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Its mission is to serve as a scientific information dissemination platform of national and international significance, mainly in areas related to the Rwanda Ministry of Health's essential mission to strengthen national and local health systems and improve the health of the people of Rwanda.

The aim is to bridge the gap in public health information sharing between policy-makers, researchers, health professionals, and practitioners.

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Dear Readers,

I wish to express my appreciation to the Rwanda Public Health Bulletin readers for the continuous support in publication of the bulletin, and I am honored to present you the 2nd Issue of the Rwanda Public Health Bulletin.

This current issue came when the world and Africa in particular is dealing with the Ebola outbreak in the central African region mostly in the Eastern part of Democratic Republic of Congo (DRC) near its border with Rwanda. The Ebola outbreak was announced by the WHO and later on confirmed by the DRC authorities followed by different reports of outbreak casualties. Rwanda has been until now spared by the disease. The Rwandan health authorities acted rapidly to prevent the outbreak from entering Rwanda through multiple preventive and preparedness strategies. Multilateral meetings and policies were prepared, simulation exercises were organized, and open communications to the general public were carried out for implementing all necessary measures in the prevention of Ebola in Rwanda.

In addition to Ebola outbreak preparedness, herein, you will also find different topics discussing the need of policy reports on different subjects relevant to public health in Rwanda. There is still a gap in dissemination of reports, commentaries, and opinions related to health data and health management. This issue tackles most of those discussions with the intention to communicate to public health experts of the necessity of interventions and awareness campaigns on different topics on health in Rwanda.

This issue comes with innovations and better visibility of the bulletin. The submission of reports and articles, and their publications are directly available online through our website: www.rwandapublichealthbulletin.org including instructions on submissions of your manuscripts. Therefore, I make a call to all of our readers, public health experts, and all healthcare professionals on the need to develop and support the publication of health data and health management discussions to address public health awareness in Rwanda.

I wish you a very pleasant reading.

A handwritten signature in black ink, appearing to be 'LM' with a stylized flourish.

Prof. Leon Mutesa, MD, PhD
Editor-in-Chief

The Rwanda National Ebola Preparedness Exercise and Response Strategies

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INTRODUCTION

Since 2018 to date, regional and global health communities are being challenged by the Ebola virus disease (EVD) outbreak in the Democratic Republic of Congo (DRC) [1, 2].

After almost a year, since the current EVD outbreak started, there is no sign that can predict when this outbreak will be controlled. On 19 July 2019, WHO declared a Public Health Emergency of International Concern (PHEIC) with risk for regional spread including Rwanda [3].

To control any outbreak and specifically for EVD, the existence of health system strength is paramount. This is the foundation for enabling the surveillance and response strategies to reduce morbidity and mortality due to EVD. Inadequate health system jeopardises the entire mechanism of response. This was demonstrated through the first ever Ebola virus disease outbreak in West African region from 2014 to 2016 where more than 11,000 lives were lost over 28,000 identified cases across Sierra Leone, Liberia and Guinea. A reoccurring outbreak was also reported in the DRC in the years 2017 and 2018 [3,4].

Based on this experience and in consideration of the current DRC outbreak geographical proximity, Rwanda has increased control on cross border population movement. In addition, Rwanda has developed a preparedness strategy based on a scenario of cross-border importation.

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This report highlights some of Rwanda's EVD key capabilities achieved in preparedness and prevention strategies as per August 2019.

COORDINATION

To ensure capacities and capabilities are strengthened, a strong multisectoral coordination platform was established for information sharing and fund mobilization. Strategic documents were developed including Ebola preparedness plans, 72 hours Ebola response plan that supplemented the existing Rwanda epidemic preparedness and

response plan. Other mini toolkits for management of public health emergencies of national and international concern were developed to support both the central and district response.

Operating procedures for Ebola were developed to prevent scattered information and ensure we operate with the same standards and language.

A guiding principle model was adopted to ensure the success of preparedness, which forecasts the success of response, the governance being the corner stone (Figure 1).

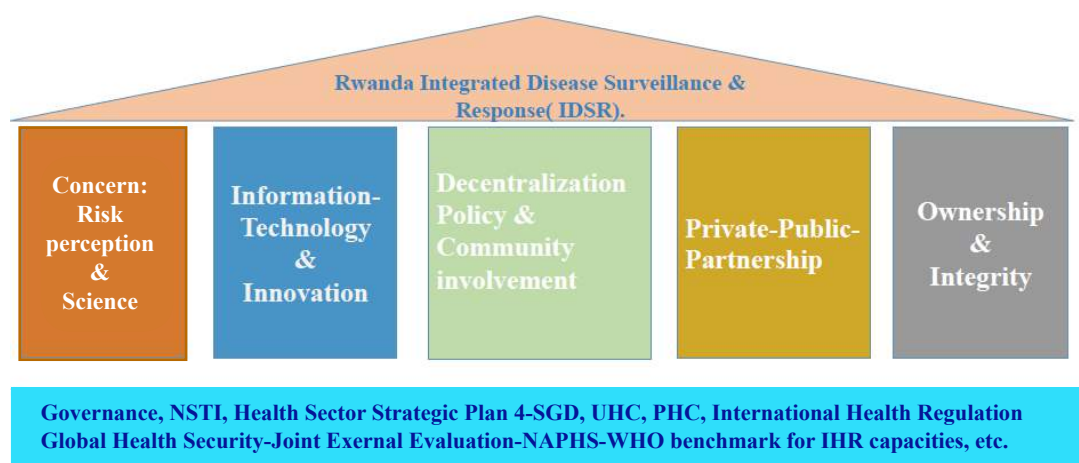


Figure 1: Rwanda Epidemic Surveillance & Response Guiding Principles

PREVENTION STRATEGIES

Being aware that every public health threat, including Ebola, starts in a household and therefore should end in the same household. To this end, the earlier you get the information the earlier a response can be triggered.

Rwanda invested in massive simultaneous community awareness, mobilization for engagement through adequately adapted, developed and selectively validated materials for community information education and communication (IEC) on EVD. These were disseminated using all existent channels and mechanism such as television and radio programs, street billboards, borders, civil society umbrellas, private sectors, academia and other mass gatherings where some include sessions with questions and answers sessions and winners awards [3].

Knowing that hand-washing reduces huge numbers of pathogens transmission through hand shaking, hand-washing basins were constructed to the key ports of entry on borders between Rwanda and DRC. This is becoming a national movement at many hospitality and other buildings (Figure 2).



Figure 2: Hand wash facilities at DRC-Rwanda land crossing border (Rubavu).

WORK FORCE DEVELOPMENT AND SAFETY

Availing adequate work force for preparedness and response as well as for skills transmission was key. In partnership with different stakeholders, a standard training modules's package was developed, adapted and validated. Trainings of trainers were conducted and intense training plans were developed. To ensure and measure the progress and identifying remaining areas for improvement, simulation exercises and drills have been conducted.

Over 23,657 were trained from community health care workers, red-cross volunteers, army and police officers, medical doctors, nurses, laboratory technicians, psychologists and other infection prevention and control experts [6].

Laboratory capacity was enhanced to ensure timely sample collection, testing and confirmation. [3, 5, 7].

Through the Rwanda Biomedical Center, the government of Rwanda with support from WHO also offered an extended access protocol for Ebola vaccination (Figure 3). The approach was not on a mass population vaccination campaign spectrum, but rather targeted frontline health care providers and EVD prospective responders [9, 10].

Around 3000 health care worker front-liners were vaccinated using the compassionate MERCK vaccine against Zaire Ebola virus (ZEBOV).



Figure 3: A Rwandan being vaccinated against Ebola virus (photo by New Times, Published on 20 August 2019).

CASE MANAGEMENT

Case management is one of the critical value points within the Ebola management chain. To ensure prevention of nosocomial transmission and reduce mortality. Adequate and adapted isolations

at hospitals and Ebola treatment centre are key. The process to construct isolations at hospitals is on-going and Ebola Treatment Centres (ETCs) were also identified and renovated in Rugerero Sector, Rubavu District to manage Ebola cases in a case it is confirmed in the country [2] (Figure 4a, 4b). A burial site was also availed to ensure safe and dignified burial.



Figure 4a, 4b: EVD Emergency Treatment Centres (ETCs), Sector, Rubavu District

Rwanda remains on high alert for Ebola outbreak. In May 2019, 25 countries among the APORA VII Conference visited Rugerero Emergency Treatment Center (ETC) located near DRC border Rugerero Sector, Rubavu District; and the delegation appreciated the preparedness and preventive measures adopted.

Simulations were demonstrated to show how Rwanda is prepared in terms of EVD prevention and first case management. Among the delegation, WHO Regional Office delegate Dr. Thierno Balde, based in Brazzaville Republic of Congo, was present and appreciations were expressed on the level of preparedness and the rapid response that teams can show in case of EVD outbreak (Figure 5a, 5b).



Figure 5a, 5b: Prevention and response strategies demonstrated in simulations at Rugerero Treatment Center.

PUBLIC HEALTH DIPLOMACY

Knowing that no single entity, sector or country can preempt to solve such a complex public health threat like Ebola, partnership with local, regional, and bilateral collaborations is inevitable.

Rwanda hosted one cross-border meeting under WHO on 6th August 2019, where a joint cross-border DRC-Rwanda was signed in Rubavu district and was followed by an action plan that allows both countries to prevent and control the common EVD threats. DRC and Rwanda respective Ministers of health presented the joint project to Dr. Tedros Adhanom Ghebreyesus, the WHO Director General and to Dr. M. Moeti, the WHO Director for African Region during a recent high level meeting at Brazzaville-Congo.



Figure 6: Meeting of DRC and Rwanda ministers of health Dr Pierre Kangudlia Mbayi and Dr Diane Gashumba with WHO Director General Dr Tedros Adhanom Ghebreyesus.

CONCLUSION

Rwanda has achieved a lot for EVD preparedness and response as assessed by the WHO joint mission assessment report. As the world is embracing the Health For All strategy, EVD preparedness cannot afford to leave any body behind. Building a resilient preparedness for response is based on governance, and existing system under which the preparedness and response operate.

As declared by Dr Tedros Adhanom Ghebreyesus “Fixing the roof before the next rain, invest in preparedness”.

Rwanda will continue building the sustainable health security resilience by ensuring the assessed gaps (JEE) are stepping up.

A national action plan for health security is finalized for dissemination and implementation.

Acknowledgments

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The quality of pre-operative preparation of patients undergoing elective surgery at the University Teaching Hospital of Kigali, Rwanda

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ABSTRACT

BACKGROUND: Pre-anesthesia preparation is essential for safe surgery. However, little is known about the quality of pre-anesthesia preparation in Rwanda. The objectives of this project were to evaluate the quality of pre-anesthesia preparation at the University Teaching Hospital of Kigali (CHUK) and to determine areas that need improvement.

METHODS: A cross-sectional survey using a convenient sampling method was conducted during the period from November 1st to November 30th 2016. We collected data on completeness of information on the operations list, timing of anesthesia visit, the rate of anesthesia consultations, the rate of explanation of the type of anesthesia and options of pain control, and the rate of non-optimized cases.

RESULTS: Among 109 patients enrolled in the study, 44 (40.4%) were females and 65 (59.6%) were males. Only 60 (55%) were written on the operation list before 1h00 pm. Name, age, hospital address, and diagnosis and procedure were mentioned in 93 (85.6%), 87 (89.2%), 80 (73.4%), and 99 (90.6%) respectively. Pre-anesthesia evaluation was done in 90 (82.6%) and mainly between 1h00 pm and 5h00 pm 62 (56.9%). The types of anesthesia and pain control were explained in 87 (79.8%) and 67 (61.5%) patients respectively. Results of investigations were available for 97 (89%) patients, 6 (5.5%) patients required optimization and 2 (1.8%) patients were postponed.

CONCLUSION: Despite a good performance in many aspects of pre-anesthesia preparation, an effective intervention is needed to improve some areas. Mainly the utilization of the operations' list and standardization of the pre-anesthesia preparation.

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INTRODUCTION

Pre-anesthesia evaluation is the process of clinical assessment by an anesthetist, which precedes the delivery of anesthesia care for surgical and

non-surgical procedures [1]. The pre-anesthesia evaluation is essential and provides multiple benefits such as improved perioperative morbidity and mortality, decreased rates of cancelled cases, improved care to patients with coexisting diseases,

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better operating room and bed utilization, reduced length of stay and the associated costs as well as decreased errors of communication among teams [2 - 4].

The content of the pre-anesthetic evaluation includes, but is not limited to, review of medical records, patient interview, pre-anesthesia examination (focusing on assessment of the airway, lungs, and heart), preoperative investigations, and specific consultations when appropriate [1].

There are not enough data in the literature on the optimal timing for pre-anesthesia evaluation. However, the timing of the pre-anesthetic evaluation can be guided by considering combination of surgical invasiveness, severity of disease, and availability of resources [1].

The pre-anesthesia clinic was started in February 2016 with the aim of conducting a systematic pre-anesthesia evaluation for all patients undergoing elective surgery, to communicate effectively with other team members (surgeons and theater nurses), and to provide timely and safe anesthesia. Since the introduction of pre-anesthesia clinic services at the University Teaching Hospital of Kigali (CHUK), the quality of services provided has not yet been determined.

The aim of the study was to determine the quality of pre-operative preparation of patients undergoing elective surgery at CHUK. The results of this study will help improve the quality of pre-anesthesia preparation in CHUK.

METHODS

Study design and study population: This was a cross-sectional survey of all patients undergoing elective surgery in the main operating room of CHUK over a one-month period (November 2016) using a convenience sampling method.

Study procedures: A diverse quality improvement team was formed in June 2016 to conduct this project. Members included 3 anesthesiologists, 1 anesthesia resident, 5 anesthetists and 1 hospital quality improvement team member. The team selected the quality of pre-anesthesia clinic services as an issue that needs to be addressed and the team decided to use the strategic problem-solving methodology to determine gaps to be addressed in order to ensure high-quality pre-anesthesia clinic services. The team decided the criteria of pre-anesthesia preparation based on the hospital policy on preparation of patients for elective surgery (Table 1).

Table 1: *Criteria of pre-anesthesia preparation*

1. Having patients information (age, hospital address, as well as diagnosis and procedure) on operation list at least one day before surgery
2. Doing pre-anesthesia evaluation for every patient
3. Filling the pre-anesthesia evaluation form completely
4. Explaining the type of anesthesia
5. Explaining the type of pain control
6. Ensuring availability of required investigations
7. Not postponing surgery after arrival of patient in the operating room

Inclusion criteria: all patients undergoing elective surgery in the main operating room of CHUK.

Exclusion criteria: Patients with missing pre-anesthesia evaluation form were excluded from analysis.

Study Setting: This study was conducted at CHUK, the major referral hospital in Rwanda with around 513 beds, serving around 6,200,000 people, and conducting approximately 12,000 surgeries annually [6].

Data collection, variables, and outcomes: We conducted a cross-sectional survey on the quality of pre-anesthesia evaluation by collecting data from the patients' files. During 1 month, we looked at patients' characteristics (age, sex, residence, availability of health insurance, American Society of Anesthesiologists (ASA) class, type of planned surgery, type of anesthesia proposed, and level of urgency of surgery) and main outcomes on quality of anesthesia clinic services (admission time in the hospital, frequency of pre-anesthesia evaluations, timing of writing patients on operation list, patients information on operation list, performance of pre-anesthesia evaluation, timing of pre-anesthesia evaluation, explanation of type of anesthesia, explanation of pain control, availability of required investigations, and course of action once the patient is in theater).

Data management and analysis: Data were entered electronically into an excel spreadsheet from paper forms. Then, descriptive statistics were used to report patient demographics and the main outcomes. Frequencies and percentages were used for categorical data. Data were analysed using Excel version 2010, and we reported the frequency and rate of occurrence of all variables.

Ethics approval, consent to participate, and confidentiality: Ethical approval was obtained from the University Teaching Hospital of Kigali Institutional Review Board (Reference number: EC/CHUK/728/2018).

Consent was obtained from participants with option to decline participation in the study. A unique identifying number was given to participants and was known only to the principal investigator. All data were collected under that unique identifying number.

After data collection any identifying information was destroyed or removed from the research records. The data record was kept in a password protected computer in the office of the Head of department of Anesthesia at CHUK. After 5 years, the data record will be completely destroyed.

RESULTS

Among 109 patients enrolled in the study, 44 (40.4%) were female and 65 (59.6%) were male (Table 2).

Table 2: Patient characteristics (N=109)

		N	%
Gender	Male	65	59.6
	Female	44	40.4
	< 1 year	6	5.5
Age	1-5 years	16	14.7
	6-15 years	10	9.2
	>15 years	77	70.6

Only 60 (55%) patients were written on the operation list before 1pm. Name, age, hospital address, as well as diagnosis and procedure were mentioned in 93 (85.6%), 87 (89.2%), 80 (73.4%), and 99 (90.6%) respectively. Pre-anesthesia evaluation was done in 90 (82.6%) with most (n=62, 56.9%) evaluations completed between 1h00 pm and 5h00 pm. The types of anesthesia and pain control were explained to 87 (79.8%) and 67 (61.5%) patients respectively. Results of investigations were available in patients' files for 97 (89%) patients. Six (5.5%) patients required further optimization prior to surgery and 2 (1.8%) patients' operations were postponed (Appendix 1).

DISCUSSION

In our study, the quality of pre-anesthesia preparation showed many areas of improvement. For instance, more than 50% of patients scheduled for major procedures are put on the list after 1h00 pm and this leaves a short time for evaluation.

Seventeen percent of patients had no pre-anesthesia evaluation before entering the operating room, 14.7% had no name on the list, 26.7% had no hospital address on the list, and 10% of patients had neither diagnosis nor procedure on the list. This can lead to delays and cancellations of cases which are usually avoided within a well-functioning pre-anesthesia clinics which has better optimization, adequate communication, and consensus of the decision to proceed to surgery [7].

Even for patients who had a pre-anesthesia visit, there is evidence of the low quality of care. Only 61.5% of patients were explained about pain control options and around 80% were explained

about the type of anesthesia. This inadequate communication with patients as well as lack of standardized process for pre-anesthesia evaluation and insufficient cooperation among teams have been also described in other settings like the report published by the Inspection of Healthcare (IGZ) in Netherland in 2007 [8].

During the study period, the anesthesia visit was done by non-physician anesthetists with 3 or 4 years post-secondary school training under the guidance of physician anesthesiologists. The same approach has been done efficiently and safely in other settings like the USA as described by Pollard in 1996 [9].

This study also showed examples of inadequate communication among teams as evidenced by delayed completion of the surgical list or incomplete patient information on the list. This may have an impact on efficient use of the operating room, and leads to delay or cancellation of operations. With a poorly functioning pre-anesthesia clinic, there is a risk to lose the benefits of an adequate pre-anesthesia clinic which reduce volumes of laboratory tests, imaging investigations, patient satisfaction, decreased cancellation rate, increased rate of same-day admission, and decreased length of hospital stay [7, 10].

Despite a good performance in many aspects of pre-anesthesia preparation, an effective intervention is needed to improve some areas

mainly the utilization of the operations' list and standardization of the pre-anesthesia preparation.

We recommend training of all anesthesia staff on pre-anesthesia evaluation and organizing the pre-anesthesia clinics in collaboration with the consultations of surgeons, which start at 8h00am so that patients can be seen by anesthesia team immediately after being scheduled for surgery. This will allow more time for pre-anesthesia evaluation. We also propose the use of a standardized patient information form for easy communication among teams.

The sample size was small with a convenience sampling method and the follow-up time was short. Therefore, the results may not be applicable to all types of surgery. In addition, this study included only elective cases done during day shifts on regular days. Therefore, results may not reflect the pre-anesthesia evaluation for cases done during the night and on weekends.

Authors' contributions: ET and JBU led the study design, protocol development, data analysis and manuscript writing. JDN, JN, UJB, MN, JR, and DB contributed to study design, protocol development and results' interpretation. ET and MN led and supervised data collection and data cleaning and analysis. All authors critically reviewed and approved the final manuscript.

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Appendix 1: Indicators of quality of pre-anesthesia preparation (N=109)

		N	%
Admission time in the hospital	Before 12h00 pm	36	33
	Post 12h00 pm	55	50.5
	No information	18	16.5
Timing of writing patients on operation list	Before 12h00 pm	60	55
	Between 12h00 pm and 4h00 pm	31	28.4
	After 4h00 pm	15	13.8
	No information	2	1.8
Patients information on operation list			
Name	Yes	93	85.3
	No	16	14.7
Age	Yes	87	79.8
	No	22	20.2
Hospital address	Yes	80	73.4
	No	29	26.6
Diagnosis and procedure	Yes	99	90.8
	No	10	9.2
Pre-anesthesia evaluation done	Yes	90	82.6
	No	19	17.4
Timing of pre-anesthesia evaluation	Before 12h00 pm	23	21.1
	Between 12h00 pm and 5h00	62	56.9
	After 5h00 pm	18	16.5
	No information	6	5.5
Explanation of type of anesthesia	Yes	87	79.8
	No	22	20.2
Explanation of pain control	Yes	67	61.5
	No	42	38.5
Availability of lab results	Yes	97	89
	No	12	11
Course of action within Theater	Proceed with surgery	101	92.7
	Optimization then surgery	6	5.5
	Postponed	2	1.8

Perception of healthcare service access, rapidity and healthcare provider-patient communication at the University Teaching Hospital of Kigali.

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ABSTRACT

BACKGROUND: Healthcare industries have seen recent movements towards continuous quality improvement and patient satisfaction which were put into metrics used to measure the quality of health care services. Our objectives were to determine the levels of services delivered and to measure the satisfaction of patients and family's perceptions on the quality of healthcare services at the University Teaching Hospital of Kigali (CHUK).

METHODS: This study used a purposive sampling method to determine the sample size calculation. Data was collected through a questionnaire distributed to patients and patient families who presented at CHUK from January to March, 2016. The analysis of qualitative data was done using Ritchie and Spencer analysis development (1994) while quantitative data analysis was done with Statistical Package for the Social Sciences (SPSS).

RESULTS: We found that 52% of participants visited the hospital because of a chronic health condition. 80% used neither phone calls nor text messages to book appointments. 14% of patients used phone calls and 2% sent text messages to book an appointment but they remained unanswered. 82% got appointments on time. The majority (44%) of the participants didn't wait at registration windows. After registration, 20% of participants were instantly seen by a health care provider while 19% waited up to 1 hour to be attended to.

CONCLUSION: We found that the majority (80%) of participants didn't use the phone when requesting appointments. Therefore, people should be announced of the existence of phone-based appointment systems. In addition, web-based appointment systems should be established for prompt service.

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INTRODUCTION

The measurement of the quality of healthcare services is receiving increased attention in public health discussions, and hospitals are improving the quality of patient care which is one of the metrics to measure the quality of care provided by hospitals [1].

Satisfaction is defined as person's feelings of pleasure or disappointment from comparing outcomes in relation to expectations [2]. There is no consensus in the literature on the definition of patient satisfaction in healthcare. In Donabedian's quality measurement model, patient satisfaction is defined as a patient-reported outcome measure [3].

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Many authors tend to have different perceptions of the definitions of patient satisfaction. For some authors, patient satisfaction represents attitudes towards care or aspects of care [5] while others consider patient satisfaction as patients' emotions, feelings and perceptions of delivered healthcare services [2]. Studies on patient satisfaction provide important information and tools to develop an action plan for the improvement of the quality of patient care. These tools are useful in improving the health care services [5].

In our study, we measured the level of services delivered by doctors and nurses to patients with the aim of improving quality services delivered in the hospital.

METHODS

The study involved qualitative and quantitative approaches, and was conducted at CHUK

A purposive sampling method was used to identify the participants. Data collection used a questionnaire as a tool to collect information from patients and patient families who were present in the hospital from January 2016 to March 2016 in the outpatient department. The questionnaire used in our study has been validated by the Health Center Patient Satisfaction Survey, Health Resources and Services Administration (HRSA) at <http://bphc.hrsa.gov/patientsurvey/>, 15/July/2010.

Analysis of qualitative data was done using analysis development by Ritchie and Spencer (1994) about the quality management reports. Quantitative data analysis was done using SPSS.

The participation in the study was voluntary and anonymous after signing an informed consent, and patients could withdraw from the study at any time.

RESULTS

No data was missing, as all questions were answered in the questionnaire. 62 patients participated in the study.

Motivation of hospital visits

We asked the participants the reasons of their most recent visit to CHUK, and 52% of participants reported breakout of the long-term health

condition, 45% reported seeking help for a new health problem and 3% reported routine visit (Figure 1).

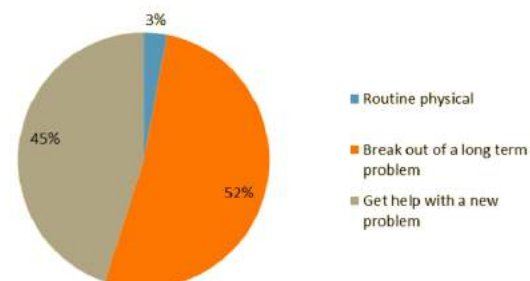


Figure 1: Motivation of most recent hospital visits

Appointments made through phone calls

When asked if they were answered when calling for an appointment at CHUK, 14% of participants responded that their phone calls to book an appointment remained unanswered, 2% got a busy signal, 2% said they left a message that remained unanswered, 2% reported that their phone calls were answered after ringing many times, and the majority (80%) didn't use phone calls to book an appointment (Figure 2).

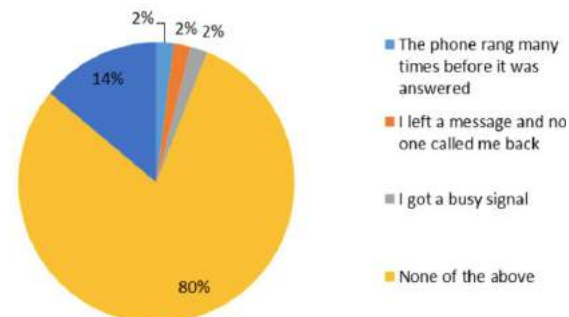


Figure 2: Phone-based appointment response

Courtesy of hospital employees who made an appointment

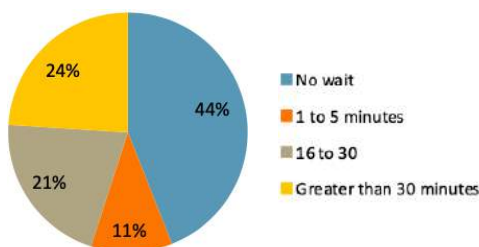
We asked the participants how they would rate the courtesy of the customer care providing hospital appointments, and the majority (37%) scored them good, followed by very good at 31%. excellent was reported by 11% of participants, 13% gave a fair score while a poor rating was provided by the minority (8%) of participants (Table 1).

Table 1: *The courtesy score of the customer care in charge of hospital appointment*

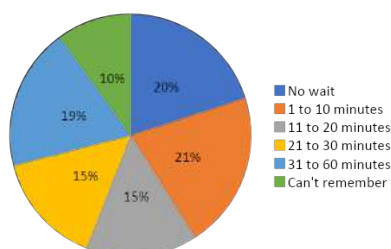
Responses	Participants	Percentage
Poor	5	8%
Fair	8	13%
Good	23	37%
Very Good	19	31%
Excellent	7	11%
Total	62	100%

Patient waiting time prior to receiving healthcare services

When asked how long they had to wait at admission and registration desks, the majority of participants (44%) responded that they didn't wait, while 24% spent more than 30 minutes waiting. The waiting time of 16-30 minutes was reported by 21% while the minority had to wait for 1 to 5 minutes. (Figure 3).

**Figure 3:** *Waiting time of participants at registration desk*

The participants who said that they had to wait 1-10 minutes after registration before being received by the healthcare provider were 21%. The percentage of participants who reported a waiting time of 11-20 minutes was 15%, 21-30 minutes was 15%, and 19% spent up to 1 hour. However, 20% reported not waiting at all with a minority of 10% who could not remember how long they waited (Figure 4).

**Figure 4:** *Waiting time of participants before reception of healthcare provider*

The healthcare providers and patient interaction and communication

We asked participants whether the healthcare provider gave them the time to explain more the reasons for their visit and listen to the details of their complaints while in discussion. Among the responses received, 67% responded that the healthcare provider gave them complete time, 18% responded that they were given some time, while 10% responded that they were given no time. 85% said that they were listened to, 5% were somewhat listened to, while 10% of them had nothing to discuss (Table 2).

Table 2: *The healthcare providers and patient interaction and communication during discussion*

Time given to explain the reason for hospital visit			The healthcare provider listened to patients		
Responses	Participants	Percent	Responses	Participants	Percent
Yes	42	67%	Yes	53	85%
Some time	11	18%	Somewhat	3	5%
No	9	15%	No discussion	6	10%
Total	62	100%	Total	62	100%

DISCUSSION

This study had the objective of evaluating the level of hospital service delivery, and patients and families perceptions on the quality of healthcare services at (CHUK).

The reason for the patient's hospital visit is an essential tool to measure patient's satisfaction. Thus, we found that most of the patients visited the hospital due to the breakout of the previously treated longterm conditions, and very few (3%) visited for routine reasons.

We found the same reasons for hospital visits as in a study done in Atlanta, Dallas and Seattle where longterm chronic conditions and diseases were identified to lead to repeated hospital visits [6].

In our study, 80% of participants didn't use CHUK's established phone call services to book an appointment. Reduced usage might be explained by our study finding that 14% of participants who used a phone call to book an appointment were never answered. We also found that 2% tried to send text messages but didn't get responses.

Different studies found that the use of phone calls and Short Message Services (SMS) for hospital appointments were traditionally used for a long time and were effective [7, 8].

However web-based appointment system was more efficient than traditionally phone-based appointment system. It was found to reduce up to 42% of absence of patients at hospital appointments [8]. Therefore, our study showed that CHUK might be missing out the efficiency of health care services and patient satisfaction aided by telephone-based appointment system.

Despite using different ways to book hospital appointments, 82% of participants were able to get timely appointments as they wanted. The satisfaction to get timely appointments was shown by scoring most of the customer care agents as good, very good and excellent by 37%, 31%, and 11% of participants respectively. This is different from what was reported in a study done by Peng Zhao *et al.* who found that most patients didn't get timely appointments due to limited availability of appointment slots, customer care agents and phone lines [8].

Waiting time at hospital registration was reported by 24% of participants to be more than 30 minutes while the majority (44%) didn't wait at all. 11% of participants waited for 1-5 minutes, while 21% waited 16-30 minutes. In addition to this, we found that 21% (majority) had to wait for 1-10 minutes after checking in before they were received by a healthcare provider. Waiting for 31-60 minutes after checking in was the longest waiting time and was reported by 19% of participants.

In a study done in China, they reported similar findings of patients who spent a long waiting time both at hospital registration services and in waiting rooms before being attended to by doctors [9]. Long waiting time was also reported in a study done in Nigeria where it was found that most 70% of patients tend to wait for up to 2 hours before being received by the healthcare provider [10].

In a study done in Iran, long waiting time in the tertiary hospital was identified as a barrier to effective accessible healthcare and they found that it led to patient unsatisfaction [11]. Findings from this study showed that long term chronic health conditions are the leading reasons for hospital visits. Despite the existence of phone-based appointment system, we found that most of our participants didn't use it and the ones who used it never got answers. However, most of the patients were satisfied and scored well appointment schedulers, but they reported long waiting time before being received.

Patient and healthcare provider relationship and interactions are very important in determining the quality of healthcare services. In our study, the majority (67%) of participants reported that the healthcare provider gave them enough time to explain their complaints, and 85% of them reported that healthcare providers paid attention to listen to them; though 15% of them were not given time to explain their complaints. Communication between healthcare providers and patients is important as shown in a study done in UK where they revealed that both patients and healthcare providers interaction can affect the health outcomes [12].

All of these findings highlight the need for campaigns for the prevention of diseases which leads to the reduction of chronic health conditions.

People should be announced of the existence of text messages and phone calls as a way of booking hospital visits appointments. There should be a web-based appointment system that operates in autonomy and reducing the need for schedulers to give patients prompt responses.

The web-based appointment system is more efficient than traditionally phone-based appointment system [8], and increasing the number of healthcare workers, coupled with their training on the management of hospital visits appointments can help to reduce the patients waiting time and the number of unanswered phone calls.

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Fostering the training of professionals to treat trauma and PTSD in Rwanda: a call for structured training curriculum

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Keywords: Posttraumatic stress disorder; trauma; curriculum; mental health professional

INTRODUCTION

Globally, the burden of Trauma and Post-traumatic Stress Disorder (PTSD) is a public health problem and it was highlighted in the recent World Mental Health survey [1] carried-out in 24 different countries across the globe. The results indicated that 70.4% of all respondents had experienced different types of traumatic events. Man-made events, that occur in many societal contexts, are a major reason of trauma [2, 3]. Despite the fact that exposure to such events is common throughout the world, most countries, including Rwanda, have their unique history of trauma.

After the atrocities of the 1994 Genocide against Tutsi in which more than 1 million people were exterminated in the period of 100 days; appreciating the extent of the injury inflicted to the society by the Genocide was not an easy task. A previous study showed that majority of Rwandans (79.4%, N = 1000) had experienced at least one traumatic event as a result of the Genocide [4].

As a result, mental health problems related to the Genocide will continue to be the most challenging problem of mental health in Rwanda [5]. PTSD, a frequent consequence of the Genocide in survivors, is often associated with other mental health conditions e.g. Depression [4] and panic attacks [6].

A mental health survey conducted in Rwanda also revealed the picture of an increased prevalence of different mental health disorders both in the general population and in Genocide survivors [8].

The prevalence of major depressive episodes was 12% in the general population and 35% among the Genocide survivors as reported in the study [8].

The prevalence of PTSD was 3.6% in the general population and 27.9% among Genocide survivors. Other disorders such as alcohol and drug abuse were also found to be elevated in Genocide survivors compared to the general population [8].

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Intergenerational trauma has also received much attention both from the government and from non-government institutions although little research exists on transmission mechanisms. This was emphasized in the recent National Trauma Symposium coordinated by the Rwanda Psychological Society (RPS) [9].

All these findings call for strategies to address the rising challenge of mental health problems in the Rwandan society.

CURRENT SITUATION IN RWANDA

In the years after 1994, community based structures were initiated for PTSD cases inherited from Genocide against Tutsi. Efforts were made to console the traumatized nation through different programs and initiatives. Non-governmental organizations were also established to help Genocide survivors.

The government of Rwanda established the National Mental Health policy in 1995 to support the decentralization of mental health services and their integration into the primary health care system [10].

General practitioners as well as general nurses have received basic trainings with regard to handling trauma cases including being able to prescribe psychotropic drugs. However, the development of guidelines, e.g. for intake assessment or handling of especially difficult situations, remains a challenge.

Despite the decentralization policy of mental health services to the community level, the Rwanda National Mental Health Survey reported that mental health services were used by only 5.3% of the population. Among these, 78.7% utilized healthcare facility services while 32.8% used services provided by religious healers [8].

These findings highlight the necessity of additional investment in the awareness of available mental health support services. These should be coupled with trainings in the field of trauma and mental health to ensure the quality of services. Regulatory bodies were also established to promote professionalism among mental health specialists.

For instance, the Rwanda Allied Health Professional Council (RAHPC) was established in 2013 in which mental health professionals belong [11].

However, there is still lack of clear guidelines and standards for mental health professionals and there are no supervision strategies.

In addition, there are few professional societies in the field: The Rwanda Psychological Society (RPS) and the Rwandan Association of Trauma counsellors (ARCT-Ruhuka). These are the only professional associations engaged in training and capacity building of PTSD professionals with a structured curriculum. The extension of supervision networks for community health workers is also important to strengthen trauma services and build up basic competences.

In 2019, the Ministry of Health upgraded the Rwanda Health System Package [12] which includes Psychological interventions to be carried-out at the medicalized health centres. Such information strengthens the referral mechanisms and cooperation of different health practitioners within the hospital setting. More communication between professionals has been encouraged and different peer to peer workshops were organized for a number of staff to facilitate service delivery.

A previous study by Sebatukura and Philip reported that peer learning was a better training strategy for enhanced community and hospital services [5].

However, at an institutional level there are still gaps in the overall mechanisms established to support trauma clients and there is a limited infrastructure for such services. Additionally, there is a need to strengthen mental health policy through its inclusion in other general health policies [13].

TRAINING OF MENTAL HEALTH PROFESSIONALS IN RWANDA

The problem of PTSD gained a considerable attention not only for the governmental, but also in the academic field. Consequently, in 1999 a clinical Psychology department was created at the University of Rwanda. Its mandate was to train mental health professionals and equip them with the ability to handle traumatic cases.

Current figures show that Rwanda has progressed from 0 psychiatrist and 295 psychiatric nurses in 1994 to 12 psychiatrists to 381 psychiatric nurses. The number of clinical psychologists increased from no clinical psychologists to 599 trained clinical psychologists [14]. This rise in the number of mental health professionals is a combined work of different training institutions: the University of Rwanda, the University of Kibungo, and the cooperation with other international Universities.

The existing curriculum includes some aspects of trauma therapy, like Narrative Therapy or

Cognitive Behavioral Therapy, but given the scope of the problem of trauma in Rwanda, more specialised training curricula are needed. To support educational efforts mentioned, clinical specialised were created.

Although, the number of PTSD specialists continues to increase, there is need for regular refresher trainings [15, 16].

This will ensure quality and accuracy of diagnostic patterns made in the decentralized units as well as increasing the number of treated patients [17].

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Indoor air pollution and fatal daily household habits: two cases report in Kigali, Rwanda

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ABSTRACT

BACKGROUND: Around 3 billion people around the world, especially in low-income countries, cook indoors using polluting open fires or simple stoves fueled by kerosene, biomass and coal, which produce indoor air pollution (IAP). According to WHO, the population of sub-Saharan Africa, South and East Asia and the Western Pacific experience the highest rates of health problems from exposure to indoor pollutants. According to the World Bank sustainable energy database, only one third of the Rwandan population have access to electricity.

CASE PRESENTATION: Two case reports with both a fatal acute and chronic outcome of IAP are presented. Because of the lack of electricity, especially in poor environments, IAP is a major risk factor for increased mortality. The health impact of IAP is exemplarily discussed on two case reports how acute high exposure to carbon monoxide for instance can lead to fatal poisoning and death of the whole family.

CONCLUSION: The indoor air poisoning can affect people who are often unaware of the existence of a toxic gas, caused by combustion of biomass in their homes. Therefore community-based preventive intervention trials are needed to educate and alert the people.

Keywords: Indoor air pollution; Rwanda; East Africa; carbon monoxide; gas poisoning; WHO; World Bank sustainable energy database.

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INTRODUCTION

An estimated 3 billion people around the world, especially in low-income countries, cook indoors using polluting open fires or simple stoves fueled by kerosene, biomass and coal, which produce indoor air pollution (IAP) [1]. According to WHO, people in sub-Saharan Africa, South and East Asia and the Western Pacific experience the highest rates of health problems from exposure to indoor pollutants.

The health problems they face are non-communicable diseases including stroke, ischemic heart disease, chronic obstructive lung disease and lung cancer as well as carbon monoxide gas poisoning which lead to premature death [2]. The indoor use of these fuels leads to a higher level of indoor air pollutants than international ambient air quality standards allowed. Women and their children at low socioeconomic level are predominantly affected because of being normally responsible for food preparation and cooking on the daily basis and infants being usually close to

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their mothers [3]. This problem is exemplarily discussed on two case reports regarding acute and chronic health impacts due to IAP in Kigali, Rwanda.

Case 1

The unidentified man was found dead near the roadside in Kigali, Rwanda and taken to the Kigali Police Hospital Mortuary for further investigation. No other information was available. The external investigation showed a 50 – 60 year old undernourished male with a body length of 170 cm and a body weight of 45 kg (BMI: 15,6 kg/m²). He was fully clothed. There were no signs of trauma or injection marks. No conjunctival and oral mucosa bleeding noted

The autopsy findings revealed severe anthracosis in both lungs, hili, paratracheal and peribronchial lymph nodes. He suffered from a chronic adhesive pleuritis with extended scarification of the pleural cavity and a chronic bronchitis (Figure 1).

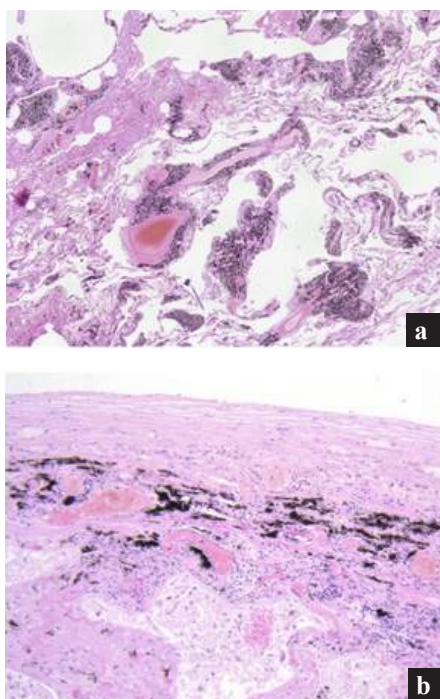


Figure 1a, 1b: Severe anthracosis and pleura fibrosis of the lung (HE, 50x)

The autopsy found chronic pulmonary emphysema pulmonary fibrosis, purulent bronchitis and bronchopneumonia with consecutive right ventricular insufficiency and chronic blood stasis in the liver and spleen.

No further macroscopic internal disease or cerebral alteration were diagnosed (Figure 2).

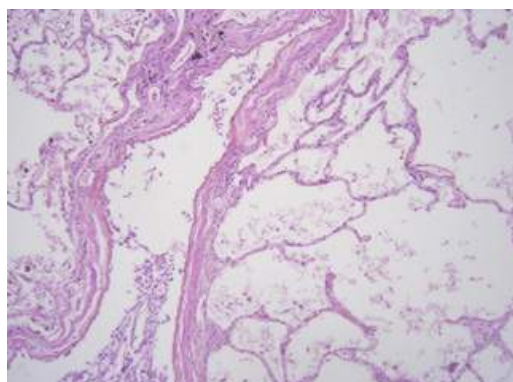


Figure 2: Severe emphysema of the lung

The cause of death was pulmonary insufficiency caused by severe chronic anthracosis, COPD and pulmonary fibrosis, complicated by purulent bronchitis and confluent bronchopneumonia.

The histology revealed severe anthracosis, pleura fibrosis, chronic emphysema and advanced confluent pneumonia in the Hematoxylin and Eosin coloration.

Case 2

A whole family was found dead in their house. The house was divided into two rooms. The father was found close to the house entrance while his wife and 7-months-old infant were found in the rear end of the house. The windows and the door were completely closed. Next to the mother and the child, a cooking station that had been prepared with fire wood was found.

The mother and the child were already dead. The father died shortly after being brought to the hospital.

The autopsy of the father showed no fatal pathologies, except slightly enlarged heart and a moderate coronary artery disease.

Heart-blood samples were taken from the mother and the child by opening the thorax. Salmon-pink-coloured muscle and light-red blood were revealed as a hint for a carbon monoxide poisoning.

The postmortem blood samples of all family members were tested in the toxicological laboratory in Hamburg, Germany.

The blood analysis revealed a 77% and 40% toxic CO-poisoning of the mother and of the child respectively. The result of COHb analysis of the father was <10%, because he had survived for several hours.

The cause of death was acute carbonmonoxide poisoning. The motives of death was defined as unnatural.

The cases were investigated during the forensic summer schools in Kigali, Rwanda, through a cooperation project between the Institute of Legal Medicine in Hamburg, Germany and the University of Rwanda.

DISCUSSION

Carbonmonoxide is a colourless, odourless and tasteless toxic gas and is the most common and widely distributed air pollutant, both in domestic and work environment. It accounts for numerous cases of carbonmonoxide poisoning every year. Carbon monoxide is produced by incomplete combustion of carbonaceous material such as charcoal and wood under high temperature and low oxygen supply [4]. Even at a combustion temperature of 1000°C the chemical balance of carbon and carbon dioxide ($C + CO_2 \leftrightarrow CO$, so-called “Boudouard equilibrium”) is almost completely on the side of the CO. The most original form of CO exposure is therefore the accumulation of the gas in charcoal or wood heated dormitories or the exit of CO from enclosed stoves and lamps in poorly or nonventilated rooms [5].

The gas prevents the binding of oxygen to the hemoglobin in the body. As a result, the blood can no longer transport the vital oxygen. The result is an oxygen deficiency of the tissue, which leads to headache, dizziness, tinnitus, blurred vision, vomiting, fatigue, muscle weakness and accelerated heartbeat in mild intoxication cases. Moderate and severe intoxications include shortness of breath and loss of consciousness with flattening of breathing. Mechanical Ventilation and oxygen supply can prevent death from this kind of intoxication. The result of prolonged respiratory disorders can be temporary or permanent brain damage [6, 7].

Because of the lack of electricity, especially in resource-limited environments, the indoor air pollution (IAP) is a major risk factor for increased mortality. According to the World Bank sustainable energy database, only one third of the Rwandan population has access to electricity (Figure 3).

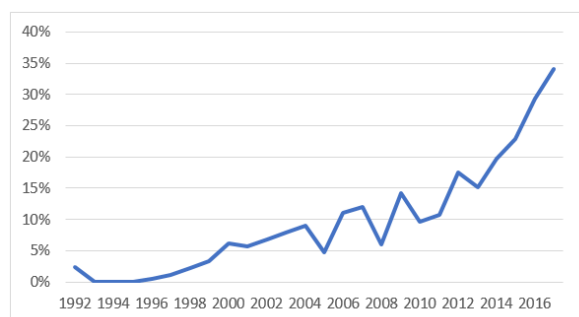


Figure 3: Access to electricity in Rwanda 1992 – 2017 [1]

Widely available, low-cost traditional energy sources such as coal and biomass (dung, wood, crop residues) are still the main source of energy for 60 to 90% of households in developing countries and are used for cooking, home heating and lightening [8]. It accounts for about 4% of the global burden of disease measured by disability-adjusted life years (DALYs) lost. In contrast to electricity, biomass is extremely polluting.

In addition to harmful pollutants and irritant gases, there are also carbon monoxide (CO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), formaldehyde, and carcinogens such as benzopyrene and benzene found in the smoke [2, 3, 9-11]. In developing countries, the international ambient air quality standards may be exceeded by a factor of 10, 20 and up to 50, exceeding even high levels found outdoors in coal-burning cities in northern China [12].

The small pollutants in indoor environments are able to penetrate deep into the lungs and appear to have a great health damage potential [13]. This leads to acute and chronic exposure and different health issues.

Acute high exposure to carbon monoxide can lead to fatal poisoning. This poisoning can affect people who are often unaware of the existence of a toxic gas, caused by combustion of biomass in their homes (Figure 4).



Figure 4a, 4b: Cooking on solid fuels, Musanze, Rwanda. Photo credit to J. Byukusenge

Carbon monoxide is absorbed by the body through inhalation and is diffused across the alveolar membrane with almost the same ease as oxygen (O_2).

The effect of CO on the human body is threefold: First, CO displaces the oxygen molecules (O_2) easily because of the approximately 200-300-fold (in fetal hemoglobin even 600-fold [LIT 29]) affinity to Iron (II) binding sites of hemoglobin and thereby reduces the oxygen transport capacity of the blood by forming carboxyhemoglobin (COHb) [14].

Second, CO ligands cause an allosteric change in hemoglobin, which enhances the binding of the remaining O_2 molecules, thereby releasing less oxygen into the tissues (physiologically, this manifests as left-shift of the oxygen-binding curve) [15].

The third effect is based on the fact that CO also binds to iron (III) centers - but much weaker than, for example, the cyanide ion of hydrocyanic acid. Therefore, intracellular CO interferes with the function of ferricytochrome enzymes such as cytochrome c oxidase, resulting in prolonged persistence, which leads to cytotoxic hypoxia [16]. Because all these effects are tissue hypoxia, CO poisoning manifests itself first of all in the hypoxia-sensitive central nervous system, and later in the myocardium. This is because CO has only a 40-fold affinity to myoglobin compared to oxygen [16, 17].

All effects are important in acute toxicity in the medium dose range. Peracute courses with death within minutes seem to be dependent on the cardiovascular history of the patient. The permanent neurological damage described by some authors after CO intoxication is mainly attributed to the cytotoxic effect of CO [7]. Long exposure time and late start of treatment is therefore also a significant health risk even with less severe clinical symptoms.

Since poisoning is difficult to identify, CO is referred to as a “silent killer”: It is, as mentioned above, invisible and odorless disease and does not cause perceptible sensations or inhalation symptoms. Back in the years many deadly poisonings were interpreted as diabolical causes, because the causes were not recognizable and therefore the death was apparently a connection with occult acts (in which often coal fire and incense played a role) [5].

The most important guiding symptom of acute poisoning is the reduction of vigilance (Table 1). In addition to the clinical symptoms, the assessment of the severity of poisoning can be based on the COHb fraction [17, 18]. Both the absorption behavior of COHb and oxygen hemoglobin cannot be differentiated in conventional pulse oximeters, because of their similarity [19]. The transcutaneous oxygen saturation measurement therefore often

shows false-normal values after CO exposure [20]. A high concentration of COHb leads to a bright red discoloration of the blood. However, this specific sign manifests clinically reliably only postmortem in the form of distinct bright red lividity, while the conspicuous reddening of the skin mentioned in textbooks is actually rarely observed [6]. The COHb value can be determined with conventional blood gas analyzers. The preclinical CO meters and multi-wave length pulse oximeters (“Rainbow” Technique) are used [19].

Preclinical CO pulse oximetry enables rapid differential diagnosis and early stratification in the sighting of larger numbers of patients.

There is persistent evidence that chronic exposure to indoor pollutants cause severe diseases, including acute lower respiratory infections (ALRI) in children and chronic obstructive lung disease (COPD) in adults as well as severe anthracosis and lung cancer [3, 21, 22]. Other illnesses attributed to IAP include eye irritation, perinatal mortality, low birth weight, increased susceptibility to asthma and middle ear infections in children, tuberculosis, cataracts and cancers of the nasopharynx and larynx in adults [2, 3, 10, 23-25].

According to the World Health Report 2002, 2.7% of the total global burden of bad health measured as DALY's is attributable to IAP (Figure 7). Indoor air pollution is on the fourth rank in developing countries with high mortality after underweight, unsafe sex and unsafe water, sanitation and hygiene [26]. Globally it is on the eighth rank among other risk factors. These risks are not distributed evenly across countries, or even within countries [26]. The health risks of indoor air pollution are strongly correlated with poverty as marked in the case reports above. There is a need in revealing these cases through forensic work to bear with this diagnosis in mind and to investigate the concentration of COHb in blood in forensic laboratories, because a CO poisoning cannot be diagnosed on a macroscopic and microscopic level.

Carbonmonoxide poisoning can be suspected by careful analysis of the circumstances and the scene of death, especially one or multiple persons in a closed room with an open fire or ash. The external examination, concerning bright red livor mortis

(indication for CO poisoning) on dark skinned people is not easy.

Nevertheless the typical bright-cherry-red colour of the livor mortis can be found on the palm, the nail bed (Figure 5),



Figure 5: Typical pink nail beds after carbon monoxide poisoning [27]

The mucosa of the mouth and the conjunctivae. Thus these signs are only indications, and not irrefutable proofs. During the autopsy the muscles are – as in textbooks described - salmon-coloured, and the blood is bright red. The suspected diagnosis can be precised with some special pretests; the commonly used is the is the “Formalin-Test”, blood mixed with formalin. In case of COHb, the fluid remains reddish (Figure 6) [27].



Figure 6: Formalin-Test: blood mixed with formalin; Brownish colour: cyanotic blood; Reddish colour: COHb = Carbon monoxide poisoning

In case of cyanotic blood the fluid becomes brownish. Another pretest is the “Heating Test”. By heating the blood in test tubes the COHb blood remains reddish, while cyanotic blood becomes brownish again.

These pretests are easy to perform and are indicators for the right diagnosis [28].

In conclusion, indoor air pollution is a major environmental risk to health. By reducing indoor air pollution levels, the burden of disease from stroke, heart diseases, lung cancer, acute and chronic respiratory diseases as well as accidental fatal gas

poisoning can be reduced in developing countries. Community-based preventive intervention trials are needed to educate and alert the population at risk. Good ventilation, use of improved cooking stoves, access to gas and electricity and an indoor, handy CO measuring device can reduce the exposure to smoke or CO gas.

Table 1: *Symptoms of carbon monoxide poisoning*

Severity	Symptoms	CO-Hb-fraction
Light	Shortness of breath during exercise, headache	>10%
	Dizziness, tinnitus, nausea and vomiting	>20%
	Tiredness, blurred vision	>30%
Moderate	Tachycardia, loss of consciousness, cardiac arrhythmias	>40%
	Coma, tachypnea	>50%
Severe	Seizures, Cheyne-Stokes respiration	>60%
	Respiratory and circulatory arrest	60 – 80%

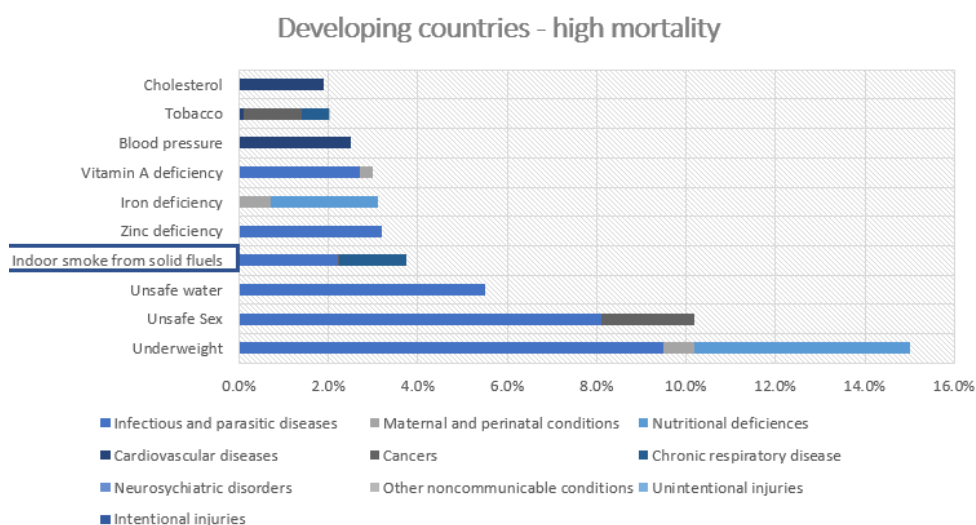


Figure 7: *Burden of disease attributable to 10 selected risk factors, by the World Health Report 2002 [26]*

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The creation of a cornea bank and corneal transplantation in Rwanda

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Keywords: Cornea; keratoplasty; cornea bank; corneal harvesting; corneal blindness; Rwanda.

BACKGROUND

The World Health Organization (WHO) estimates that 33 million people worldwide are currently blind and 191 million live with severely impaired vision. Unfortunately, 90% of these people live in the poorest parts of the world [1, 2].

In 2002, a WHO report mentioned that 5.1% of blindness globally were due to corneal clouding [3] and that 98% of global corneal blindness occur in developing countries and affect young people [4].

In sub-Saharan Africa, the prevalence of blindness is about 7 million and about 30 million have impaired vision [2]. The prevalence of blindness in the 50+ age group in Western and Eastern Sub-Saharan Africa is at 4% compared to 0.4% in Europe [1].

Potential risk factors of corneal blindness are: injuries, infections, corneal dystrophies, keratoconus, onchocerciasis, trachoma and smallpox infection. Strong prevention measures have been reported to limit corneal blindness. However, in the most affected areas, prevention strategies have often failed or are not in place [3]. Corneal transplants have therefore been used to successfully restore sight.

Other surgical approaches in corneal surgery are also available: These range from penetrating keratoplasty to the exchange of individual layers; the example being Descemet-stripping endothelial keratoplasty (DMEK) [8]. In developing countries, it is estimated that 80-90% of corneal blindness can be treated through perforating keratoplasty and as such, these therapies have therefore yielded good

and long-term results for a considerable number of treated patients. e.g. graft survival of 88% after 5 years, and 80% after 10 years as well as long-term im visual [5].

Both corneal transplants and surgeries rely on cornea banks. The sub-Saharan region only has three known cornea banks-in Ethiopia, South Africa

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and Kenya. Only about 150-200 transplantations are carried out annually both in Kenya and Ethiopia [4]. These are still few in numbers considering the demand within the region.

Possibilities to expand and create more cornea banks in Africa, have been challenged by continuous decreases of corneal donors [9]. This is mainly due to a number of social beliefs and cultural perceptions towards eye donation, inefficient operations, restrictive political will/policies and non-adherence to medical standards [4]. Moreover, even greater challenges are being constantly reported on postoperative refractive errors and the lack of correction therapies due to missing glasses or contact lenses in the region [6].

Despite these challenges however, studies done in Ethiopia have, shown that of the 312 patients that underwent corneal transplantation between 2000 and 2013, the average transplant survival rate was 80% after 2 years [5, 8]. Studies in Kenya showed a similar picture with a 1-year transplant survival rate at 85% [7].

CORNEAL TRANSPLANTATION IN RWANDA

The healthcare system in Rwanda has greatly improved in the last two decades due to the government's commitment and international donors support. Nevertheless, the doctor-to-patient ratio is still a challenge to the system (e.g: 1 doctor for 18,000 patients) [9]. This ratio is even lower in ophthalmology: One ophthalmologist is expected to see about 1 million patients annually [4].

Causes of blindness in Rwanda are similar to those reported across the African continent.

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However, in Rwanda, the major risk factors are cataract (clouding of the lens), glaucoma and corneal diseases [1].

The actual prevalence of corneal blindness in Rwanda is still unknown. It is assumed that the prevalence could be between 5% [1, 2] and 10% [2]. To our knowledge, about 300 corneas have been transplanted since 2011. A preliminary study by Nyemazi A. although not yet published, revealed that over 800 people are currently in need for a corneal transplant in Rwanda.

Currently, all transplanted corneas in Rwanda are donated or bought from other countries, like the United States of America and Germany. Rwanda has only one experienced corneal transplant specialist [2], the current workload and demand of corneal transplantation therefore necessitates that more ophthalmologists be trained to offer the same services at different health care facilities [1]. To be able to respond to the current cornea demand, national corneal tissue banks and donations need to be created and promoted respectively.

Commendable efforts are already in place: Rwanda has this far passed laws enabling the country to transplant tissue and build a cornea bank. In addition, the country is also developing governmental and ministerial orders for donation, harvesting and cultivation of corneal tissue, leading to the creating of a cornea bank [2].

With the support of different institutions such as the University Medical Center Hamburg- Eppendorf through the Institute of Legal Medicine and the Eye Clinic. A cornea bank will be available in Rwanda by 2019/2020. The first corneal transplantation with a cornea harvested and banked in Rwanda is consequently scheduled by July 2020.

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