed to most of the risk factors, it is of important to have well equipped professionals to be able to prevent, identify and treat AKI accordingly.

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Simulation in Nursing Education Taking the Patient to the Classroom :
Applying Theoretical Frameworks to Simulation in Nursing Education

Appendix A. Demographic survey in English

Section 1: Study Information		
Date of interview: ____/____/____ (Day, Month, Year)		
Participant ID number:		
Written informed consent	1=Yes, 2=No	_____
Section 2: Demographic Characteristics		
Question (Please circle answer)	Response	
1. What is your gender (sex)?	1= Male 2 = Female	_____
2. What is your age?	1= 21- 30 years 2= 31- 40 years 3= 41- 50 years 4= more than 50 years	_____
3. What is your level of education	1 = Master's Nurse 2 = A0 Nurse 3 = A1 Nurse 4 = A2 Nurse	_____
4. Which hospital unit do you work in?	1 = Internal Medicine 2= Surgery 3= Emergency and Accident 4= Pediatric 5= Intensive (Critical Care)	_____
5. How many years have you been working in your current profession?	1 = less than 5 years 2 = 5 ó 10years	_____

	3 = 10 to 15 years 4 = More than 16 years	
6. Did you receive any training about acute kidney injury during your nursing education?	1 = Yes 2 = No	<input type="text"/>
7. In the past five-years, have you received any training in acute kidney injury?	1 = Yes 2 = No	<input type="text"/>

Annexe B. Enquête démographique en français



Section 1: Informations sur l'étude		
Date de l'interview: __ __ / __ __ / __ __ __ __ (Jour mois année)		
Numéro d'identification du participant:		
Consentement écrit	1= Oui, 2 = Non	_____
Section 2: Caractéristiques démographiques		
Question (Veuillez contourner la réponse)	Réponse	
1. Quel est votre sexe?	1 = home 2 = femme	_____
2. Quel est votre âge?	1 = 21 à 30 ans 2 = 31 à 40 ans 3 = 41-50 ans 4 = plus de 50 ans	_____
3. Quel est votre niveau d'étude ?	1 = infirmière de maîtrise 2 = A0 Infirmière 3 = A1 Infirmière 4 = infirmière A2	_____
4. Dans quelle unité d'hôpital travaillez-vous?	1 = Médecine interne 2 = Chirurgie 3 = Urgence et accident 4 = Pédiatrie 5 = Soins intensifs	_____
5. Combien d'années avez-vous travaillé dans ce service actuel?	1 = moins d'un an 2 = 1 à 3 ans 3 = 4 à 7 ans 4 = 8 - 10 ans 5 = 11-15 ans	_____
6. Avez-vous reçu une session sur l'insuffisance rénale aiguë pendant vos études en sciences infirmières?	1 = Oui 2 = non	_____

8. Au cours des cinq dernières années, avez-vous reçu une formation sur l'insuffisance rénale aiguë?	1 = Oui 2 = non	<input type="text"/>
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c. AKI questionnaire form

Date of interview: |_|_|/ |_|_|/ |_|_|_|_|_| (Day, Month, Year)

Participant ID number:_____

Section A

Knowledge of nurses on early detection and identification of AKI

a. True/False- Circle the correct answer

T F 1. Nonsteroidal anti-inflammatory drugs (NSAIDs), vancomycin, and contrast agents have been shown to cause Acute Kidney Injury (AKI).

T F 2. AKI is uncommon in critically ill patients

T F 3. AKI is preventable, treatable and reversible if identified early

b. Multiple Choice Questions: Please circle the correct answer

4. Acute kidney injury is defined as a rapid deterioration in kidney function evidenced by:

a. Urine volume of > 0.5ml/kg/hour for 6 hours

b. Increase in serum creatinine by 0.3mg/dL or $\geq 26.5\mu\text{mol/l}$ from baseline within 48 hours

c. Decrease in serum creatinine to 1.5 baseline

d. Urine volume of > 10ml/kg for 6 hours

5. The classification of AKI caused by impaired blood supply to the kidney (hemorrhage, shock, fluid volume deficit, vomiting, burns) is:

a. Prerenal

b. Intrarenal

c. Postrenal

d. Perirenal

6. Risk factors for AKI include all of the following **EXCEPT**

- a. Burns
 - b. Malaria
 - c. Dehydration or volume depletion
 - d. Age < 60 years
7. The classification of AKI caused by obstruction of urine flow (kidney calculi, urethral obstruction) is:
- a. Prerenal
 - b. Postrenal
 - c. Intrarenal
 - d. Perirenal
8. Which drug below is nephrotoxic?
- a. Tramadol
 - b. Sodium bicarbonate
 - c. Gentamycin
 - d. Paracetamol
9. The classification of AKI caused by acute damage to renal tissue and nephrons or acute tubular necrosis is:
- a. Prerenal
 - b. Postrenal
 - c. Intrarenal
 - d. Perirenal
10. Which is the normal value of Serum Creatinine?
- a. 53- 250 mol/L
 - b. 44- 88.4 mol/L
 - c. 30 -200 mol/L
 - d. 12- 470 mol/L
11. All of the following statements are true regarding oliguria **EXCEPT**
- a. Oliguria is defined as urine volume < 500ml/24 hours
 - b. Oliguria may result from a normal response of kidneys to hypovolemia
 - c. Oliguria may be the result of an underlying kidney disease
 - d. Oliguria is a normal finding for critically ill patients

Section B

Knowledge of nurses on the management of AKI

a. True/False- Circle the correct answer

T F 12. Dopamine may be used at low doses to increase renal perfusion in critically ill patients.

T F 13. Pulmonary edema is not a complication of fluid overload.

b. Multiple Choice Questions: Please circle the correct answer

14. Common electrolyte imbalances in AKI:

a. Hypercalcemia

b. Hypokalemia

c. Hyperkalemia

d. Hypomagnesium

15. A 21-year-old female is admitted for fever and weakness post-caesarean section. She is found to be hypotensive and tachycardic. She is diagnosed with septic shock.

Which of the following fluids is most appropriate?

a. Packed red blood cells

b. Dextrose 5%

c. Normal Saline

d. All of the above

16. The treatment of AKI includes:

a. Balancing body fluids

b. Monitoring electrolyte and acid base balance

c. Providing nutritional support

d. All the above

17. A 24-year-old male with severe malaria develops AKI. He presents with peripheral edema, nausea and vomiting and dyspnea-respirations 30 breaths per minute. What is the priority physical assessment for the nurse?

- a. Palpate the abdomen for edema
- b. Auscultate lung sounds for crackles and rales
- c. Assess neurological status

Auscultate the abdomen for bowel sounds

18. A 5-year-old child with AKI due to severe gastroenteritis is unresponsive to fluid resuscitation. She presents with hyperkalemia of 7mmol/L. What is the priority action of the nurse?
- a. Regular monitoring of electrocardiogram (ECG)
 - b. Discontinue all IV fluids
 - c. Administer antibiotics
 - d. Apply oxygen at 5 liters per face mask

THANK YOU!

d.Questionnaire sur la connaissance des infirmières sur la détection et la gestion précoces de l'insuffisance rénale aiguë

Date de l'interview: | ___ | ___ | / | ___ | ___ | / | ___ | ___ | ___ | ___ | (Jour mois année)

Numéro d'identification du participant: _____

Section A

Connaissance de la détection de l'insuffisance renal

Vrai / Faux - Encerclez la bonne réponse

V F 1. Les anti-inflammatoires non stéroïdiens (AINS), la vancomycine et les agents de contraste sont capable de causer l'insuffisance rénale aiguë (IRA).

V F 2. L'insuffisance rénale aiguë est rare chez les patients gravement malades

V F 3. L'insuffisance rénale aiguë est évitable, traitable et réversible si elle est identifiée précocement.

Questions à choix multiples: circulez la bonne réponse

4. L'insuffisance rénale aiguë est définie comme une détérioration rapide de la fonction rénale mise en évidence par:

- a. Volume d'urine de > 0,5 ml / kg / heure pendant 6 heures
- b. Augmentation du creatinine sérique de 0.3mg/dl ou de 26.5umol/L à partir de la ligne de base dans les 48 heures
- c. Diminution de la créatinine sérique à 1,5 ligne de base
- d. Volume d'urine > 10 ml / kg pendant 6 heures

5. Le classement de l'IRA causé par la déficience de l'apport sanguin au rein (hémorragie, choc, déficit en volume de liquide, vomissements, brûlures) est:

- a. Prérenal
- b. Intrarénale
- c. Postrenal
- d. Perirénale

6. Les facteurs de risque pour les IRA incluent tous les éléments suivants SAUF

- a. Brûrule
- b. Paludisme
- c. Déshydratation ou épuisement du volume
- d. Âge <60 ans

7. La classification de l'IRA due à l'obstruction du flux d'urine (calcul du rein, obstruction de l'urètre) est:

- a. Prérenal
- b. Postrenal
- c. Intrarénale
- d. Perirénale

8. Quel médicament ci-dessous est néphrotoxique?

- a. Tramadol
- b. Bicarbonate de sodium
- c. Gentamicine
- d. Paracetamol

9. La classification de l'IRA causée par des dommages aigus au tissu rénal et aux néphrons ou à la nécrose tubulaire aiguë est:

- a. Prérenal
- b. Postrenal
- c. Intrarénale
- d. Perirénale

10. Quelle est la valeur normale de la créatinine sérique?

- a. 53- 250 mol / L
- b. 53-88,4 mol / L
- c. 30 -200 mol / L
- d. 12 - 470 mol / L

11. Déséquilibres électrolytiques courants chez les IRA:

- a. Hypercalcémie
- b. Hypokaliémie
- c. Hyperkaliémie
- d. Hypomagnésium

Section B

Connaissance sur la prise en charge de l'IRA

V F 12. La dopamine peut être utilisée à de faibles doses pour augmenter la perfusion rénale chez les patients en phase critique.

V F 13. L'œdème pulmonaire n'est pas une complication de la surcharge de liquide.

14. Une femme de 21 ans est admise pour la fièvre et la faiblesse après la césarienne. Elle se révèle hypotensive et tachycardique. Elle est diagnostiquée avec un choc septique. Lequel des fluides suivants est le plus approprié?

- a. Globules rouges emballés/ Concentré globulaire
- b. Dextrose 5%
- c. Saline normale
- d. Tout ce qui précède

15. Toutes les affirmations suivantes sont vraies concernant l'oligurie SAUF
- L'oligurie est définie comme le volume d'urine <500 ml / 24 heures
 - L'oligurie peut résulter d'une réponse normale des reins à l'hypovolémie
 - L'oligopurie peut résulter d'une maladie du rein
 - L'oligurie est une constatation normale pour les patients gravement malades

16. Le traitement de l'IRA comprend:
- Équilibrage des fluides corporels
 - Surveillance de l'électrolyte et de l'équilibre acide
 - Fournir un soutien nutritionnel
 - Tout ce qui précède

17. Un homme de 24 ans souffrant de malaria sévère développe une IRA avec un œdème pulmonaire. Il présente un œdème périphérique, des nausées et des vomissements et une dyspnée respiratoire 30 respirations par minute. Quelle est l'évaluation physique prioritaire pour l'infirmière?
- Palper l'abdomen pour l'œdème
 - Auscultation des sons pulmonaires pour les craquements et les râles crépitants
 - Évaluer l'état neurologique
 - Auscultation de l'abdomen pour les péristaltismes

18. Un enfant de 5 ans atteint d'IRA due à une gastro-entérite sévère ne réagit pas à la réanimation fluide. Elle présente une hyperkaliémie de 7mmol / L. Quelle est l'action prioritaire de l'infirmière?
- Surveillance régulière de l'électrocardiogramme (ECG)
 - Arrêter tous les liquides en IV
 - Administer des antibiotiques
 - Appliquer de l'oxygène à 5 litres par masque

MERCI BEAUCOUP!

e. Time frame

ACTIVITY TO BE DONE	DATE TO BE COMPLETED	DAYS NEEDED
1. Research proposal preparation and submission	20 th August- 28 th November, 2016	98 days
2. Ethical clearance and permission to do the work	05 th January-27 th January, 2017	23 days
3. Community contact to orient members on the project	30 th January-09 th February, 2017	11 days
4. Pre testing and finalization of research questionnaires	10-14 th March, 2017	4 days
5. Data collection	15 th March- 20 th April, 2017	35 days
6. Data entry into computer	24 th April-28 th April, 2017	5 days
7. Data analysis	2 nd May- 19 th May, 2017	18 days
8. Report writing (first draft)	22 nd May-12 th June, 2017	22 days
9. Project presentation	19 th -21 st June, 2017	3 days
10. Report writing (final draft)	03 rd -24 th July, 2017	21 days
11. Submission of final report	25 th -28 th July, 2017	4 days
12. feedback to the community/ stakeholders	1 st -18 th August, 2017	18 days

f. Informed consent

Dear Sir/Madam,

Re: Request to participate in a Research Study. “*Knowledge of nurses in early detection and management of acute kidney injury a selected hospital in Rwanda*”.

Voluntarily, you are requested to participate in a research study which is being conducted by a postgraduate student DUSHIMIYIMANA Violette, supervised by Dr. Patricia Moreland from the School of Nursing and midwifery in College of Medicine and Health Sciences-University of Rwanda. This study will be conducted in Centre Hospitalier Universtaire de Kigali (CHUK). The aim of this study is to illustrate the level of knowledge of a nurses in their daily nursing practice towards early detection and management of acute kidney injury (AKI) among nurses at CHUK. This survey will take no more than 20 minutes to complete.

I guarantee confidentiality of your voluntary participation and the information you provide will be made anonymous once you hand in this questionnaire. This means that your form of identification will not be included in any records presentation and your answers in this questionnaire will not be shared with your medical or nursing team. We can assure you that your team will treat you in the same way whether or not you choose to participate in our research.

If you consent to participate in this study, please sign this form and remove it from the questionnaire. The participant can keep this signed copy as proof of consent. Then please complete the survey attached. If you have any further questions or require more information about this study, you can contact the researcher and supervisor directly.

VioletteDushimiyimana

Dr. Patricia Moreland

Email: dushimevio@yahoo.fr

Email: pjmoreland2012@gmail.com

Phone: 0788215863

Phones: 0787115028

Participant: All of my questions and concerns about this study have been addressed. I choose, voluntarily, to participate in this research project.

Names of the participants:

Signature of participant:

Date:

