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THE ANALYSIS OF ANATOMICAL CONTENT IN SURGICAL NOTES USING CASE ANATOMICAL KNOWLEDGE INDEX (CAKI): A MIXED-METHODS STUDY

A dissertation submitted in partial fulfillment of the requirements for the award of the degree of Master of Medicine in General Surgery, University of Rwanda.

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DECLARATION

The researcher:

I, Dr HATANGIMANA Theobald, hereby declare that this dissertation **"The analysis of anatomical content in surgical notes using Case Anatomical Knowledge Index (CAKI): A mixed-methods study"** is the result of my own work and has not been submitted for any other degree at the University of Rwanda or any other institution.

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Dr HATANGIMANA Theobald

DEDICATION

To God the Almighty

To my Parents

To my beloved Uncle

To Dayenu

To my Brother and Sisters

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LIST OF ABBREVIATIONS

CAKI: Case Anatomical Knowledge Index

CHUK: (Centre Hospitalier Universitaire de Kigali) University Teaching Hospital of Kigali

PBL: Problem-based learning

TBL: Team-based learning

CBL: Case-based learning

RCS: Royal College of Surgeons

PGY: Postgraduate Year

SPSS: Statistical Package for the Social Sciences

CMHS: College of Medicine and Health Sciences

IRB: Institutional Review Board

OR: Operating Room

ABSTRACT

Background: Knowledge of anatomy is fundamental for medical training and practice especially in surgery. Surgical notes writing is part of the core surgical skills. However, there is huge variability of anatomy details for most common procedures in CHUK among surgeons and surgical trainees.

Objectives: This study assessed the Case Anatomical Knowledge Index (CAKI) score of anatomy content in surgical notes, identified the factors associated with the quality of anatomy content and explored surgeons and trainees' perceptions about anatomy documentation within surgical cases.

Methodology: This was a mixed-methods study with sequential explanatory design. Quantitative data were collected and analyzed in the first place using CAKI scoring tool and a pre-established 5-point Likert Scale questionnaire. Based on quantitative findings, qualitative, open-ended questions were developed and asked to participants through individual face-to-face in-depth interviews to explore perceptions of surgeons and surgical trainees.

Results: 119 patients' files were assessed, 5 surgeons and 15 surgical trainees interviewed. 46.2% files accounted for gallbladder surgery, 44.5% and 9.2% for hernia and thyroid respectively. 52% of patients were females. The majority of surgical notes (89.9%) were done by residents. The mean overall total score of anatomical content using CAKI score was average (11.9/15). The type of disease ($p< 0.001$) and the surgical procedure ($p< 0.001$) have been identified as factors influencing the quality of anatomy in surgical notes.

The majority of surgeons and trainees feel that the lack of adequate knowledge of surgical anatomy, heavy workload and lack of consideration to recording of anatomy as well as lack of mentorship and training to properly record the anatomy have a negative impact on the quality of anatomy recorded in surgical notes.

The main challenges faced by surgeons and trainees include lack of continuous anatomy training mechanisms, inaccessibility to anatomy dissection laboratory and lack of a space in the file reminding to take into consideration the anatomy details found in a given surgical procedure were among the recurrent themes.

Finally, the majority of surgeons and surgical trainees agreed that mastering the surgical anatomy through organized regular cadaveric dissection courses and anatomy refresher sessions will increase anatomy knowledge of surgeons and trainees, consequently improving the quality of anatomical details recorded within surgical notes.

Conclusion: The content of anatomy in surgical notes is average. It is influenced by the type of disease, the surgical procedure and level of expertise of the notes taker. An increased awareness among surgeons and surgical trainees, better documentation and continued anatomy integration in surgical practice may improve the quality and quantity of the anatomy content in surgical notes.

Key words: CAKI score, anatomy content, surgical notes, surgeons' perceptions

CHAPTER I: INTRODUCTION

1.1. Background

Anatomy is a fundamental science in medical training. The scope and depth of anatomy is crucial when preparing trainees for clinical practice. Studies revealed that new teaching methods have reduced the time available for anatomy teaching. Moreover, literature presents little evidence to direct the scope and depth of anatomy teaching(1).

Surgical notes contain varying degrees of demand for anatomical knowledge which allow trainees to encounter anatomy in the context of clinical problem (diagnostic, investigative, or for treatment). In addition, case based learning allows trainees to acquire sufficient anatomical knowledge to practice safely and successfully (2).

The Case anatomical knowledge index (CAKI) is a validated tool evaluating the anatomical knowledge embedded in a clinical case through headings of diagnosis, investigations, and treatment domains based on 10 “universe attributes” (3).

The CAKI is able to rank clinical cases/conditions according to demands for anatomical knowledge required to comprehend the concepts of a diagnosis and/or disease condition, interpret investigations and carry out clinical procedures, and plan and implement treatment (4). Identified most common surgical conditions with high-yield CAKI scores include hernias and perianal pathologies (anal fissure, fistula, hemorrhoids) (4).

Unfortunately, there is no data reflecting on the quality of the anatomy content recorded while taking care of surgical patients in our settings. Analysis of anatomy content and investigation of factors influencing the quality the anatomy encountered in common surgical conditions using the above mentioned tool as well as exploration of surgeons and surgical trainees’ perceptions will contribute to the improvement of documentation and teaching of clinically oriented anatomy to surgical trainees.

1.2. Problem Statement

Anatomy is crucial for the management of surgical patients. Surgical notes constitute an important element in the surgical patient management. They allow documentation, communication between the treating team, research projects; treatment cost evaluation as well as legal litigation.

However, there are no standard surgical notes in CHUK (Kigali University Teaching Hospital). This leads to disparity and huge variability where each surgeon/surgical trainee describes the procedure as good as they can, making surgical notes content shallow as well as many times even incomplete.

The current medical file has no space dedicated to guide the surgeons/surgical trainees about important anatomical information that a surgical procedure may contain for continuous and comprehensive patient's care, teaching purposes, good record keeping and documentation as well as legal matters.

This study is needed to investigate the quality of anatomy content within surgical notes and to improve the documentation of clinically relevant anatomy within surgical cases.

1.3. Research Questions

a. What is the quality of anatomy content description within surgical notes?
b. What are the factors influencing the quality of anatomy content within surgical notes?
c. What are the perceptions of surgeons and surgical trainees about the importance of accurate anatomy description in surgical notes?

1.4. Objectives

1.4.1. General Objective

This study aimed to improve the documentation of clinically relevant anatomy in surgical notes for both patients 'care and teaching purposes.

1.4.2. Specific Objectives

a. To calculate CAKI score of anatomy content in surgical cases at CHUK.
b. To identify the factors influencing the quality of anatomy content in surgical notes at CHUK.
c. To explore surgeons and surgical trainees' perceptions about anatomy content and documentation within surgical cases.

CHAPTER II: LITERATURE REVIEW

2.1. Anatomy Teaching in Surgery

Anatomy is a fundamental aspect in the medical training and documentation especially when it comes to surgical clinical cases (2) and knowledge of anatomy is of paramount importance for successful clinical practicing (5). Moreover, anatomy is considered to be the core of surgery (6). The mainstay of teaching has been the lecture method and practicum through dissection (4). The reduction in time allocated to the teaching of human anatomy, shortage of cadavers and instructors (7) have led the utilization of new innovative teaching methods (8) where anatomy is met in a context of a clinical problem (4) but with concerns through studies (1) on the scope and depth of anatomy delivered to trainees.

Various new methods to make teaching of anatomy interesting and dynamic for problem solving and application in the clinical context for delivery of quality health care include interactive lecturing, problem-based learning (PBL), case-based learning (CBL) (9) and computer assisted learning (10).

The team based learning (TBL) is an instructional, student-centered approach based on group discussion which allows better knowledge retention with clinical context. Its goals include helping students develop flexible knowledge, effective problem-solving skills, student-directed learning skills, effective collaboration skills and intrinsic motivation (11). It has been endorsed as education strategy by World Federation of Medical Education and Word Health Organization (12)(13). It has been adopted as anatomy teaching methodology at the University of Rwanda since 2013 (14).

Case-based learning for teaching anatomy is done through modules where students are given paper-based clinical scenarios and cases with specific objectives. These new methods of teaching anatomy are advocated because they allow students to learn anatomy with interest and to apply knowledge on clinical practice by providing clinical correlations with gross anatomy. Concerns for PBL include time consuming and difficulties for underperforming students to fulfill the expectations. Studies have

suggested hybrid approach with traditional teaching method in order to increase its effectiveness (15).

Finally, a system of teaching anatomy before and during surgical procedures in theater developed by the University of South Florida is gaining popularity in training of medical students and postgraduate trainees. Anatomists play an important and significant role in teaching the regional anatomy in conjunction with surgeons. However, further studies are needed to evaluate the effectiveness of this method(16).

2.2. Surgical Notes

Surgical notes are very important written document in the surgical journey of a patient (17). Writing and note-taking, part of core surgical skills teaching (18), was introduced as significant part of medicine by Hippocrates and his disciples (19). They are essential for documentation, communication between health care providers for continuous patient care, research projects, audits, billing as well as legal litigation (18)(20)(21). The Royal College of Surgeons (RCS) guidance, Good Surgical Practice informs that surgeons "ensure all medical records are legible, complete and contemporaneous" (22).

The quality of surgical notes based on information related to patient safety as well as documentation and recording of important clinical findings have been widely reported in literature with various findings (17)(23)(24). Anatomy within the clinical cases is another subject of significant interest.

Studies have revealed that surgical notes contain varying degrees for anatomical knowledge. They allow trainees to encounter anatomy in the context of clinical problem (diagnostic, investigative or for treatment). In addition, acquiring anatomy through the context of case-based learning was found to allows trainees to get sufficient anatomical knowledge to practice safely and successfully (2).

2.3. CAKI Score

The Case Anatomical Knowledge Index (CAKI) is a validated tool (3) evaluating the anatomical knowledge embedded in a clinical case (4). The CAKI is able to grade clinical cases through headings of diagnosis, investigations and treatment domains (3).

The CAKI has been used to score clinical cases through surgical notes in General Surgery in order to evaluate the anatomy they contain for case-based teaching anatomy (3). In a study done in Zambia, the most prevalent diseases were ranked then evaluated for anatomy content for all the three domains of interest. Categorization of results revealed high (12 and above), average (9-11), and low (8 and below) scores. The most common prevalent diseases with high-yield CAKI scores were inguinal hernias, perianal conditions, intestinal obstruction and shoulder dislocations (4).

The analysis of surgical notes using the CAKI brings out the potential of a clinical case to foster anatomy learning, promoting the validity of clinically oriented anatomy teaching (4).

2.4. Perceptions on Anatomy Knowledge and Teaching in Surgery

Most of surgeons agree that a strong knowledge in anatomy is essential for surgical training and good medical practice (25). Knowledge of anatomy helps to avoid mistakes in daily practice of a surgeon and reduce avoidable deaths. Moreover, good knowledge of anatomical variations is paramount for safe practice of surgery (26). However, the teaching of anatomy to surgical trainees has been decreasing in the last decades which sadly can lead to misdiagnosis and malpractice (iatrogenic injuries) as well as medico-legal litigation (27).

Consultant surgeons often complain about deficiencies in their surgical trainees' level of anatomy (6). A significant number of surgeons find the junior surgeons' level of anatomical knowledge to be poor and not adequately prepared for fellowship (28). The challenges include reduction on time dedicated to dissection and prosection, increase in number of trainees, significant decline in the number of experienced demonstrators and in the number of cadavers (25). Surgical trainees have to benefit from increasing the time dedicated for anatomy teaching, involvement of surgeons in the process of anatomy teaching and participation in the cadaveric dissection (6).

Calls for anatomy teaching by surgeons are also growing. It was found that the teaching of anatomy is predominantly undertaken by non-clinical staff, including medical students, science graduates, physiotherapists and technical staff; this may lead to a lack of depth in

understanding topographical clinical anatomy among medical graduates. Surgeons who teach anatomy dissection offer a valuable, rare resource, essential to the provision of a clinical context to trainees. Moreover, recruitment mechanisms that attract surgeons to teach anatomy would ensure a high-quality anatomical learning experience for surgical trainees and medical students (29).

In addition, many trainees feel that the anatomical knowledge they bring to their early postgraduate training is not fit for the purpose(30). Anatomy demonstration has been proposed to be one way to fill up the gap. Anatomy demonstration would reinforce their anatomical knowledge by dissection, attending tutorials with senior anatomists and by teaching medical undergraduates (31). The literature indicates that cadaveric dissection is one of the most powerful ways of teaching topographic and regional anatomy. It is associated with an increase in confidence levels and surgical skills of residents through procedure-oriented cadaveric dissection courses(32)(33). Importantly, these skills acquired during cadaveric courses can be transferred to the operating room. This leads to an improvement of surgical outcomes by means of identifying proper anatomical landmarks, practicing more without any stress of operation room in a comfortable environment, and teaching the basis of new modification in a surgical approach (34)(23).

2.5. Factors with Influence on Anatomical Knowledge of the Surgical Trainees

A sound knowledge of anatomy is crucial for clinical practice as surgical trainee or surgeon. However, there have been concerns for the deficiency in anatomy of trainees and graduates (35). This trend has been explained by generational conflict, non medical staff teaching anatomy, scarcity of dissection use as a teaching tool and introduction of problem based learning (36).

The assessment of predictors of self-reported confidence in anatomy knowledge identified vertical integration of anatomy learning and teaching, integration of anatomy teaching with other basic sciences, and providing consistent assessment through both pre-clinical and clinical stages as positively influencing factors. Moreover, dissection should be incorporated in anatomy education as a teaching tool (37).

The declining anatomical knowledge has been attributed to eight factors. These include teaching by non medically qualified teachers, the absence of a core anatomy curriculum, decreased use of dissection as a teaching tool, lack of teaching anatomy in context, integrated problem-based learning or systems-based curricula, inadequate assessment of anatomical knowledge, decreased anatomy teaching time and neglect of vertical integration of anatomy teaching (38).

The recommendations stipulated to address the above mentioned concerns include implementation of teaching in context, implementation of vertical integration, implementation of assessment strategies, increasing the recognition for teachers, enhancing the professional recognition of anatomists and to encourage anatomists to participate in educational research (38).

CHAPTER III: METHODS

3.1. Study Design

This was a mixed-methods study with sequential explanatory design. Quantitative data were collected and analyzed in the first place using CAKI scoring tool and a pre-established 5-point Likert Scale questionnaire. Based on quantitative findings, qualitative, open-ended questions were developed and asked to participants through individual face-to-face in-depth interviews to explore perceptions of surgeons and surgical trainees.

3.2. Selection of Participants

Following strategic problem solving approach, the top three most frequently done general surgery procedures were identified. Consecutive patients undergoing those procedures were included in the quantitative phase of the study over a 12 months' period. All general surgeons and senior residents were included in the qualitative interviews.

3.2.1. Quantitative Phase

3.2.1.1. Inclusion criteria

As described above, hernia repair (25%), cholecystectomy (32%) and thyroidectomy (10%) were identified as the top three most performed general surgical procedures in CHUK. For a period of 12 months, 145 medical files of patients operated for elective thyroid surgery, open/laparoscopic cholecystectomy and inguinal hernia repair were retrieved and reviewed. 119 met the inclusion criteria:

- File with admission, progress and surgical procedure notes.
- Patient operated for hernia repair, cholecystectomy and thyroidectomy.

3.2.1.2. Exclusion criteria

Medical files with missing or lost admission, progress or surgical notes pages were excluded.

3.2.2. Qualitative Phase

3.2.2.1. Inclusion criteria

All general surgeons practicing at CHUK and senior residents in general surgery (PGY 3 and 4) were recruited.

3.2.2.2. Exclusion criteria

No exclusion criteria.

3.3. Study Site

The study site was CHUK (The University teaching hospital of Kigali). The University teaching hospital of Kigali (Centre Hospitalier Universitaire de Kigali [CHUK]) is the main public tertiary referral and teaching hospital in Rwanda with 519 beds. CHUK has 11 Operating rooms (OR) among them, 6 are in the main theater complex where 2 OR are dedicated to general surgery(39).

3.4. Sampling Technique

This study used a convenience, non-probability sampling.

For the quantitative phase, all medical files of patients operated for elective thyroid surgery, open/laparoscopic cholecystectomy and inguinal hernia repair from March 1st 2020 to February 28th 2021 were reviewed. 119 files fulfilled selection criteria and were considered for analysis.

For the qualitative phase, a purposive sampling was used and 20 participants have been interviewed before reaching saturation among them 5 general surgeons and 15 senior residents in General Surgery Program.

3.5. Main Outcomes

The main outcomes of this study were the overall scores of the anatomy content in surgical notes according to CAKI, factors influencing the score of anatomy content as well as surgeons and surgical trainees' perceptions about anatomy documentation within surgical cases.

3.6. Data collection and Analysis

Quantitative data were collected using CAKI scoring questionnaire developed to assess anatomy content in medical files. A 5-point Likert scale questionnaire was added to allow surgeons and trainees to identify the factors which may be associated with the anatomy content as seen in surgical notes. Data were collected and entered using Excel. They were then exported to SPSS version 25 for analysis.

Based on the quantitative phase findings, a qualitative data collection questionnaire was developed to explore better and explain further the quantitative findings. Qualitative data were collected through individual in-depth interviews. Answers to open-ended semi-structured questions were grouped according to different themes, coded, and analyzed using the "Atlas.ti" software version 7.1.4.

The collected data have been entered in a password-protected computer of the principal investigator. Data will be safely stored for a period of 5 years following the presentation of this dissertation.

3.7. Ethical Considerations

This study has been approved by the Department of Surgery/UR. It has been evaluated and approved by CMHS IRB (Institutional Review Board Approval Notice: No 255/CMHS IRB/2021) of the University of Rwanda, College of Medicine and Health Sciences. CHUK Ethics Committee clearance was obtained prior to data collection (EC/CHUK/090/2021). Participants (Consultants and Residents) signed the consent form in English before participation into the study. The data obtained have been treated confidentially, and only used for research purposes.

3.8. Resources Required for the Study

- Medical files of patients from CHUK Surgery department
- Data collection forms
- Two trained assistants for data collection
- Statistician for data analysis
- Budget

3.9. Conflict of interest

The authors declare no conflict of interest.

CHAPTER IV: RESULTS

IV.1. QUANTITATIVE RESULTS

IV.1.1. Demographic characteristics of study participants

119 medical files were retrieved and reviewed covering a period from March 1st 2020 to February 28th 2021. The cases involving gallbladder surgery accounted for 46.2% (55 cases), 44.5% of cases (53 cases) accounted for elective hernia surgery whereas thyroid surgery accounted for only 9.2% (11 cases).23 participants (7 consultant general surgeons and 16 senior residents in General Surgery Program) responded to the quantitative survey.

Table 1: Frequency of cases according to surgical disease

	Frequency	Percent	Valid Percent	Cumulative Percent
Thyroid	11	9.2	9.2	9.2
Hernia	53	44.5	44.5	53.8
Gallbladder	55	46.2	46.2	100.0
Total	119	100.0	100.0	

52.1% of the files in the study belonged to female patients and the majority of surgical notes were done by residents (89.9%). (Table 2)

Table 2: Demographic characteristics of study participants

Variable		Count	Percentage
Gender	Male	57	47.9%
	Female	62	52.1%
Training level of surgical notes taker	Consultants	10	8.4%
	Residents	107	89.9%
	Others	2	1.7%

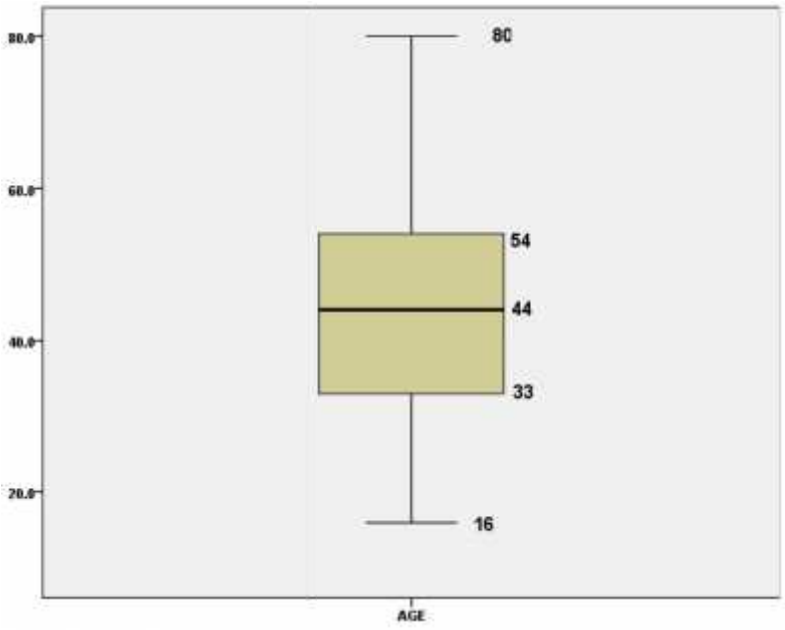

Figure 1: Age distribution of study participants

The median age of the patients in reviewed medical files was 44 years, while the minimum, maximum, 1st quartile and 3rd quartile were 16, 80, 33 and 54 respectively (Figure 1).

4.1.2. Assessment of Anatomy Content in Surgical Cases using CAKI Score.

Table 3: Anatomy Content in Surgical Cases using CAKI Score

Variable	Score	Disease					
		Thyroid		Hernia		Gallbladder	
		Count	Percentage	Count	Percentage	Count	Percentage
Diagnostic	1.0	1	9.1%	6	11.3%	4	7.3%
	2.0	0	0.0%	4	7.5%	7	12.7%
	3.0	5	45.5%	14	26.4%	3	5.5%
	4.0	2	18.2%	22	41.5%	38	69.1%
	5.0	3	27.3%	7	13.2%	3	5.5%
Investigation	2.0	0	0.0%	1	1.9%	0	0.0%
	4.0	1	9.1%	1	1.9%	1	1.8%
	5.0	10	90.9%	51	96.2%	54	98.2%
Treatment	2.0	1	9.1%	15	28.3%	3	5.5%
	3.0	5	45.5%	29	54.7%	14	25.5%
	4.0	2	18.2%	4	7.5%	18	32.7%
	5.0	3	27.3%	5	9.4%	20	36.4%
Overall score	</=8	0	0.0%	0	0.0%	0	0.0%
	9-11	7	63.6%	31	58.5%	11	20.0%
	>/=12	4	36.4%	22	41.5%	44	80.0%

***A CAKI overall score of 8 and below, 9 to 11, as well as 12 and above were considered low, average and high respectively. All the surgical notes takers scored above low for the anatomy content recording.**

The recording of anatomy content had a high CAKI overall score for gallbladder (80.0%) whereas the overall scores for anatomy in surgical notes were mostly in average range (9 to 11) for thyroid (63.3%) and hernia (58.5%).The surgical notes takers scored in small percentage (36.4%) within high overall CAKI score range for hernia procedures.

The mean overall total score of anatomical knowledge of the surgical notes according to CAKI is 11.94 which is an average score according to the categorization (Table 4).

Table 4: Mean Overall Total Score of Anatomical Knowledge according to CAKI Score.

	N	Mean	Std. Deviation
Overall Score	119	11.94	1.422
Valid N	119		

4.1.3. Factors Influencing the Quality of Anatomy in Surgical Notes at CHUK.

Table 5: Note content- related factors.

Variables		**CAKI SCORE**		**p-value**
		<12, N (%)	>/=12, N (%)	
Training level of surgical note taker	Consultant	2(4.1)	8(14.4)	0.073
	Resident	45(91.8)	62(88.6)	
	Other	2(4.1)	0(0)	
Surgical procedure	Thyroidectomy	7(14.3)	4(5.7)	**<0.001**
	Hernia repair	31(63.3)	22(31.4)	
	Cholecystectomy	11(22.4)	44(62.9)	
Experience	<4 years	11(22.4)	20(28.6)	0.528
	>/=4 years	38(77.6)	50(71.4)	

Table 5 showed that the type of disease (p-value <0.001) and surgical procedure (p<0.001) are significantly associated with the quality of anatomical content in surgical

notes. The training level of surgical note taker (p: 0.073) as well as experience of surgical note writer (p: 0.528) do not show any statistically relevant significance.

Table 6: Surgeons and trainees perceived factors influencing the quality of anatomical content in surgical notes using the 5-point Likert scale survey

Variable		Count	Percentage
Knowledge of regional anatomy	Disagree	4	17.4%
	Neutral	1	4.3%
	Agree	7	30.4%
	S. agree	11	47.8%
Level of training of surgical notes taker	Disagree	1	4.3%
	Neutral	1	4.3%
	Agree	14	60.9%
	S. agree	7	30.4%
Workload of surgeon/trainee	Disagree	2	8.7%
	Neutral	2	8.7%
	Agree	11	47.8%
	S. agree	8	34.8%
Experience in years of surgical note takers	S. Disagree	1	4.3%
	Disagree	1	4.3%
	Neutral	4	17.4%
	Agree	12	52.2%
	S. agree	5	21.7%
Time of redaction of surgical notes	S.disagree	1	4.3%
	Disagree	2	8.7%
	Neutral	9	39.1%
	Agree	10	43.5%

	S.agree	1	4.3%
Anatomy refresher courses introduction	Disagree	1	4.3%
	Neutral	3	13.0%
	Agree	6	26.1%
	S. agree	13	56.5%
Anatomy teaching time	Disagree	1	4.3%
	Neutral	8	34.8%
	Agree	6	26.1%
	S. agree	8	34.8%
Involvement of the anatomist	S. disagree	1	4.3%
	Disagree	2	8.7%
	Neutral	6	26.1%
	Agree	9	39.1%
Rotation in anatomy department	S. agree	5	21.7%
	Disagree	2	8.7%
	Neutral	6	26.1%
	Agree	7	30.4%
Dissection courses	S. agree	8	34.8%
	Neutral	2	8.7%
	Agree	13	56.5%
Type of surgery	S.agree	8	34.8%
	S.disagree	1	4.3%
	Disagree	9	39.1%
	Neutral	3	13.0%
	Agree	8	34.8%
	S. agree	2	8.7%

Table 6 represents the other factors reported by surgeons and trainees that influence the quality of anatomical content in surgical notes through a 5-point Likert scale survey. The

above results showed that the majority of the participants (91.3% of the participants) agreed that the quality of anatomy content in surgical notes could be influenced by the level of surgical notes taker and use of cadaveric dissection as regional anatomy teaching tool. The introduction of refresher anatomy courses was considered by 82.6% of participants as having a positive influence on the quality of anatomy in surgical notes. Other factors that participants' agreement was below 80% were considered as not significant and dropped.

In summary, the quantitative phase showed that average CAKI score of anatomical content in surgical notes was average. The only factor found to be statistically associated with overall score of anatomy content in surgical notes was the type of disease ($p<0.001$) and type of the surgical procedure ($p<0.001$). The majority of participants agreed that the quality of anatomy content in surgical notes is positively influenced by level of training of surgical notes taker (91.3% of participants), use of cadaver dissection for regional anatomy teaching (91.3% of participants) and introduction of refresher anatomy courses (82.6% of participants).

From the above findings, we conducted a qualitative study to assess the perceptions of surgical trainees and surgeons about the anatomy documentation within surgical notes.

4.2. QUALITATIVE RESULTS

The qualitative phase of this study aimed to explore surgeons and surgical trainees' perceptions about anatomy documentation within surgical notes. The data were thematically analyzed, presented as themes, supported with quotes from the narratives of the study participants.

4.2.1. Characteristics of participants in qualitative part

The qualitative part of the study was conducted on 20 participants in total where among them 15 participants were surgical trainees and the remaining 5 participants were surgeons.

4.2.1.1. Perceptions of surgeons and surgical trainees about anatomy documentation within surgical cases

4.2.1.1.1. Perceived reasons of an average CAKI score of anatomical content in surgical notes

When the participants were asked about what they think might be the reasons behind the average CAKI score of anatomical content in surgical notes, the majority mentioned about the lack of proper knowledge of the surgical anatomy among surgery trainees and surgeons thus less consideration in surgical notes.

> *"there is lack of awareness about the importance on proper recording of anatomy in surgical notes as well as the writer of surgical notes not familiar with regional anatomy of a given case"*. [Participant 10]

> *"The main reasons are low level of anatomy knowledge and lack of awareness of importance of documenting anatomy"*. [Participant 20]

> *"Second, may be as we learned generally pure anatomy, surgical team does not have enough knowledge of surgical/applied anatomy which is relevant to their daily activities hence poor surgical anatomy leads to poor notes"* . [Participant 5]

> *"The main reason for poor anatomical description in surgical notes is that the majority of surgical trainees and surgeons do not have enough knowledge about surgical anatomy and thus they don't describe it in their notes"*. [Participant 3]

Other participants revealed that the busy workload for surgeons and surgical trainees is the main reason for them to not properly document the anatomy while writing the surgical notes.

> *"I think that writing notes which are very summarized without anatomical content is probably due to the high workload"*. [Participant 4]

> *"It might be due to a short time to write all the anatomical relevant parts, high number of cases to operate on; sometimes it is written by residents who do not know how to properly write a surgical note"*. [Participant 13]

"*I think that it is due to huge work overload leads to inability to document well the anatomy in surgical notes".* [Participant 4]

"*….and there is a problem of huge workload and pressure to complete the huge operation list…*" [Participant 11]

Other participants mentioned about the lack of consideration and low importance given to the anatomy in surgical notes.

"There is also negligence of some surgeons about anatomy details of a surgical case and lack of awareness of medico-legal implications for not properly recording the anatomy". [Participant 11]

"… and sometimes it is due to low level of anatomy knowledge; they don't realize the importance of documenting anatomy" [Participant 14]

" sometimes we don't know that anatomy or we think it is not important to state everything because none is going to read or notes are taken by someone who did note operate like medical student or taken by less knowledgeable person". [Participant 8]

"…. And another reason is not knowing the importance of writing detailed notes that include specific description of anatomy". [Participant 4]

"They don't recognize the value and the importance of recording anatomy encountered in surgery and hey just write key steps which is not helpful to record anatomy". [Participant 16]

Other participants mentioned about lack of training and mentorship on how to write a proper surgical note during residency training.

"… and I think the main reason is the lack of training of surgical trainees by faculty members on how to document anatomical contents". [Participant 4]

"They don't realize the importance of documenting anatomy as there is no proper teaching on how to write proper surgical notes during surgical training". [Participant 14]

"Most of the time, they are not mentored on how to properly write those surgical notes and sometimes the Residents are alone when filling the surgical notes". *[Participant 13]*

"Most surgical notes are written by surgical trainees and consultants don't have enough time to revise and correct those notes". [Participant 4]

Participants mentioned the other factors that might influence the quality of anatomy in surgical notes other than the type of disease and gender of the patient and the majority focused on the timing of writing the notes, complexity of the anatomy of the region operated, the type of operation and the level of training for the surgical trainees.

"The other factors include timing of the operation (night shift, weekend, late in the day), anatomy complexity of the case and level of training of the resident". [Participant 10]

"….and the other factors influencing the quality of anatomy include the writing time, anatomical knowledge and skills, structured postoperative guide and operating team discussion". [Participant 12]

"The other factors may be like age (for infants and neonates, anatomy will not be described every well). If the case is emergency or elective also may influence the quality of surgical notes". [Participant 2]

4.2.1.1.2. Challenges limiting proper anatomy documentation in surgical notes for surgeons and surgical trainees

Almost all the participants mentioned that the main challenge for both surgeons and surgical trainees that limit them to document the anatomy in surgical notes is heavy workload. For example, some said:

"They usually have many cases on their operative day and they are trying to gain time as much as possible to be able to prepare and work on all their cases. Sometimes, the surgeon is tired; you can compare the notes at the beginning and at the end of their operative day. Sometimes, cases are difficult due to the altered anatomy and the notes become inaccurate". [Participant 13]

"Due to the lack of time and heavy workload, sometimes surgeons don't consider documentation of anatomy as an important part in the surgical notes". [Participant 15]

"The heavy workload and working under pressure to operate all the patients on the schedule do not allow the residents to be meticulous with anatomical details of a given case". [Participant 11]

"Many consultants are doing a non-stop 7 days duty while they have worked during the day and this result in leaving many procedures to residents alone as well as post-op notes. They don't get time to supervise what is written in surgical notes". [Participant 3]

Two participants mentioned about poor operative notes forms that do not have a specific space to fill the anatomical part in the surgical notes.

"…. another challenge that I think surgeons meet is that there is no proper area on papers to fill and include anatomy while writing the surgical notes". [Participant 14]

"….not remembering well the anatomical description of the structures and there are no guidelines or space in file reserved to remembering to document anatomical content from surgical case…". [Participant 12]

Lack of continuous anatomy learning for surgeons was mentioned as a challenge that leads to poor or lack of anatomy documentation while writing the surgical notes.

"Some consultants are not putting too much anatomical descriptions because they don't remember very well about the anatomy because of lack of continuous anatomy learning".[Participant 2]

Other participants mentioned that lack of the access to the anatomy laboratory is the main challenge for the resident to have the required anatomy knowledge that they can use in describing the anatomy while writing the surgical notes.

"….the other challenge is the inability to have access to anatomy teaching facilities like anatomy laboratory where trainees should get the additional and practical anatomy knowledge". [Participant 18]

"Knowledge of applied anatomy may be insufficient, due to lack of refresher courses or regular dissection courses in their training". [Participant 4]

4.2.1.1.3. Proposed solutions to the challenges that limit proper documentation of the anatomy in surgical notes

When the participants were asked to propose the solutions to the challenges that limit the proper documentation of the anatomy details while writing the surgical notes, the majority proposed to enhance the continuous courses of anatomy and practical cadaveric dissection courses for both surgical trainees and surgeons.

"The solutions to increase the scoring of anatomy in surgical notes include mainly multiple courses of surgical anatomy dissection…" [Participant 1]

"Surgical trainees should benefit from cadaveric dissection courses and all people involved in recording the anatomy should be sensitized about the importance of recording the surgical anatomy". [Participant 10]

"The solution can be to emphasize on the role of teaching anatomy to residents and initiate regular dissection courses for the trainees…". [Participant 16]

"Teaching the course of anatomy very well at the level of undergraduate and the same also should apply at the level of postgraduate during surgical training. Surgical trainees should also have access to the teaching materials like anatomy lab for dissecting cadavers and videos for teaching anatomy but experienced lecturers should also be available". [Participant 2]

"I think the long-term solutions include providing enough anatomy dissection courses regularly to all surgeons/residents in order to stay fresh in anatomy and to remind the anatomy needed in every surgical case before the surgery starts…" [Participant 8]

Continuous mentorship to surgical trainees about the importance of proper documentation of the anatomy in surgical notes and its medico-legal implication should be a good solution according to the participants.

"Mentoring of all the residents for each surgery and how to write proper surgical notes, to show or outline all the relevant anatomy encountered during surgery, and take enough time to write proper notes". [Participant 13]

"Another solution is to sensitize surgeons and trainees about the importance of good quality of recorded anatomy in surgical notes…." [Participant 19]

"the solution would be to initiate regular dissection courses as well as sensitization/awareness about the importance of good documentation since early in surgical training which will help surgical trainees throughout their training and even when they become surgeons". [Participant 17]

"I think it would be important to show how crucial and legal those notes are. Surgical notes should be taken seriously and maybe even given a time to be really taught as part of the Resident's training". [Participant 13]

"...to increase the awareness among the trainees during their surgical training about the need to have accurate anatomical description for medico-legal reasons" [Participant 16]

Participants mentioned that there should be modifications of the patient's files so that on the part which is designed for the operative notes includes the special space dedicated to the anatomical details which will indirectly force or remind the surgeons to document the anatomy went through during the operation.

> *"…. We also think that surgical file should have a space dedicated to record all the anatomical details involving a given surgical procedure"* [Participant 10]

> *"A special space dedicated to record anatomy should be made available in surgical file in order to remind surgeons and trainees to record anatomical details"*. [Participant 12]

4.2.1.1.4. Participants' opinions about the use of cadaveric dissection as anatomy teaching tool to improve the quality of anatomy recorded within surgical notes

When the participants were asked about their opinions on the use of cadaveric dissection as regional anatomy teaching tool to improve the quality of anatomy recorded within surgical notes, the majority agreed that cadaveric dissection can play an important role in increasing the practical anatomy knowledge, identification of the anatomical anomalies and improves the confidence of trainees and surgeons which can lead to the proper recording of anatomy while writing surgical notes.

> *"Cadaveric dissection increases the knowledge and familiarity with regional anatomy of given surgical cases, the confidence of the resident, as well as the ability to identify even anomalous regional anatomical patterns and this is reflected through the proper documentation of anatomy as well as increased operative skills"*. [Participant 10]

> *"Regular anatomy dissection courses need to be established to make residents familiar with regional anatomy, to give them the ability to detect anomalous anatomical findings. It helps to record anatomy with intention of proper documentation and teaching purposes"*. [Participant 11]

> *"It can help the surgeon/resident to learn about relevant anatomical parts on*

different surgical procedures. This will definitely have an impact on getting more anatomical accuracy in surgical notes". [Participant 13]

"Cadaveric dissection course leads to an increase in anatomical and surgical knowledge, confidence and relieve from the fear of danger of injuring sensible structures as well as understanding the rationale of recording accurately the anatomy. It increases also the awareness about anomalous anatomical findings". [Participant 17]

"The cadaveric anatomy dissection is the best way to teach regional anatomy leading to improved quality of anatomy in surgical notes". [Participant 9]

4.2.1.1.5. Participants' opinions about the role of level of training of writer of surgical notes on the quality of anatomy in surgical notes

Participants expressed that the quality of anatomy content in surgical notes is proportional to the level of surgical training because as the residents attains high level of education and training, they also gain much understanding of the surgical anatomy which positively plays role on the a better anatomical description within the surgical notes.

"Trainees with a high level of training have increased level of regional anatomy knowledge due to increased and repetitive exposure, as well as their desire to teach his junior residents and medical students. This leads to mastery of regional anatomy". [Participant 11]

"The advanced level of the trainee is associated with more knowledge, more exposure more understanding of anatomy as well as recording of anatomical details within". [Participant 16]

"It is true the level matters and understanding of the importance of a detailed notes increases with the levels as the more you increase the education level the more you understand the importance of anatomical landmarks". [Participant 17]

"As the trainee is more experienced, the knowledge in surgical anatomy and performance of the procedure is higher and this will lead to higher quality surgical notes". [Participant 4]

One participant mentioned that it may be different because for some surgeons and/or surgical trainees, as they get more experienced or increase their education level, they tend to only document few things that they think are relevant for the operation.

"…if the level of training is low, the trainee may be having difficulties in documenting anatomy very well or he/she may document very well because he/she has not yet reached the level of neglecting things. For somebody whose level of training is advanced, he will tend to document what he/she thinks is very important, he/she is at the level where a big number of them start to neglect certain details". [Participant 2]

4.2.1.1.6. Participants' opinions on the role of introduction of refresher courses of anatomy in improving the quality of anatomy recorded in surgical notes

When the participants were asked their opinions about whether introducing refresher courses may improve the quality of anatomy content recorded in the surgical notes, all the participants agreed that it is important to introduce the refresher anatomy courses as it can help improving the knowledge of surgical anatomy among surgeons and surgical trainees and eventually improves its documentation in surgical notes. For example some participants said:

"It can help to recall and fix well the regional anatomy, therefore leading to improved anatomical content in surgical notes". [Participant 10]

"They serve as reminder and updates of anatomy allowing them to master surgical anatomy of any given disease. This has a positive effect of the recording of anatomy

in surgical notes". [Participant 11]

"It can help the surgeon to refresh his/her knowledge about relevant anatomical parts on different surgical procedures. This will lead to more anatomically accurate surgical notes and he/she would also be able to outline those relevant parts during surgery and therefore teach his/her residents better. He/She will be able to dictate better surgical notes". [Participant 13]

"The refresher course of anatomy will improve the quality of anatomy because the trainee will keep remembering the anatomy and make it applied to surgical procedures and therefore leading to improved documentation of anatomy in surgical notes". [Participant 15]

CHAPTER V: DISCUSSION

Anatomy knowledge is crucial for a safe and successful practice of surgery(5). The documentation of important anatomical details encountered in a surgical case is a fundamental core principle of training in Surgery (18). Moreover, they are useful for continuous patient follow up, research programs, cost evaluation, teaching and medico-legal reasons(18)(20) . However, there are concerns about shallowness and poor description of anatomical content of surgical notes at CHUK.

In this study, we aimed to assess the CAKI score of anatomy content in surgical cases, identify the factors influencing the quality of anatomy content in surgical notes as well as to explore the perceptions of surgeons and trainees about anatomy documentation within surgical cases at CHUK. 119 medical files of patients operated for cholecystitis, thyroid diseases and inguinal hernia in general surgery department at CHUK were reviewed using a CAKI scorecard and were included in the quantitative analysis. In addition, sixteen senior residents and seven general surgeons were included to the second part of quantitative analysis using the 5-point Likert scale questionnaire to identify the factors influencing the quality of anatomy content in surgical notes. Finally, twenty interviews were conducted before reaching the saturation point for the qualitative phase of the study evaluating the perceptions of surgeons and trainees.

The CAKI score was used to grade anatomy knowledge embedded in each clinical case through the diagnosis, investigation and treatment headings with highest possible score being 15. The CAKI score was classified as high (12 and above), average (9 to 11) and low (8 and below). This is a validated tool to measure anatomical knowledge found in a given clinical case/condition (3).

In our study, the mean overall total score of anatomical knowledge according to CAKI was found to be 11.94 indicating an average score. Almost 75% of graded surgical notes scored below 13. The inguinal hernia represented 44.5% of cases with a mean average score (9 to 11) in 41.5%. However, Sekelani Banda et al. identified inguinal hernia as frequent condition with high CAKI score (above 12) in general surgery (4). The highest overall score was for the gallbladder conditions. This inconsistency in anatomy content was found during the analysis on a book used in clinical practice showing huge

variability and insufficiency in anatomical terms being used with consequences on quality of depth and scope gained from it by trainees (40). The average score of anatomy content in surgical notes in our study can be explained by inadequate knowledge of surgical anatomy as well as lack of consideration and low value given to anatomy details by some surgeons and trainees.

The type of disease (p-value <0.001) and the surgical procedure (p-value <0.001) were identified as significant factors influencing the quality of anatomy content in surgical notes at CHUK in our study. Using a 5-point Likert scale based questionnaire, surgeons and trainees identified the level of training of the surgical trainee (91.3%), the use of cadaveric dissection as regional anatomy teaching tool (91.3%) and introduction of refresher anatomy courses (82.6%) respectively as having a positive influence on the quality of anatomy content in surgical notes. In a review by Kowalczyk et al. it was found that common general surgery conditions involving gallbladder surgery and inguinal hernia repairs may be associated with presence of anatomical variations making the recording of anatomy challenging to surgeons and trainees (41). Furthermore, the inability to recognize anatomical variation lead to iatrogenic injuries with complications to the patient and malpractice claims(27). In addition, conditions can be gender related. A study done in USA found that inguinal hernias are found commonly in males (42) whereas female gender is an established risk factor for gallbladder conditions (43).

Findings from other studies are relatively similar. A study conducted by Tayyem et al. showed that increasing the frequency of anatomy teaching courses and access to dissection facility would improve anatomical knowledge of trainees and consequently its documentation (6). Moreover, a study done by Tibrewal et al. showed that the decrease in time of amount allocated to cadaveric dissection and the dwindling number of anatomy demonstrators and cadaveric dissection have a negative impact on the quality of anatomy knowledge as well as documentation (25). The systematic inaccessibility to dissection laboratory into our settings fits into this finding.

Through face to face interviews with open-ended questions, the majority of surgeons and trainees in our study identified the lack of adequate knowledge of surgical anatomy among surgeons and trainees as the main reason behind average CAKI score of

anatomical content in surgical notes. Other reasons identified by participants into our study include heavy workload face by surgeons and trainees, lack of consideration and low importance given to anatomy in surgical notes as well as lack of training and mentorship on how to properly write surgical notes.

Similarly, one study highlighted concerns of consultant surgeons about deficiencies in trainee's surgical anatomy knowledge (6). In another study, Mattar et al. showed that fellowship program directors were worried about poor knowledge in surgical anatomy of junior surgeons (28). Furthermore, a study done by Cottam et al. showed that trainees estimated to have low level of surgical anatomy knowledge when joining the postgraduate training (30). Tibrewal et al. showed decline on time spent in teaching anatomy and dissection courses, great number of trainees as well as the decline in number of dissection teachers and cadavers as some of the reasons explaining the deficiencies of surgeons and trainees in surgical anatomy (25)(7). In another study, the team-based learning approach for anatomy teaching was found not to help poorly performing trainees despite being the new teaching methodology of anatomy even at the University of Rwanda(15)(14).

In the current study, the majority of participants outlined the time of writing surgical notes, anatomical complexity of the operated region, the type of operation as well as the level of training of the surgical trainees as factors that might influence the quality of anatomical content in surgical notes.

Our study participants expressed a variety of challenges hindering the proper documentation of anatomy in surgical notes. The main challenge was acknowledged to be work overload. They expressed that they work under pressure to finish the schedule of patients; preventing them to be meticulous with anatomical details while recording notes. Other challenges include the lack of a space dedicated to anatomical details within the file, lack of continuous anatomy learning process to surgeons and trainees as well as lack of access to anatomy dissection laboratory. In addition, a study done by Bugress et al. identified that the absence of surgeons teaching anatomy to trainees as well as teaching of anatomy by non-clinical staff were associated with poor understanding and recording of

clinical anatomy. This is caused by busy work schedule and engagement into other clinical activities (29).

In our study, the solutions proposed by the majority of participants included the enhancement of continuous anatomical courses as well as cadaveric dissection sessions to surgeons and trainees as ways to improve knowledge and consequently documentation of anatomy in surgical notes. Other solutions included continuous mentorship to trainees to raise their awareness about the importance of proper anatomy documentation as well as introduction of patient file with space dedicated to documentation of anatomical details involved in a given clinical case for teaching and medico-legal purposes.

The majority of our study participants agreed that the cadaveric dissection plays a significant role in improving the quality of anatomy recording in surgical notes. It increases the familiarity with regional anatomy, the ability to identify anomalous anatomical details as well as the confidence to properly teach and document anatomy. Similarly, in a study done by Bunting et al. the cadaveric dissection was an important channel of teaching regional surgical anatomy. It was associated with ability to identify proper anatomical landmarks (23). A mixed-methods study by Juo et al. revealed that dissection courses increase surgical anatomy acquisition by trainees as well as its documentation(32). Similarly, a review by Streith et al. elicited that cadavers are highly preferred by trainees in General Surgery and Obstetrics and Gynecology as means of getting, retaining and increasing knowledge of clinically relevant anatomy(33).Moreover, it continues to remain the cornerstone in anatomy education curriculum especially in developing countries due to good availability of cadavers (44). The cadaveric dissection is still the prime tool for human anatomy teaching in the future as it leads to building and retention of knowledge base, to developing clinical skills and ensuring core competencies in a physician (45). Studies showed that time has come to reinstate dissection as the core method of teaching gross anatomy curriculum to ensure safe medical practice. Moreover, anatomy dissection needs to be supplemented and supported with other new emerging innovative teaching and learning modalities (44)(46).

Our study participants agreed that the quality of anatomy recorded in surgical notes is positively affected by the high level of training of surgical trainees. However, one

participant mentioned that this may be the other way round as experienced surgeons and senior trainees tend to document only key steps of operation especially if working under tight schedule.

Finally, all of the study participants agreed that introduction of refresher anatomy courses is crucial in improving the quality of anatomy in surgical notes. Participants perceived that it could lead to an improvement in knowledge and retention of regional surgical anatomy and consequently to proper documentation of anatomical details in surgical notes. Similarly, Tatal et al. reported that regular rotation program to anatomy department should be put in place in surgical residency program to improve the anatomical knowledge of trainees through dissection sessions, attendance of tutorials with senior anatomists and teaching junior trainees and medical students. Furthermore, anatomists should be involved at any stage of surgical training for an effective continuous education of surgical anatomy and consequently improving the quality of anatomy content in surgical notes (34). In addition, using surgical residents to demonstrate anatomy to undergraduate students is one way to enhance their knowledge in anatomy, not only making them excellent anatomists but also good anatomy educators consequently improving the quality of anatomy knowledge and its documentation (47).

Study limitations

This study used a non-probability convenience sampling and may have limited generelizability.

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The anatomical content in surgical notes at CHUK has an average CAKI score. There is a strong association between the quality of anatomy content in surgical notes and the surgical procedure performed as well as the type of disease. However, the level of expertise of surgical notes takers was not found to influence the anatomy content.

The majority of surgeons and trainees feel that the lack of adequate knowledge of surgical anatomy, heavy workload and lack of consideration to recording of anatomy as well as lack of mentorship and training to properly record the anatomy have a negative impact on the quality of anatomy recorded in surgical notes.

The main challenges faced by surgeons and trainees include lack of continuous anatomy training mechanisms, inaccessibility to anatomy dissection laboratory and lack of a space in the file reminding to take into consideration the anatomy details found in a given surgical case.

Finally, the majority of surgeons and surgical trainees agreed that mastering the surgical anatomy through organized regular cadaveric dissection courses and anatomy refresher sessions will increase anatomy knowledge of surgeons and trainees, consequently improving the quality of anatomical details recorded within surgical notes.

6.2. Recommendations

Based on the findings of this study, we recommend:

- To empower surgeons and trainees in regional surgical anatomy knowledge by organization of regular anatomy cadaveric dissection demonstration sessions throughout the surgery training program starting with junior residents. If possible, a mandatory rotation to department of clinical anatomy can be implemented.
- To implement a medical file with special space dedicated to recording of anatomical details

- To actively involve clinical anatomists in the training of surgical residents through regular preoperative and intraoperative review of anatomy for given cases in order to strengthen their knowledge and retention of surgical anatomy.
- To organize regular awareness campaigns about the importance of properly record anatomy details encountered in a given case for the sake of documentation, teaching, income generation as well as possible medico-legal litigations.
- To conduct regular audit to assess the quality and quantity of anatomy content in surgical notes to improve safe and accurate surgery for both patients care and teaching purposes.

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ANNEXES

ANNEX 1: Case Anatomical Knowledge Index (CAKI) Scorecard

Clinical case/Condition for consideration				
Key	Universe of Attributes	Knowledge of anatomy required for:		
		Diagnosis and concepts	**Investigations**	**Treatment**
Very Low =1	• Knowledge of parts of the body using lays terms • Knowledge of general functions of structures of the body			
Low =2	All of above AND • Knowledge of specific mechanism of function of structures in the body • Knowledge of parts of the body using anatomical terms			
Average = 3	All of above AND • Knowledge of specific and accurate developmental anatomy of structures of the body • Ability to identify tissue types, named blood vessels and nerves			
High = 4	All of above AND • Knowledge of blood supply/drainage and nerve supply of structures in body • Knowledge of specific and accurate topographical relationships of body structures			
Very High = 5	All of above AND • Knowledge of basic tissue types of the body • Ability to identify specific structures accurately in topographical context			
	Enter Score Here			

Scoring: For each of the domains (diagnosis& concepts; investigations; treatment) follow the column downwards and select, from the first two columns on the left, the corresponding score, then enter your score in the last row. The three scores on the last row are totaled to obtain the total CAKI Score.

ANNEX 2: DATA COLLECTION TOOL: THE ANALYSIS OF ANATOMICAL CONTENT WITHIN SURGICAL NOTES USING THE CASE ANATOMICAL KNOWLEDGE INDEX (CAKI): MIXED-METHODS STUDY/HERNIA

Hospital ID number: **…… Date of Surgery: ……..**

Age: …. Gender: **Male/Female**

Disease: **Thyroid/hernia hernia/gallbladder**

Level of training of surgical notes author: **Consultant surgeon/resident/ others**

Clinical case/Condition for consideration				
Key	Universe of Attributes	Knowledge of anatomy required for:		
		Diagnosis and concepts	**Investigations**	**Treatment**
Very Low =1	• Knowledge of parts of the body using lays terms • Knowledge of general functions of structures of the body			
Low =2	All of above AND • Knowledge of specific mechanism of function of structures in the body • Knowledge of parts of the body using anatomical terms			
Average = 3	All of above AND • Knowledge of specific and accurate developmental anatomy of structures of the body • Ability to identify tissue types, named blood vessels and nerves			
High = 4	All of above AND • Knowledge of blood supply/drainage and nerve supply of structures in body • Knowledge of specific and accurate topographical relationships of body structures			
Very High = 5	All of above AND • Knowledge of basic tissue types of the body • Ability to identify specific structures accurately in topographical context			
	Enter Score Here			

ANATOMICAL CHECKLIST FOR INGUINAL HERNIA

	KNOWLEDGE OF ANATOMY REQUIRED FOR INGUINAL HERNIA		
KEY	**DIAGNOSIS**	**INVESTIGATIONS**	**MANAGEMENT**
1: VERY LOW	Groin bulge or swelling		Hernia repair or correction
2: LOW	Protrusion of groin on cough Self or manual reduction		Repair of inguinal hernia
3: AVERAGE	Position of hernia with external ring Anatomical position (Rt or Lt) Evaluation of scrotum Palpable testes		Description of layers of abdominal wall: • Skin, subcutaneous tissue • Camper's and Scarpa's fascia • External oblique fascia • Internal oblique fascia • Transversalis fascia Identification of named vessels and nerves • Iliohypogastric n. • Ilioinguinal n. • Genital branch of GFN • Inferior hypogastric vessels
4: HIGH	Hernia position according to • inguinal ligament • pubic tubercle • scrotum		Identification of spermatic cord contents, hernia sac
5: VERY HIGH	Inguinal hernia: • Hasselbach triangle • Direct • Indirect • Nyhus classification	History and clinical exam Ultrasound CT scan/MRI	Description of tissues involved in the repair • identification of inguinal ligament • identification of conjoint tendon • identification of deep ring • position of stitches and mesh

ANNEX 3: DATA COLLECTION TOOL: THE ANALYSIS OF ANATOMICAL CONTENT WITHIN SURGICAL NOTES USING THE CASE ANATOMICAL KNOWLEDGE INDEX (CAKI): MIXED-METHODS STUDY.

Hospital ID number: **…… Date of Surgery: ……..**

Age: …. Gender: **Male/Female**

Disease: **Thyroid/hernia hernia/gallbladder**

Level of training of surgical notes author: **Consultant surgeon/resident/ others**

Clinical case/Condition for consideration				
Key	Universe of Attributes	Knowledge of anatomy required for:		
		Diagnosis and concepts	**Investigations**	**Treatment**
Very Low =1	• Knowledge of parts of the body using lays terms • Knowledge of general functions of structures of the body			
Low =2	All of above AND • Knowledge of specific mechanism of function of structures in the body • Knowledge of parts of the body using anatomical terms			
Average = 3	All of above AND • Knowledge of specific and accurate developmental anatomy of structures of the body • Ability to identify tissue types, named blood vessels and nerves			
High = 4	All of above AND • Knowledge of blood supply/drainage and nerve supply of structures in body • Knowledge of specific and accurate topographical relationships of body structures			
Very High = 5	All of above AND • Knowledge of basic tissue types of the body • Ability to identify specific structures accurately in topographical context			
	Enter Score Here			

ANATOMICAL CHECKLIST FOR CHOLECYSTECTOMY

	KNOWLEDGE OF ANATOMY REQUIRED FOR CHOLECYSTECTOMY		
KEY	**DIAGNOSIS**	**INVESTIGATIONS**	**MANAGEMENT**
1: VERY LOW	Upper abdominal pain	FBC: leucocytosis	Removal of gallbladder
2: LOW	RUQ pain, its radiations	Intraoperative cholangiogram	RUQ or subcostal incision Trocar placement sites
3: AVERAGE	Acute onset of RUQ pain		Position of the gallbladder Structures of the porta hepatis
4: HIGH	RUQ tenderness RUQ tenderness on deep inspiration Palpable gallbladder		Borders and contents of Calot triangle • Cystic duct • Common hepatic duct • Liver • Cystic artery • Rt hepatic artery
5: VERY HIGH	Murphy sign	Ultrasound ERCP/MRCP cholangiogram	• Ligation/clipping of cystic artery and cystic duct • Retrograde vs. antegrade dissection • Assessment for possible anatomical branching variations. A)Hepatic artery B)Bile ducts

ANNEX 4: DATA COLLECTION TOOL: THE ANALYSIS OF ANATOMICAL CONTENT WITHIN SURGICAL NOTES USING THE CASE ANATOMICAL KNOWLEDGE INDEX (CAKI): MIXED-METHODS STUDY.

Hospital ID number: **…… Date of Surgery: ……..**

Age: …. Gender: **Male/Female**

Disease: **Thyroid/hernia hernia/gallbladder**

Level of training of surgical notes author: **Consultant surgeon/resident/ others**

Clinical case/Condition for consideration				
Key	Universe of Attributes	Knowledge of anatomy required for:		
		Diagnosis and concepts	**Investigations**	**Treatment**
Very Low =1	• Knowledge of parts of the body using lays terms • Knowledge of general functions of structures of the body			
Low =2	All of above AND • Knowledge of specific mechanism of function of structures in the body • Knowledge of parts of the body using anatomical terms			
Average = 3	All of above AND • Knowledge of specific and accurate developmental anatomy of structures of the body • Ability to identify tissue types, named blood vessels and nerves			
High = 4	All of above AND • Knowledge of blood supply/drainage and nerve supply of structures in body • Knowledge of specific and accurate topographical relationships of body structures			
Very High = 5	All of above AND • Knowledge of basic tissue types of the body • Ability to identify specific structures accurately in topographical context			
	Enter Score Here			

ANATOMICAL CHECKLIST FOR THYROID SURGICAL CASE

	KNOWLEDGE OF ANATOMY REQUIRED FOR THYROID SURGERY		
KEY	**DIAGNOSIS**	**INVESTIGATIONS**	**MANAGEMENT**
1: VERY LOW	Neck swelling		Thyroidectomy, extirpation
2: LOW	Anterior neck mass		Collar incision done Layers: • Skin • Platysma muscle • SCM and strap muscles • Capsule of thyroid gland • Rt and Lt lobes, isthmus, • Assess for pyramidal lobe
3: AVERAGE	Midline, moving on swallowing		Named vessels and nerves/ tissue types: • Anterior jugular vein • Middle thyroid vein • Superior and inferior thyroid vessels • External branch of the superior laryngeal nerve • Recurrent laryngeal nerve • Parathyroid glands
4: HIGH	Description of the surface and lobes of the thyroid on palpation		• Identification of the important vessels and nerves • Identification of parathyroid glands in the fossa posterior to the gland • Identification of

			tertiary branches from inferior thyroid artery • Identification of sternohyoid and sternothyroid muscles
5: VERY HIGH	All the above	Neck ultrasound • Cystic or solid • Nodules • calcifications CT scan and MRI • Relations to airway and vascular structures • Adjacent nodes	• Exposure of the EBSRL near the upper pole and RLN • Exposure of the inferior and superior thyroid arteries • Assessment of anatomical variation vessels: ima thyroid artery (48)(49) • Exposure of the trachea • Carotid sheath exploration.

ANNEX 5: FACTORS INFLUENCING THE QUALITY OF ANATOMY CONTENT IN SURGICAL NOTES AT CHUK USING 5-POINT LIKERT SCALE
Gender: …….

Healthcare provider: **Surgical trainee/Surgeon Level of training/Experience**: …..Years

Factors	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Knowledge of regional surgical anatomy					
Level of training of surgical trainee					
Amount of anatomy teaching time					
Workload of surgical trainee/surgeon					
Working experience (years) of surgeon					
Involvement of clinical anatomists in teaching of surgical anatomy to surgical trainee/surgeon					
Rotation of surgical trainees into the anatomy department					
Use of cadaveric dissection as regional anatomy teaching tool					
Time of redaction of the notes					
Type of surgery: minor versus major procedure					
Introduction of refresher courses in anatomy for surgical trainees					

ANNEX 6: INFORMED CONSENT FORM

PART I: INFORMATION SHEET

STUDY: "THE ANALYSIS OF ANATOMICAL CONTENT IN SURGICAL NOTES USING CASE ANATOMICAL KNOWLEDGE INDEX (CAKI): A MIXED-METHODS STUDY"

PRINCIPAL INVESTIGATOR: Dr HATANGIMANA Theobald, Senior resident in General Surgery Post graduate Program in College of Medicine and Health Sciences at the University of Rwanda.

The aim of this study is to improve the documentation of clinically relevant anatomy in surgical notes for patients' care and teaching purposes. The specific objectives are to assess the anatomy content in surgical cases, identify factors influencing the quality of anatomy content in surgical notes and explore surgeons and surgical trainees' perceptions about anatomy documentations within surgical cases.

This consent form will be specifically used during the second phase of the study for the collection of quantitative and qualitative data in this research study.

- Participation in this study is out of your own free will. Your participation will not have any impact about your job or surgical postgraduate training. You may terminate the participation at any time with no consequences whatsoever
- You will be asked a series of questions using questionnaire form and interviews.
- The participant is free to refuse to consent for his/her participation in the study and refusal to participate will not affect his/her title or job
- The study results will be published, and policy makers informed for possible use of information to improve anatomy documentation within surgical clinical cases for patients 'care and teaching purposes at Kigali University Teaching Hospital.

PART II: CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I (or witness) have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of Participant/Witness……

Signature of Participant/Witness……

Date……../……/……. (Day/Month/Year)

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability, made sure that the participant understands that filling a questionnaire will be done.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of Research/Person taking the consent……..

Signature of Research/Person taking the consent……..

Date……/……./…… (Day/Month/Year)

Researcher contacts:

Dr. HATANGIMANA Theobald Tel: (+250)788480190

E-mail: theohatangim@gmail.com

If you have questions about your rights in the study, contact:

CMHS/University of Rwanda, Directorate of Research, Technology Transfer and Consultancy

PO Box 3286 Kigali E-mail: esearchcenter@ur.ac.rw Tel: (+250) 788563312

Chairperson CMHS IRB/University of Rwanda Phone: (+250) 788 490522

Deputy Chairperson CMHS IRB/University of Rwanda Phone: (+250)783 340 040

ANNEX 7: INTERVIEW GUIDE OF QUALITATIVE DATA COLLECTION

TITLE OF RESEARCH: ANALYSIS OF ANATOMICAL CONTENT IN SURGICAL NOTES USING CASE ANATOMICAL KNOWLEDGE INDEX (CAKI): A MIXED-METHODS STUDY.

DATE OF THE INTERVIEW ……..

NUMBER OF RESPONDENT…… **GENDER**……..

Healthcare provider: **Surgical trainee/Surgeon**

Year of training as resident: …….. **Years of experience as Surgeon**: ……..

1. What is your saying/ are the reasons you think are behind average CAKI score of anatomical content in surgical notes?

2. What are the challenges faced by surgical trainees (residents) leading to that average CAKI score of anatomy in surgical notes?

3. What are the challenges faced by consultant surgeons leading to that average CAKI score of anatomy in surgical notes?

4. What are the solutions/interventions that can help to increase the scoring of CAKI in surgical notes?

5. According to you, what are the other factors influencing the quality of anatomy in surgical notes other than the type of disease ($p<0.001$) and surgical procedure ($p<0.001$)?

6. Why do you think the level of training of writer of surgical notes influence the quality of anatomy in surgical notes?

7. Why do you think the use of cadaveric dissection as regional anatomy teaching tool can improve the quality of anatomy recorded within surgical notes?

8. Why do you think the introduction of refresher courses of anatomy can improve the quality of anatomy recorded in surgical notes?

Is there any information would you like to share with me that was not covered in this interview?

Thank you very much for taking your precious time to discuss with me.

ANNEX 8: CMHS IRB APPROVAL

UNIVERSITY of RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DIRECTORATE OF RESEARCH & INNOVATION

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 29th /July/2021

Dr. HATANGIMANA Theobald
School of Medicine and Pharmacy, CMHS, UR

Approval Notice: No 255/CMHS IRB/2021

Your Project Title *"The Analysis Of Anatomical Content In Surgical Notes Using Case Anatomical Knowledge Index (CAKI): A Mixed-Methods Study."* has been evaluated by CMHS Institutional Review Board,

Name of Members	Institute	Involved in the decision		
		Yes	No (Reason)	
			Absent	Withdrawn from the proceeding
Prof Kato J. Njunwa	UR-CMHS	X		
Dr Stefan Jansen	UR-CMHS	X		
Dr Brenda Asiimwe-Kateera	UR-CMHS	X		
Prof Ntaganira Joseph	UR-CMHS	X		
Dr Tumusime K. David	UR-CMHS	X		
Dr Kayonga N. Egide	UR-CMHS	X		
Mr Kanyoni Maurice	UR-CMHS		X	
Prof Munyanshongore Cyprien	UR-CMHS	X		
Mrs Ruzindana Landrine	Kicukiro district		X	
Dr Gizhoma Darius	UR-CMHS	X		
Dr Donatilla Mukamana	UR-CMHS	X		
Prof Kyamanywa Patrick	UR-CMHS		X	
Prof Condo Umutesi Jeanine	UR-CMHS		X	
Dr Nyiraninyoye Laetitia	UR-CMHS	X		
Dr Nkeramihigo Emmanuel	UR-CMHS		X	
Sr Mailloli Marie Josee	CHUK	X		
Dr Mudenge Charles	Centre Psycho-Social	X		

After reviewing your protocol during the IRB meeting of where quorum was met and revisions made on the advice of the CMHS IRB submitted on 21st July 2021, **Approval has been granted to your study.**

Please note that approval of the protocol and consent form is valid for **12 months.**

You are responsible for fulfilling the following requirements:

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrolment of participants.
3. All consent forms signed by subjects should be retained on file. The IRB may conduct audits of all study records, and consent documentation may be part of such audits.
4. A continuing review application must be submitted to the IRB in a timely fashion and before expiry of this approval
5. Failure to submit a continuing review application will result in termination of the study
6. Notify the IRB committee once the study is finished

Sincerely,

Date of Approval: The 29th July 2021

Expiration date: The 29th July 2022

Dr. Stefan Jansen
Ag. Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate Studies, UR

ANNEX 9: CHUK Ethics Committee Approval Notice

CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL

Ethics Committee / Comité d'éthique

11th Aug.2021 Ref :EC/CHUK/090/2021

Review Approval Notice

Dear Theobald HATANGIMANA,

Your research project: ***"The analysis of anatomical content in surgical notes using Case Anatomical Knowledge Index (CAKI): a mixed-methods study "***

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 11th Aug.2021 to evaluate your request for ethical approval of the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your research project.

You are required to present the results of your study to CHUK Ethics Committee before publication by using this link:www.chuk.rw/research/fullreport/?appid=391&&chuk

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,

Dr Emmanuel Rusingiza Kamanzi
The Chairperson, Ethics Committee,
University Teaching Hospital of Kigali

THICS COMMITTEE
CHUK

Scan code to verify

" University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and Ethics guidelines and regulations "

Web Site : www.chuk.rw : B.P. 655 Kigali, RWANDA Tel. / 00 (250) 252575402 E-Mail: chuk.hospital@chuk.rw