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Introduction of systematic triage in the emergency room at Dhulikhel Hospital, Nepal: Evaluation of a quality improvement project

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Cover illustration: Mass-casualty triage performed with color-wristbands during the 2015 Nepal earthquake. Copyright © Dhulikhel Hospital. Printed with permission from Dr. Rajendra Koju.

Abstract

Introduction: Correct use of systematic triage has been shown to provide the sickest patients essential care first and to increase survival. As a validated tool for both adults and children, and an established system at St. Olavs Hospital, RETTS (Rapid Emergency Triage and Treatment System) was chosen to be introduced in the Emergency Room (ER) at Dhulikhel Hospital (DH), Nepal. Our study aims to describe the implementation of a triage system in a low-resource setting and analyse adherence to the system after introduction. This quality improvement project evaluation was done one year after the implementation.

Materials and methods: All patients presenting to the ER at DH from the 1st of February to the 30th of September 2015 were included in the study. Data including age, gender, if the patients had been triaged or not, color-code of triage and time of admission from 8499 handwritten records were collected and registered. Qualitative observations, semi-structured interviews and a questionnaire among the staff were performed. We made a statistical process control chart to control the percentage of patients with triage. The results from the remaining data collection and from the questionnaire were analysed and presented.

Results: During our study period two large earthquakes struck Nepal, and this natural disaster affected our results considerably. The documented triage percentage was at 30% before the earthquake-period and at 71% after. There were 23% patients in the most severe triage categories red or orange. The yellow category constituted 36% of the patients and 42% were categorized as green. There were 6158 (82%) adult patients (>16 years) and 1281 (17%) children (0-15 years). Triage category were given in 51% of the adult population, while only 37% of the children had a registered triage category. The triage categories were also distributed differently among the pediatric and adult population, in particular it was fewer children in the most severe categories. No use of the triage room and also the lack of using ESS (an important part of the RETTS) was observed. Most of the doctors who was interviewed highlighted that high turnover of staff in the ER is a challenge to continuity and that frequent training is important. From the questionnaire it emerged that nearly half of the triage-staff do not think the triage system is easy to use. Close to 100% of the staff think it is meaningful to continue doing triage in the future.

Conclusion: The implementation of triage some months in advance seem to have had a positive impact on the way the staff at DH handled the earthquake. One year after implementation, triage percentage is about to reach the goal at a stable 80%. However, several errors in performing RETTS were identified. It is possible that the RETTS is too complex and time-consuming for the Nepali setting. To improve and maintain triage skills, further training is essential, in particular towards pediatric patients. Relocation of the triage room would probably increase the share of triaged cases. Another possible solution is to implement an easier and more context-friendly triage system, like the South African Triage Scale (SATS).

Acknowledgements

We would like to thank everyone who has been involved in this project, making it possible for us to through with this study in two countries.

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Introduction

Emergency care

Emergency care seems to have been a neglected topic in middle and low-income countries (MLIC), while improving its quality and efficacy has been a top priority in industrialized countries during the last decade (1). Despite the global health community's historical focus on providing basic, cost-effective primary health care, recent trends in the developing world show increasing demand for the implementation of emergency care infrastructures. Due to the focus on emergency care in industrialized countries, western medicine has gathered a growing experience in evidence-based interventions during the past three to four decades, and are thus in the position to share this knowledge with the developing world (2).

Non-communicable diseases, especially traffic injuries and cardiovascular disease, are on the rise in developing countries (3). The complications and exacerbations of these diseases demands emergency services (4). The Word Health Organization predicts that by 2020, road traffic injuries will be the third largest contributor to the global burden of disease, with 90% of the associated mortality occurring in low-income nations (3). Evidence-based interventions have showed that emergency treatment is the crux in reduction of mortality for some serious medical conditions (4). Integrating emergency care into existing health care systems will ideally rely on modest, low-cost steps to augment current models of primary health care delivery, focusing on adapting the lessons learned in the developed world to the unique needs and local variability of MLIC (2). While the state of emergency care in MLIC is gaining increasing priority and has come a long way the recent years, the emergency care infrastructures are still significantly underdeveloped. Many countries are lacking training in basic life-saving protocols and triage systems, where lack of the latter has shown to result in potentially harmful delays in treatment (2).

Triage

Triage is an intake assessment process that is increasingly used in emergency departments (EDs) to safely sort patients so that the sickest are provided care first (5). Nurses in the ED usually do the triage, and they often have the title "*triage officer"*. Based on a brief examination, they assess each patient's medical needs. Because triage decisions may have such extensive consequences, they weigh heavily on those who must make them. It is therefore important that triage officers understand the triage system they employ and the moral values and principles upon which it is based (6). Although the techniques show considerable variation from one institution to another, and in different parts of the world, they all share the same goal of prioritizing clinical urgency based on the greatest need. The triage assessment is based on vital parameters, chief complaints and medical history. Algorithms or a

set of criteria is used to determine treatment priority. A validated triage system can also be used to help report statistics of the patient population of an ED (5).

Some of the most valid and best tested triage-systems are Australasian Triage Scale (ATS), Canadian Emergency Department Triage and Acuity Scale (CTAS), Emergency Severity Index (ESI) and Manchester Triage Scale (MTS). Triage-systems sorting patients in five different degrees of urgency may be more reliable than those of three or four degrees, in which they discriminate better between patients (7). At St. Olavs Hospital, Trondheim, the Swedish scale RETTS (Rapid Emergency Triage and Treatment System) is used since 2010. The RETTS scale grade patients in different categories using vital parameters and algorithms for emergency symptoms and signs (ESS). The triage method includes two steps, assessed simultaneously, that includes one algorithm for vital signs and one algorithm for one of 43 ESS. The ESS is specific for the RETTS protocol (Appendix 1). The highest level of these algorithms is given the final priority level. The scale sort patients into five categories; from blue – no need of further triage or any hospital care, through green, yellow, orange and the highest category red. Red is categorized as life threatening and need of immediate medical care. Orange is potentially life threatening and should be seen by a doctor within 20 minutes. The recommended time of medical attention is within 120 minutes for yellow and 240 minutes for patients in green category (8, 9). Studies of RETTS in Sweden and Denmark have shown that this triage-system is simple and safe (8), has good predictive validity (10), has good inter-rater agreement among nurses (11) and increases survival (12).

Nepal and DHECARE

Nepal is a small country with an area of 147 180 km^2 and a population of roughly 31 million, of which 81% lives in rural areas. It is among the poorest and least developed nations globally, with about one-quarter of its population living below the poverty line. The life expectancy at birth is 67,5 years. Six percent of the GDP (gross domestic product) goes to health expenditures, and the hospitals have 5 beds / 1,000 inhabitants (13). With these limited resources and political turmoil, the country is struggling to improve its health care indicators (14).

Since 2007, The Medical faculty at NTNU has had a close collaboration with the Kathmandu University School of Medicine (KUSM) / Dhulikhel Hospital (DH). The collaboration covers a wide range of projects in different disciplines, like emergency medicine, neuroscience, mother/child-health, psychiatry, immunology and many more. As a part of this unique collaboration an initiative to improve emergency care in a non-selected population in Nepal - the DHECARE study was started (Dhulikhel Hospital Emergency CARE Study). DH covers the population of 1.9 million people from

both rural and urban areas, which gives a potentially high caseload of patients. This makes it crucial to have an efficient emergency room (ER).

On the 25th of April 2015, an earthquake which was measured 7.9 on the Richter scale, struck Nepal. It was the worst natural disaster to strike Nepal since 1934. Entire villages were wiped out across the country, leaving hundreds of thousands homeless. The earthquake was followed by a large number of aftershocks, including one that measured 7.3 on May 12th which contributed to further damage and casualties. The earthquakes killed more than 9,000 people and injured more than 23,000. Dhulikhel was close by both epicenters, thus lying in the center of a highly affected area. DH reports that as of 10th of June, they have provided medical treatment to over 3500 people injured in the earthquake and the following aftershocks (15).

Implementation of triage in Dhulikhel Hospital

Implementation of triage is one of the main focuses of the DHECARE project. When the collaboration started in DH no formal triage system existed, and patients were mainly prioritized after the principle "first come, first served". A pre-intervention study performed in DH showed that of the discharged hospitalized patients, 50% came from the Outpatient Department (OPD) and the other 50% from the ER, thus suggesting that sorting of patients was necessary. The need of a triage system was also identified from other resource-poor settings, where reports showed reduction of mortality and improved patient flow after implementation of triage (16-18). As a validated and reliable triage tool for both adults and children (10, 19), and an established system at St. Olavs Hospital, RETTS was chosen to be introduced in Nepal.

In April 2014 focus groups were gathered in DH to map out difficulties and potential for improvement in the ER, and plan interventions to make the ER more efficient. It was crucial that the proposals of improvement came from the local staff at DH. Three main goals were identified and established. The first was to start basic sorting of patients presenting to the hospital. That means OPD patients are sent to the OPDs and those who need emergency care to the ER. This was important to achieve more efficient logistics and improvement of patient flow. The second was to establish Response teams. When surgical emergencies occur, or emergencies in pediatrics, internal medicine, orthopedics etc., the Medical Officers in the ER could use the ER alarm phone to call the on-duty doctor in the respective departments. The third goal of improvement in the ER, which will be the focus of this thesis, is the implementation of systematic triage to improve patient treatment and patient flow through the ER.

In October 2014 a team from St. Olavs Hospital and NTNU in Trondheim traveled to Dhulikhel to teach and train triage to the staff in the ER. The team consisted of Erik Solligård (Research Director

and Associate Professor of Anaesthesiology), Eli Aunøien (Emergency Department Section Leader at St. Olav), Director of the Simulation center Stine Gundrosen, Erlend Vandvik (Disaster management Director, St. Olav) and Ingrid Nissen (Senior Consultant, Department of Pediatrics, St. Olav). Solligård and Aunøien were responsible for triage teaching and training, Gundrosen and Nissen for simulation sessions while Vandvik and Solligård were working with organizational issues. A four-day training program of triage was completed, consisting of lessons, case-solving, and group discussions, with every nurse, paramedic and doctor in the ER as participants. Triage was practiced on patients in the ER under surveillance. As mentioned previously, simulator training and resuscitation of newborns was also a part of the program. There was in total fifty participants in the triage course, also including staff of DH from other departments. This was to promote knowledge and awareness of triage across the hospital.

During this same visit plans to rebuild and expand the ER was made, which was found to be necessary to improve patient flow and make the triage possible (Figure 1). The ER was at this time consisting of a shock room for stabilization of acutely ill patients and one large ER-room for all of the patients, regardless of urgency. The ER was to be expanded to more rooms, one room to do the triage and different zones to sort patients according to urgency. One new room would be the green and yellow zone, and the old ER-room would be orange and red zone. The aim was that every patient present at one site where vital parameters is taken and chief complaint is accounted for, with subsequently sorting and referral to appropriate zones.

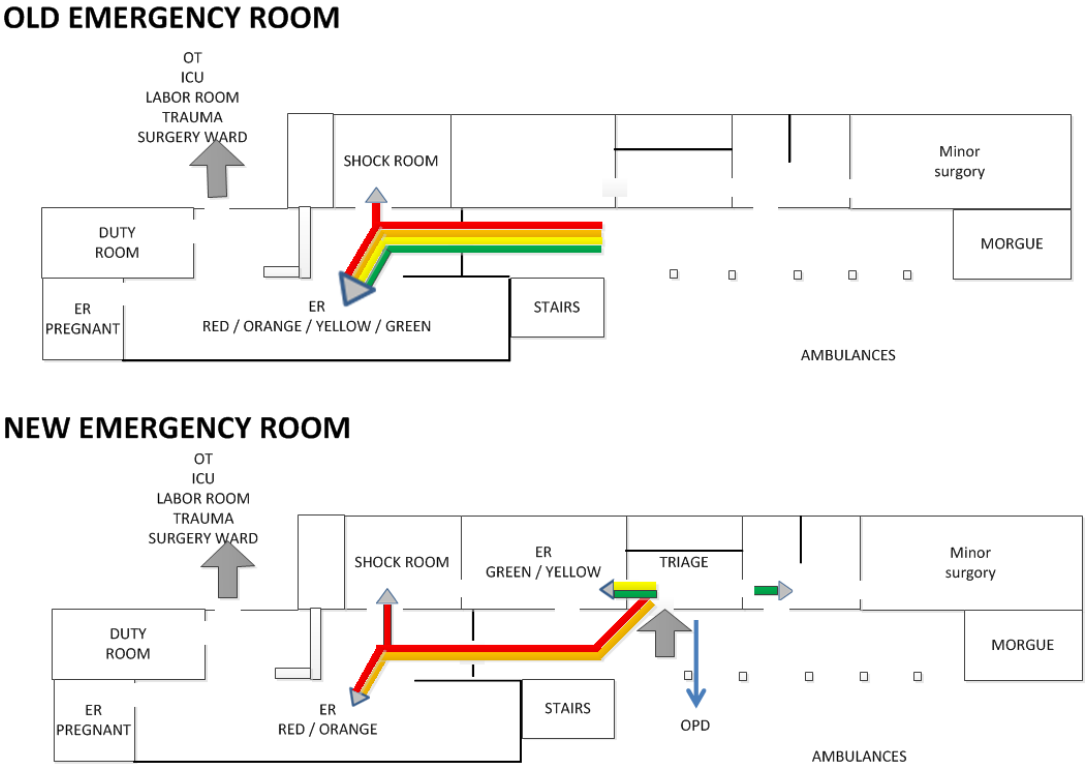

Figure 1: Plan drawing of the old and new Emergency Room. The change was from one large patient area and shock room to different triage zones and a triage room.

Quality improvement work and statistical process control

Quality improvement work has gained increasing importance in healthcare, and has become an own field with theories and models (20). All improvement requires change, and improvement work is about changing an unstable, non-standardized process into a stable process. It can also be about changing a process that is stable, but poor, into a process that is stable, but better. The purpose of the DHECARE project in Dhulikhel Hospital is to introduce something completely new by implementing a new routine in the ER. Quality improvement could be defined as the combined and unceasing effort to make changes that will lead to better patient outcomes and better system performance (21). To measure a process and improvement of it, it is ideal to have a baseline to get a starting point to compare with when investigating whether the change is an improvement (22). Statistical process control (SPC) is a method of quality control which uses statistical methods in order to monitor, control and improve processes.

Aim

General aim:

As a part of the DHECARE Study, this thesis is a quality improvement project evaluation. The aim is to describe the implementation (introduction) of a triage system in a low-resource setting and analyse adherence to the system after introduction.

Specific objectives:

To analyse the triage-data from a certain time period after DH started triage independently, and follow the proportion of triaged patients over time since the start of the intervention, as well as in which triage-category the patients are distributed. This provide information whether triage in the ER in fact has become a routine, which is very important for the interventions to be effective. Interviews and a survey among staff working at DH will hopefully reveal the perceptions and possible barriers to the implementation.

Materials and methods

Ethical considerations

As a part of the larger DHECARE study ethical approval from Regional Committees for Medical and Health Research Ethics (REC), and the local Institutional Review Committee (IRC) at DH was granted in 2013, updated in 2015. All data was collected without name of the patients; therefore, no person-identifiable results are stored or presented. Confidentiality was maintained.

Study setting

Dhulikhel Hospital is located in Dhulikhel Municipality, administrative center of the Kavre district. The city of Dhulikhel has a population of about 14.000, and is situated 1650 meters above sea level and 30 km Northeast of Kathmandu, the capital city of Nepal. Dhulikhel Hospital covers the population of approximately 1,9 million people from Kavre and the other surrounding districts. The hospital has 18 community-based outreach clinics, to improve health care in rural areas. It also serves as the university hospital for Kathmandu University. The hospital is an independent, not for profit, non-governmental institution (23).

The Emergency Department provides services to more than 10,000 patients a year. The Emergency Department serves an unselected patient population; patients can seek health care in the department directly without an appointment and without being referred from health personnel. Patient in ER are selected for hospitalization or outpatient services and the ER is therefore one of the major gateways to all the other departments. Dhulikhel has wide catchment area, and the spectrum of cases coming to the Emergency Room (ER) is diverse. The staff working in the ER consists of a team of doctors, paramedics, nurses and supporting staff like security guards. Since 2013 Dhulikhel Hospital has provided an ambulance service staffed with trained paramedics, emergency drugs and medical equipment, but with very limited capacity (one part-time car). Thus, most of the patients come to the ER in other mode of transportation than ambulance and they arrive in the ER without getting pre-hospital care (24).

Study population

All patients presenting to the ER during the study period were included in the study. That includes both patients that were hospitalized as well as patients treated in the ER and went directly home afterwards. Patients that presented directly to the outpatient clinics were not included.

Data collection

One year after the initial implementation of RETTS, an evaluation of how the staff in the ER were using the system was undertaken. Our work in Dhulikhel Hospital consisted of several parts. The main task was to abstract data from all ER medical records for patients presenting in the ER during our study period. We also sought to evaluate the triage implementation process. In addition, we used semi-structured interviews and questionnaires for this evaluation. Changes over time and identification of measures that has changed practices were identified.

At the ER in DH all the patients have medical records which are handwritten, and both nurses, paramedics and doctors write in these records. The layout has changed during our study period. From February to the end of July a five-paged record was used (Appendix 2) which consisted of two pages with triage form, one for adults and one for pediatric patients, and the other two pages depended on whether the patient was a trauma- or medical patient. A new form came the 31st of July (Appendix 3), which consists of two pages, one for triage evaluation and one page for symptoms, working diagnosis and treatment. All of the records contains information about age, gender, address, vital parameters: pulse, respiration rate, blood pressure, temperature, O2-saturation and Glasgow Coma Scale (GCS), as well as presenting complaints, working diagnosis and given treatment.

All the patients that presented to the ER from 1st of February 2015 to 30th of September 2015 were included in our study. That includes 8499 patients, with an average monthly caseload of 1063. For the present study we abstracted data from paper records, except from the period from 25th of April to 16th of May, which includes 701 patients. In this period Nepal was hit by an earthquake and collection of data was already done by the DHECARE research assistants. All records from the 24th of April, the day before the earthquake, had been lost and the patient data from this day is missing in our data collection. The information we abstracted was: date of admission, patient-ID, age (years), gender, if the patient has been triaged or not, color-code of triage and time of day. Adult was defined as of 16 years for this study. We divided the day into three parts according to the working hours of the staff in ER, nurses and paramedics accordingly: 07:00 – 12:59, 13:00 – 18:59 and 19:00 – 06:59. The aim was to see if it is any diurnal variation, in particular day time compared to evening and night time, when the ER is less staffed by 1-2 nurses or paramedics. Patients who were dead on arrival, sometimes color coded with “black”, were not included in the data collection.

A semi-structured interview was performed with senior doctors from different departments at the hospital. We started the interviews with the same questions and had a list of topics to be covered to provide reliable, comparable qualitative data. This methodology allows the interviewee the freedom to express their views in their own terms, and provides the opportunity for identifying new ways of seeing and understanding the topic.

A survey about triage was conducted among the ER staff and the consultants. The survey was anonymous, except the respondents had to state their profession. The questionnaire was handed out and gathered by one of the DHECARE research assistants, not by us personally. Through the questionnaire we tried to get an overview of the thoughts about learning and using a new system and if it has made the work in the ER more efficient, safe and meaningful.

Observations of how the work in the ER is done and how the routines are when a patient is admitted were also done.

Data analysis and statistics

By using statistical process control (SPC) and making SPC charts both researchers and practitioners of quality improvement can be helped to determine whether changes in processes are making a real difference in outcomes. An advantage of SPC is that this statistical method considers the continuous sequence of the samples. In this way it is easier to measure change over shorter time, and monitor and control a process.

In SPC theory "common cause variation" refer to the natural variation in a process. This is the variation that is expected to occur according to the underlying statistical distribution if its parameters remain constant over time. Conversely, "special cause variation" refers to unnatural variation due to events or changes that have not previously been typical in the regular process. This is similar to traditional hypothesis tests of data, but with the key distinction being that we now test for changes graphically and over time using small samples. Special cause variation can be a cause of either deliberate intervention or an external event over which we have little control. Interventions in a quality improvement project are deliberate attempts to introduce special cause variation (25).

Our collection of data from the patient records was registered directly into IBM SPSS Statistics 23.0.0. Data analysis was performed with SPSS. EpiData Analysis 2.2.1 was used to generate the SPC-graph. For the presentation of the results in this study we have chosen to use a control chart. Control charts give sensitive graphical presentation, and in addition to having a centerline based on mean, it has control limits to identify special cause variations (25). The control chart was made to control the percentage of patients where triage was done. We divided the time period into weeks, using the average percentage of patients triaged in each of these weeks in the diagram. We divided the diagram in three time periods to compare the results: before earthquake, weeks around earthquake, and months after the earthquake. Continuous variables were compared with the t-test. Differences were considered significant when p value was less than 0,05.

To make the questionnaire for the staff working in the ER and for the doctors that were interviewed, *Google Forms* was used. These results were presented in Microsoft Excel 2016.

Results

Documented triage

Triage was started in November 2014, but was not well documented and only a few patients were actually triaged the first months. Triage was not really implemented until February 2015, when a new triage officer was recruited and the ER got an English version of RETTS in paper form (Appendix 2). The study period therefore starts February 1st 2015.

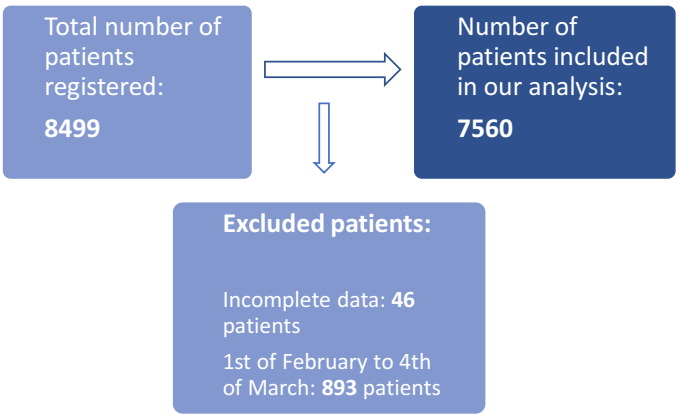

Figure 2: Selection of patients for the study.

A total of 8499 patients presented to the ER in the period 1st of February to 30th of September 2015 (Figure 2). Because of incomplete data 46 patients were excluded, e.g. triage was registered as "yes" but no color code was registered. We also excluded 893 patients that were registered from February 1st to March 4th. In this period the triage officer practiced triage by doing retrospective triage in the ER records. This was performed in addition to the actual triage performed by the ER staff; therefore it was not possible to estimate the actual share of triaged patients for this period. This leaves 7560 records from the period 5th of March 2015 to 30th of September 2015.

The 2015 Nepal earthquake

Two large earthquakes struck Nepal on the 25th of April and the 12th of May 2015. During the earthquake period triage was performed at the main gate, and all the patients were sorted with color-coded wristbands. Different triage zones were set up outdoors on the hospital grounds, one area for green, one for yellow and one for orange, the ER was the red zone. The idea was that the most severely injured patients should get a bed and be treated in the ER, while others could continue to get treated and stay outside. The majority of the patients that presented during the earthquake period were

thus triaged, but only a limited number of patients got an ER record that could be included in the present study. From the 25th of April to 16th of May 701 earthquake victims had an ER record. These records, however, were largely incomplete due to the high workload and only 118 (17%) of these patients got a documented triage category. 1700 patients were registered in a separate "earthquake" registry, this includes both ER patients and patients of other departments. A huge number of patients did not get a record, consequently the actual number of patients presenting to DH during the earthquake period is uncertain.

Some weeks after the earthquake the ER staff had a meeting where triage was discussed. Here, the senior consultant strictly instructed every nurse and paramedic to do triage on an equal basis, the triage officer should not be the only one responsible. The triage officer changed her position to be a regular nurse on duty in the ER after this meeting.

Implementation of triage

The development of use of triage is presented in a process control chart (Figure 3). The figure shows percentages of patients with documented triage out of all patients presenting to the ER. In the case of our study the first baseline (before implementation) is at zero. Triage was not done in the ER before the training in October 2014, and there is no documentation available on this before February 2015. In March 2015 a new baseline is formed which is valid for the period before the earthquake.

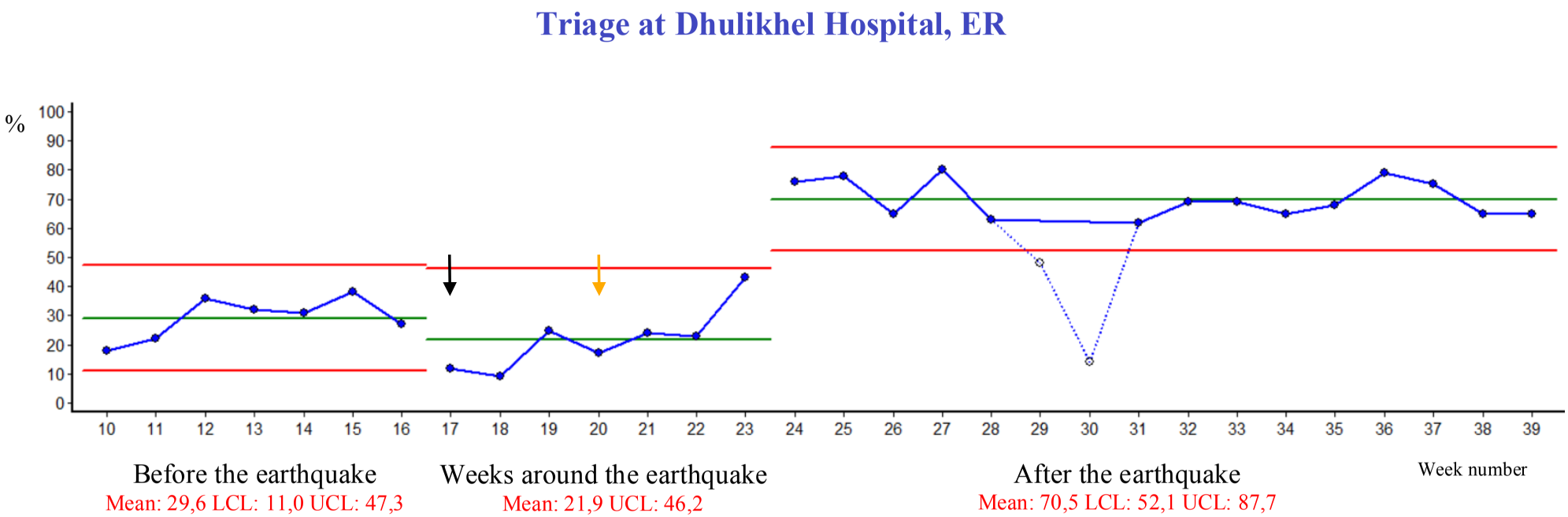

Figure 3: Statistical process control diagram comparing percentage of triaged before the earthquake, weeks around the earthquake and the period after the earthquake. Means are calculated using data from each week in these periods. The earthquake on 25th of April (black arrow) and 12th of May (orange arrow) are shown. LCL= lower control limit, UCL= upper control limit

The period "before the earthquake" is defined as 5th of March to 22nd of April (week 10 to 16). The implementation of triage was at his time performed, but the system was only used in a small scale. The mean triage percentage for this period is 30%. The period "weeks around the earthquake", defined as 23th of April to 10th of June (week 17 to 23), contain the earthquake and the weeks after. In this period the data is largely incomplete and the process is unstable. Some weeks after the earthquake period the process stabilizes and a new mean is formed. The period "after the earthquake", defined as 11th of June to 30th of September (week 24 to 39) represent quite a stable process with a mean triage percentage at 71%. We have chosen to present the results of week 29 and 30 graphically (dotted line) since this is a good example of a special cause variation, an unnatural variation due to a change that have not previously been typical in the regular process. The cause of the low triage percentage these weeks is the lack of triage forms (Appendix 2), and consequently, very few patients were triaged. However, we have chosen not to use the data from these "no-paper"-weeks in the SPC-calculations and the statistical calculations, since the cause is known and the calculations of mean would be strongly affected. Although, if included in the calculations the mean increases to 66% (S.D. 19,5), which is still significant (p<0,001).

After the earthquake, the mean increased significantly (Table 1) from the period before the earthquake with 30% (S.D. 14,2) to the period after the earthquake with 71% (S.D. 13,1).

Table 1: Comparison of triage percentage in the period before the earthquake and after the earthquake.

	Before the earthquake		**After the earthquake**		***p***
	Mean [%]	S.D.	Mean [%]	S.D.	
Proportion of ER patients with documented triage	29,6	14,2	70,5	13,1	<0,001

Population

The total number of triaged patients, stratified by gender, and the distribution of triage categories is presented in Table 2. The total number cases were 3644 (48%) in the period 5th of March to 30th of September 2015. From the total patient population 820 (23%) were triaged in the most severe categories red or orange (Table 2). 1296 patients (36%) were triaged as yellow while 1528 patients (42%) where triaged as green.

Table 2: Characteristics of the study population, including distribution of the triage categories green, yellow, orange and red and stratification by gender.

	Age	Triage "yes"	Green	Yellow	Orange	Red
Included patients 7560	Median 31 Range (0-99)	3644 (48,2%)	1528 (41,9%)	1296 (35,6%)	585 (16,1%)	235 (6,4%)
Female 3762 (49,8%)	Median 30 Range (0-93)	1892 (50,3%)	772 (40,8%)	699 (36,9%)	301 (15,9%)	120 (6,3%)
Male 3719 (49,2%)	Median 31 Range (0-99)	1723 (46,3%)	744 (43,2%)	586 (34,0%)	279 (16,2%)	114 (6,6%)

Women and men are equally represented in the study population and females and males are equally being triaged in the ER. The distribution of the triage categories is also quite similar, when comparing men and women. Information on gender was lacking in 79 records.

Triage in children and adults

The adherence to triage in children compared to adults is presented in Figure 4. Of the total population presenting in the study period nearly 82% (*n*=6158) were adults (above 16 years) and 17% (*n*=1281) were children (0-15 years). 121 records had no registered age.

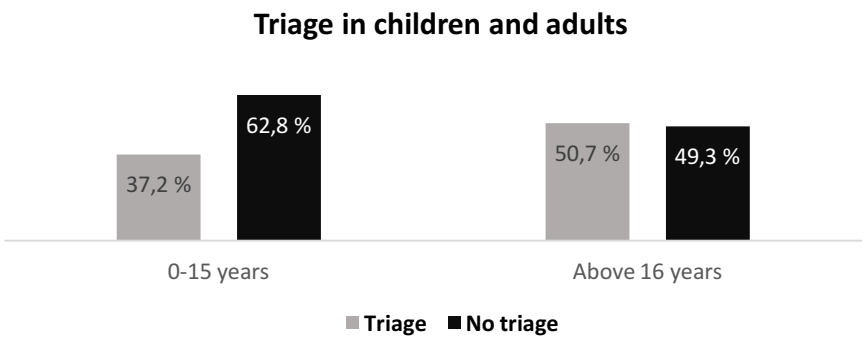

Figure 4: Triage in children (0-15 years) and adults (> 16 years).

The results show a rather large difference in triage performed on the adult and pediatric population. Over 60% of the children have not been triaged, but more than half of the adult population has a registered triage category.

Figure 5 shows how the triage categories are distributed among the pediatric population (left) and adult population (right). In the pediatric population 69 patients (15%) were triaged in the category red or orange, while 24% (*n*=736) of the adult population was in these most severe categories. In addition, the pediatric population has a greater share of patients in the green category (51%) compared to the adult population (41%).

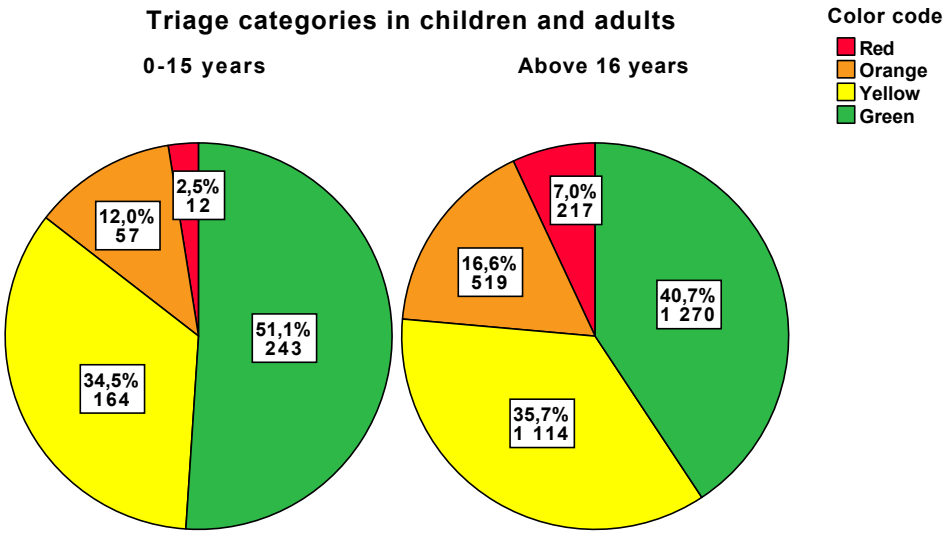

Figure 5: The distribution of triage categories in children (0-15 years) and adults (above 16 years). Percentage and number of cases are shown.

In the triage paper children have their own page or section for triage, called "RETTS-p" (RETTS-pediatrics) (Appendix 2 and 3). The vital parameters vary in the different triage categories, depending on the child's age. E.g. a pulse of 75 gives red category for a one-month old baby and green category for a one-year-old baby. When studying the records, we noticed that the page or section for RETTS-p were rarely filled out, however, the vitals were written in the adult part of the triage paper.

Triage by work shifts

The distribution of triaged patients according to the work shifts is presented in Figure 6 and shows that this has changed over time. In the total study period the percentage of triaged cases was 66% (*n*=1454) on the day shift, in the afternoon (13:00-18:59) the triaged share was 52% (*n*=1080) and 48% (*n*=912) on the night shift. In March 2015, when triage was quite new in the ER, there was a rather large difference between triage done on the day shift (52%) compared to the night shift (7%). Together with an increase in overall triage, this gap has evened out during the period with the triage numbers from September being 77%, 73%, 68% on the day-, afternoon- and night shift respectively.

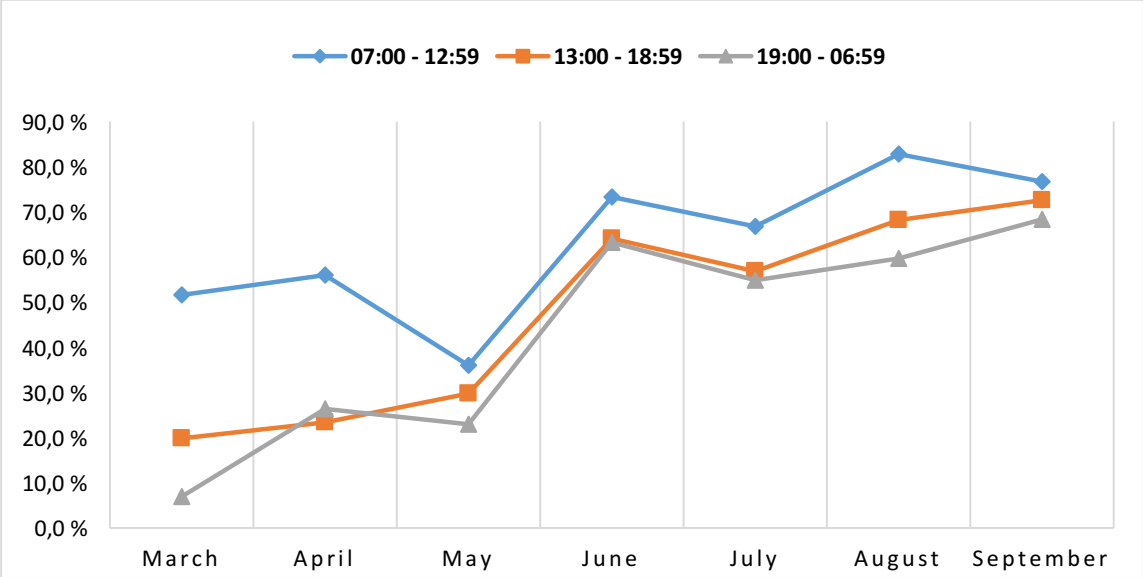

Figure 6: The monthly percentage of triaged cases distributed by work shifts from 5th of March to September 30th 2015.

Figure 7 shows how patient cases present in the triage categories during an average day. The categories are quite evenly distributed; the only noticeable difference is a slightly larger amount of cases in the red and orange categories in day time (25%) compared to the afternoon and night shift, with 20% and 21% respectively. In 1381 patients (18%) information did not include time of admittance. Of the triaged population, 198 patients (5%) were missing time of admittance in their records.

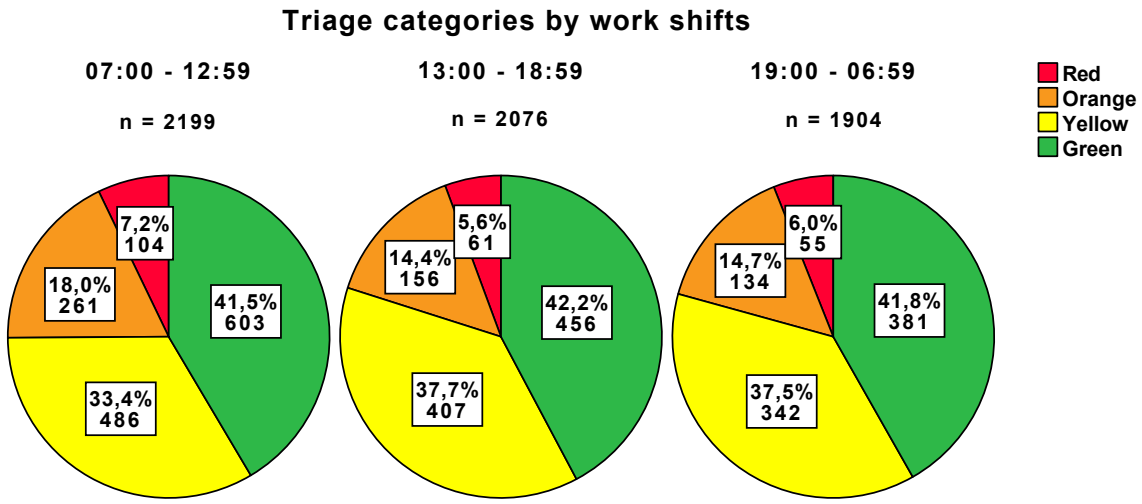

Figure 7: Pie charts showing distribution of color categories related to work shifts.

Qualitative observations in the ER

The role of buildings - Emergency Room at Dhulikhel Hospital

The rebuilding of the ER to different zones was finished in March/April 2015. The new and expanded ER has a capacity of 23 beds: 2 beds in the shock room, 10 in the orange/red zone, 8 in green/yellow, and in addition 2 obstetrical beds and one poison bed. Our observation is that the shock room equals the red zone, and the orange/red zone (Figure 1, p. 12) is used as the orange zone. On a normal day the ER is staffed by two nurses, one or two paramedics, two medical officers and two intern doctors. There is one senior consultant who works 8 am–16 pm on weekdays only. The nurse's main tasks are to measure vitals, collect basic patient data, do triage, draw blood and start intravenous fluid therapy. The paramedics in the ER do most of the same tasks as the nurses and also sometimes more tasks directed towards patient treatments, helping out where needed.

The triage room

The triage room includes a counter and a single bed to assess vitals and patient history. The triage room was one of the first changes in the new ER related to the current project, and was finished built in the end of February 2015. However, the door into the triage room was not built until July 31st. Regardless of this, it was possible to use the triage room from a door through the Minor surgery room (Figure 1, p. 12).

The purpose of the triage room was that every patient where to present at one area where vital parameters and history is taken, triage form filled out, and subsequently direction of patients to the different zones depending on their designated color code. The original plan was that the triage officer would be on-duty in the triage room at day time. Other staff were also encouraged to do triage, especially during evening- and night time, when the triage officer was not on duty.

Our observation was that the triage room was not in use during our stay. Anecdotal evidence supported this, saying the triage room was only used for a couple of weeks after it was built, and a couple of weeks after the door came. Triage is usually performed bedside in the orange zone. The orange zone is the old ER hall and still contains the reception desk and the door to the orange zone is the original ER entrance (Figure 1, p. 12). The assessment routine is that patients present directly to the desk in the orange room, get a bed where triage is undertaken and usually get redirected to appropriate zone.

Emergency symptoms and signs (ESS)

When studying the records, we noticed that the fields for emergency symptoms and signs (ESS) were left blank (Appendix 2). A folder with a list of the ESS algorithms was placed in the ER during the implementation period in October 2014. However, when asking the staff about this, they said that they do not use ESS when triaging patients.

New triage paper

The new two-paged triage paper was introduced the 31st of July 2015 (Appendix 3). We cannot see any significant or qualitative change in the triage percentage after that.

Semi-structured interview

Six senior consultants from the respective departments; pediatrics, obstetrics and gynecology, orthopedics, anesthesia, surgery and internal medicine, were interviewed. The interviews were performed in a private room with one consultant at a time.

During the semi-structured interviews, we discovered that all the interviewed consultants were aware that triage training had been performed among the emergency care staff approximately one year ago. None of them had been a participant or directly involved in the training. When asking if they have noticed any difference after the implementation of triage, most of them answer positively affirmative. Some of the doctors were also aware of the rebuilding of the ER and introduction to new triage forms.

> "People have realized the importance of triage and systematically sorting of patients"
>
> "Efficiency has become in focus"
>
> "The sickest patients will be given higher priority to a greater extent than before"

When inquiring the doctors about what is good with the process now, and what could have been even better, some ideas emerged. Five out of six interviewee highlighted that high turnover of staff in the ER is a challenge to continuity, and that consequently more frequent training among staff should be carried out. Several consultants spoke of the importance of promoting triage and promoting why it is such an advantageous system to use.

> "All the new nurses, paramedics and doctors should get a basic introduction to triage when arriving at the ER"
>
> "Every doctor should know that when it is a red patient, urgent help is necessary."
>
> "It seems like green patients sometimes get neglected, and stay in the ER for a long time without supervision. It is important for the staff in the ER to know that the patient situation can change, and that nurses and doctors have to take rounds and do re triage often."

The architecture and location of the triage room was emphasized by a couple of consultants as a weakness in the ER, and that the triage could be done better with better premises and if every patient had to go through the triage room before getting a bed in the ER.

> "It is like a detour. The patients have to go in, out, and then in again"

Three of the interviewees spoke spontaneously of the relation between triage and the earthquake.

> "During the earthquake a lot of the staff saw that triage was useful, and that triage made the patient treatment better and efficient."

Questionnaire

A survey about triage was conducted among the ER staff and the consultants. The survey response rate was 100% of those approached. Eight nurses and eight paramedics answered the questionnaire (Appendix 4), whom all perform triage as a part of their every-day duties in the ER. Thirteen doctors also participated in the survey, among these five medical officers and two intern doctors in the ER, as well as six senior consultants from other departments. Although doctors do not perform triage, and doctors from other departments may know little about the circumstances in the ER, the aim was to get a view of their understanding and perceptions of triage. Since the questionnaire was anonymous, the different doctors are presented in the same group in the bar charts (Figure 8-13).

All respondents (*n*=29) knew about triage and knew what triage is and 27 out of 29 respondents works or have previously worked with triage in some setting. One nurse and one doctor who completed the questionnaire had not worked with triage.

The respondents were further asked to rate the level of agreement on six statements (Figure 8-13) regarding the introduction of triage. These survey responses where recorded using a scale from "strongly agree", "agree", "uncertain" and "disagree", to "strongly disagree".

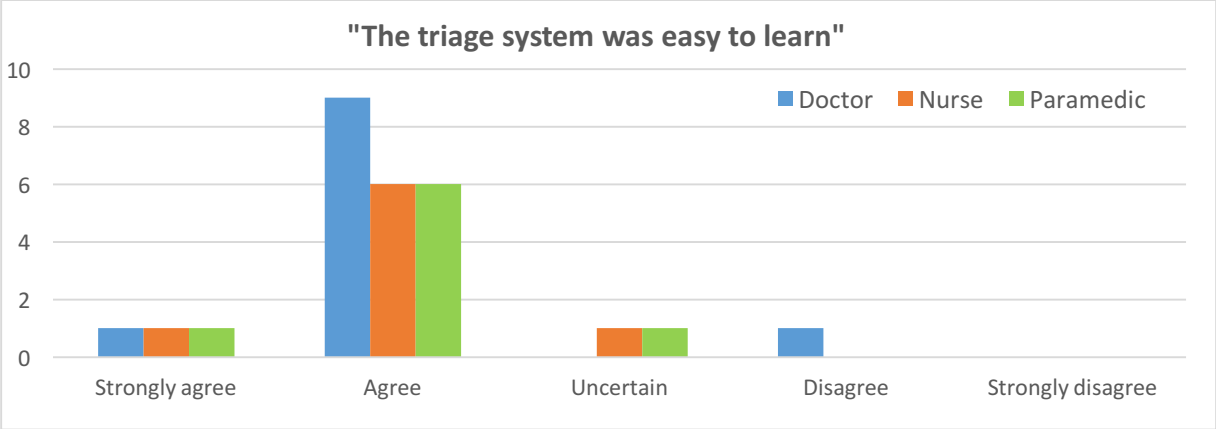

Figure 8: Distribution of responses to statement one

Over 80% (24/29) thought the triage system was easy to learn, but among these only three people strongly agreed (Figure 8). One doctor disagreed.

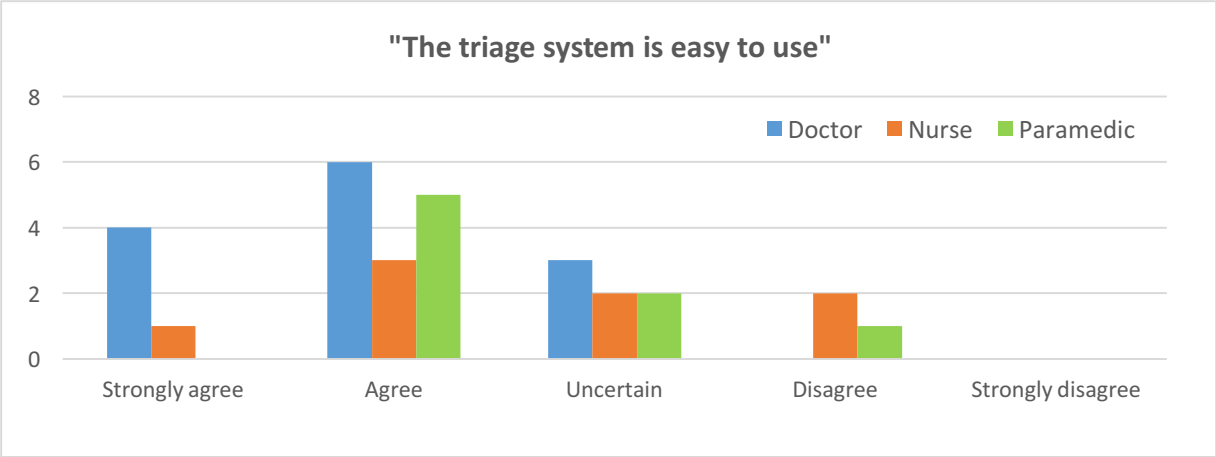

Figure 9: Distribution of responses to statement two

Regarding the statement "The triage system is easy to use" (Figure 9) the answers were more scattered. Most of the doctors (10/13) thought the system is easy to use. Slightly more than half of the nurses and paramedics agreed that it is easy to use. 7 of 16 of the "triage staff" did not agree on this statement, thus thinking RETTS is difficult or challenging to use.

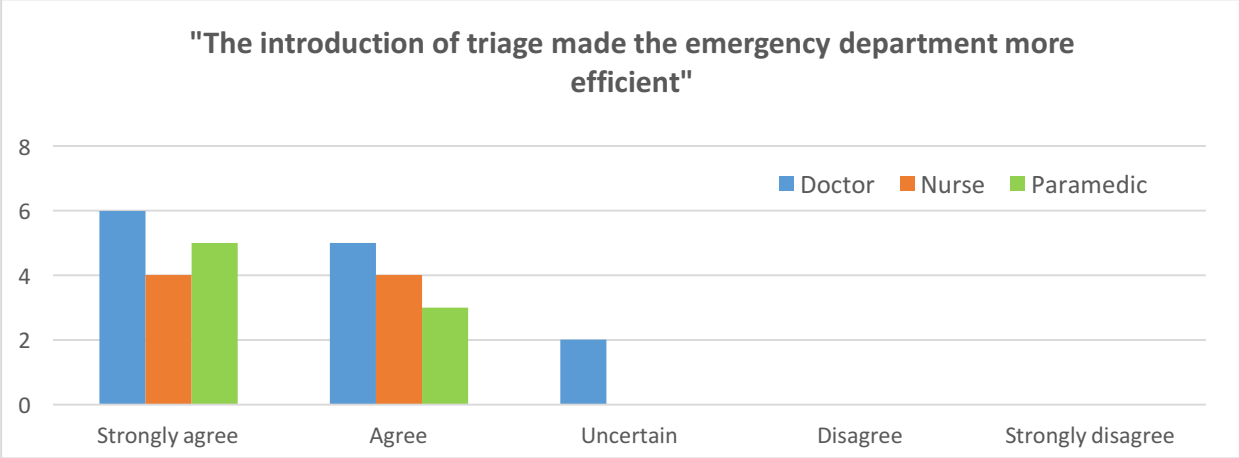

Figure 10: Distribution of responses to statement three

The majority of the staff (93%), both in the ER and doctors from other departments, thought that the introduction of triage increased the ER efficiency (Figure 10).

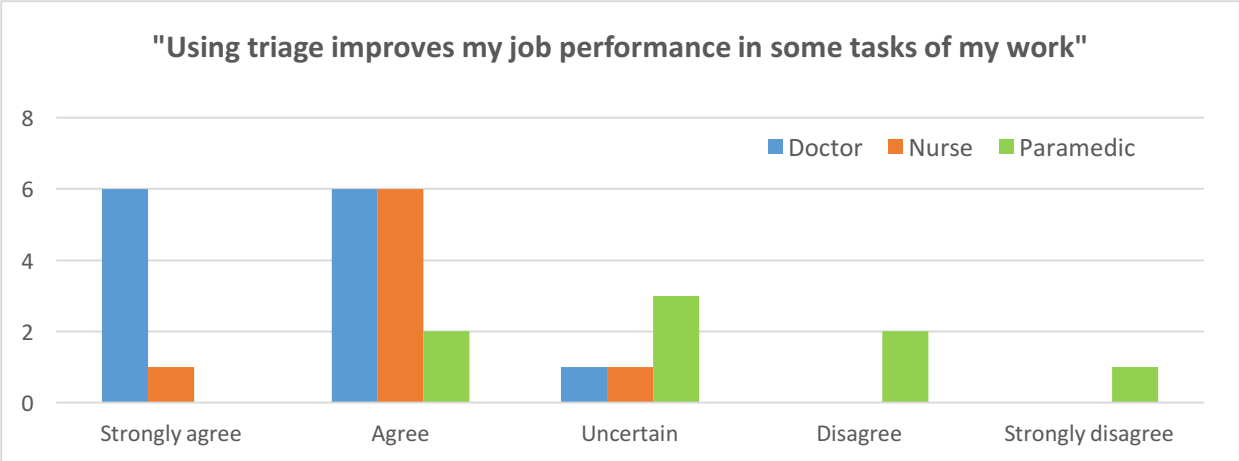

Figure 11: Distribution of responses to statement four

Regarding the statement concerning if triage improves job performance, it was seen a divergence between the different work groups (Figure 11). 12 of 13 doctors thought triage improves their job performance, and among these half of the doctors strongly agreed. Among the nurses 7 out of 8 agreed. The paramedics are the group that stood out, where 6 out of 8 did not agree that triage improves their job performance.

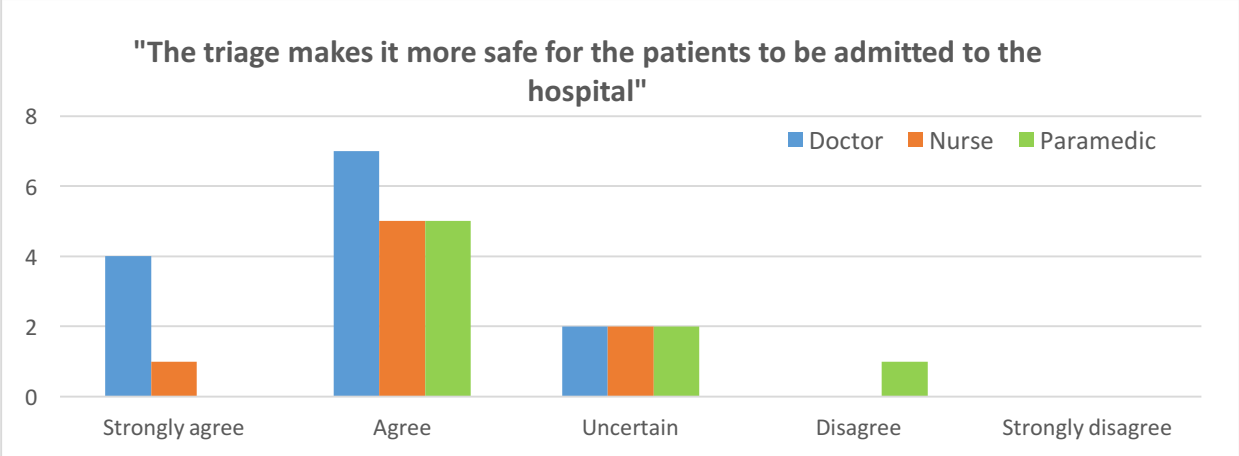

Figure 12: Distribution of responses to statement five

The overall agreement regarding whether triage makes it more safe for the patients to be admitted were 76% (22/29) (Figure 12). 7 of 29 DH staff were not certain that the safety has become better.

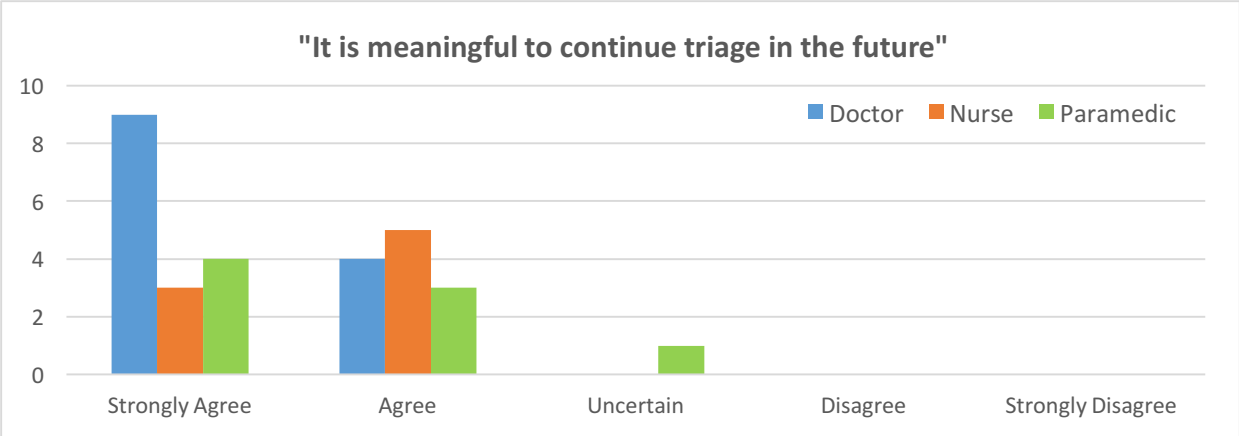

Figure 13: Distribution of responses to statement six

Nearly 100% of the staff (28/29) thought that it is meaningful to continue doing triage (Figure 13), where more than half of these strongly agreed.

Discussion

After the implementation of triage, it took several months for the staff in the ER to start using the system. In the period before the earthquake (March–April) about one in three patients were triaged, a number much lower than the anticipated 80%. However, in the period after the earthquakes (June–September) the process stabilized with high adherence (close to 80%) to the triage procedures among the staff. We conclude that is is likely that the earthquake had a positive effect on this development and that this critical situation made the staff of DH see the value of triage. In addition, the chief consultant admonished all the staff to do triage after the earthquake. Most of the staff thinks that triage is advantageous, but it appears that the system is complicated and difficult to use, especially factors related to ESS algorithms and pediatric triage.

Implementation of triage and the 2015 earthquake

The triage system was not adopted at DH until four months after the training, and it is likely that this delay had a negative impact on the implementation. Even though the triage officer was hired in February and all the staff were encouraged to do triage, the share of triaged patients did not increase very much at the outset. The period March to April (before the earthquake) was therefore a stable, but poor process. A part of the DHECARE-team from Norway travelled to Dhulikhel in April 2015, with the return to Norway just a few days before the earthquake that struck Nepal the 25th of April. The team arranged several meetings about triage, both with the hospital administration and with the staff working in the ER. The goal with this visit was to make the performance of triage better. One can assume that this visit may have affected the implementation of triage during and after the earthquake at DH positively, by refreshing the knowledge and making the staff more alert.

The earthquake period was a state of emergency, and with all the patients pouring in it was both chaotic and hectic. Dhulikhel Hospital describes the earthquake and the subsequent days on their homepage (26):

> As the staff in the hospital tried to quell the panic and prepare for the incoming flux of the injured, vehicles started arriving at the gate. The injured were met at the gate and given tetanus and Diclofenac shots. Tents were bought and set up in the front courtyard of the hospital. After two hours, the number of patients escalated to the point where almost every space in the courtyard was occupied. All the staff were called back to report for duty. (…) The second day the influx of the injured reached to the point where due to lack of space, some of the injured were relocated to an army barrack in Dhulikhel. (…) Fearful of the recurrent aftershocks, people slept outdoors in spite of the biting cold and incessant rain. (…) Most had been injured by falling objects as they ran out of their house or buried alive under the debris and rubbles.

Through the interviews with the staff it emerged that the number of patients presenting to the ER on the day of the earthquake and the weeks after is unknown, and they believe that more than half were not registered. Consequently, the documentation is poor and it is difficult, maybe impossible, to study this period in retrospect in regards of triage. However, it must be emphasized that even though the documented triage percentage was less than 20% during the earthquake weeks, the majority of the patients were actually triaged with a simplified triage-system. The triage zones and the color-coded wristbands made efficient triage and patient flow possible. A study by Djalali et al. (2011) shows that the key elements in medical response to disasters are triage and immediate treatment. Triage is a vital issue in a disaster plan, and the lack of triage could affect medical response at all levels (27). We therefore assume that both the implementation of a triage system some months in advance and the visit just a week before the earthquake had impact on the way the staff at DH handled this chaotic situation.

Some weeks after the earthquake we can see a positive trend in triage percentage in how the share of patients markedly increases. This could be explained by the meeting the ER staff had where every nurse and paramedic strictly were instructed to do triage, and the fact that the staff experienced the value of triage in how the earthquake casualties were managed. The tragic event may have enhanced an ownership to the triage-system and increased the feeling of responsibility among the staff.

In our study period after the earthquake the process was stable with a mean triage percentage at about 70%. The DHECARE project had 80% as a goal when starting this quality improvement project. Consequently, our results show that DH is close to reaching this goal. However, even though the ER staff document triage, the RETTS protocol is not completely followed. The triage is only based on vital parameters, and ESS is not considered (discussed later). In addition, the patients are not sorted as strictly as after protocol. No matter in which triage category the patients fit, they still get assigned to a bed in the orange zone, if available. The fact that the orange zone used to be the ER and that the monitors and the staff stay there, could be an explanation for this. The gross decrease in triage percentage because of the lack of triage paper in week 29 and 30, shows that the process is vulnerable. Shortage of paper can make such a big difference and have a big negative impact on the process.

RETTS in a limited-resource setting

The questionnaire revealed that the majority of the staff think RETTS is easy to learn, conversely, almost half the triage staff think the triage-system is difficult to use. Most of the doctors, however, think the system is easy to use, although performing triage is not a doctor's duty. This discrepancy shows that despite being easy comprehensible, RETTS may be too complex and time-consuming for the Nepali setting with overworked ER staff and limited medical resources. This may explain why 6 of 8 paramedics do not agree that triage improves their job performance. The fact that the ER staff does

not use ESS could be explained by the fact that it consists of many algorithms, which makes the RETTS-system complex.

A possible solution is to implement an easier and more context-friendly triage-system. The staff do want to continue triage in the future, and this may justify such a change. RETTS has been validated and well established in a Scandinavian setting (8, 19, 28), and have not previously been implemented in a less developed country. The South African Triage Scale (SATS) is one of few validated triage-systems adapted to resource-poor settings. SATS uses a basic scoring system based on physiology, the Triage Early Warning Score (TEWS) (Appendix 5), in conjunction with a short list of important clinical discriminators to triage patients into five color categories, similar to RETTS (29, 30). The system combines both vital parameters and symptoms in a simple and quick way, and is easy to use (30, 31).

The SATS has been successfully implemented in other developing countries such as Malawi (32), Somaliland (33), Brazil (31) and Pakistan (34). A study in Botswana found reduced over-triage and under-triage when they adopted the SATS, compared to the contrary in their previous triage system (35). Médecins Sans Frontières ("Doctors without Borders") are impressed with the results from these settings, and want to adopt the SATS system as its standard emergency protocol for resource-poor countries world-wide (31).

Triage training

To have an optimal performance of the triage-system, adequate skills among the staff is essential. Therefore, training is important. It took seven months from the training in October 2014 until all of the staff actually started triaging. The ER staff did not receive additional training. This might help to explain why several deficiencies in triage performance are identified, e.g. ESS is not used. During the semi-structured interviews many consultants mentioned that continuous training of the ER staff is important, and with a high turnover of the ER staff frequent training is required. Studies have shown that *continuous* training among nurses in telephone-triage is important (36).

ESS and triage categories

Both vital parameters and algorithms for symptoms are assessed simultaneously in RETTS, and the highest level of these algorithms is given the final priority level (8). Since ESS is not used in Dhulikhel, only the vital parameters are taken into consideration. However, we observed when a medical condition is obviously serious, e.g. testicular torsion or a cerebral stroke, the patients will have a high priority triage category (orange or red) regardless of normal and stable vitals. Thus, without a systematic ESS evaluation, under-triage in certain serious cases will occur.

A study on triaging patient cases in retrospect in the ER in Dhulikhel was done prior to the implementation (37). This showed that most patients had vital parameters in the green category, however only 5% had green as final triage. This means that many of the patients were triaged up a level because of their ESS in the retrospective triage, which included ESS evaluation. In our study 42% were triaged as green, thus we may assume that some patient cases in the green category should actually be in yellow, or even in the orange category, if ESS was taken in consideration.

On the contrary, both to stratify critically ill patients as well as for predicting mortality, vital signs have been reported to be superior (38). The pre-implementation-study showed that for the red category vital parameters mainly decided the final triage, and only a small amount of patients had an ESS that decided the red category (37). Since DH only use vital parameters in triage we may assume that under-triage occurred to a small extent in this category, and only in cases where an ESS alone decide the red category (e.g. new localized paresis as in suspected stroke).

In our study one in five patients were triaged in the category red and orange. Similar numbers are shown in other studies on triage in Dharan and Patan, Nepal, where the Australasian Triage Scale (ATS) is used. ATS category 1 and 2 is comparable to the RETTS categories red and orange. Of all the patients presented to the ER in a certain time period in these hospitals, 23% were categorized as ATS 1 or 2 both in Dharan (*n*=166)(39) in 2003 and Patan (*n*=452) in 2006 (40). In spite of not using ESS, this may suggest that there was little over- and/or under-triage in these specific categories.

Checking for triage accuracy was beyond the limits of our research, thus is it difficult to draw firm conclusions of how the lack of use of ESS has affected the final triage and patient outcome.

Pediatric triage

Some deficiencies were identified regarding triage of the pediatric population. Only 37% have been triaged, in comparison to more than half of the adult population. This low percentage might make it difficult to know if the distribution of triage categories is correct, and draw any conclusions based on this. Only 12 patients (3%) were in the red category, which differs from the 7% in the adult population. In comparison, a study performed in the emergency department at a Norwegian university hospital shows that more than 30% of patients younger than 16 years of age were triaged to the red level (28). This may be an indication of under-triage among children at DH. Still, it might be difficult to compare our data with Norwegian studies due to the characteristics of the Norwegian Health Care System. In Norway the general practitioners and urgent care centers have a key role as gatekeepers for the specialist health services, including the EDs (41), one can therefore see a high percentage of high level acuity patients in the EDs compared to countries where general practitioners to not have this function (28).

In addition to the poor documentation, the children's vitals are mainly, with rare exceptions, filled out in the adult section of the RETTS paper. Consequently, the vitals according to age are not accounted for, and logically this should lead to over-triage. E.g. a one-year-old has a normal respiration rate up to 30, and higher respiration rate than 30 will lead to a red triage category according to the adult algorithm. Nonetheless, over-triage is not an issue in the present study when we observe the low numbers of orange, and especially red pediatric patients. We may therefore expect that a considerable amount of the children without documented triage are actually in a high triage category. The reason for the inaccuracy in documentation is not observed, and we can therefore not explain this. However, we think that this might be yet another indication that the RETTS may be too complicated to use in this setting, and also that the training specifically towards pediatric patients have not been sufficient.

Triage by work shifts

Of the 1391 patients that were lacking time of admittance 697 were earthquake victims, where time is irrelevant as the hospital was in a state of emergency. Consequently, the time of admittance is well documented. The triage percentage compared to work shifts is almost at the same level at the end of our study period. Yet there is still a difference, with 8% less triage in the night shift versus day shift. The workload is almost the same during day (n=2199) and night (n=1904) and the ER is less staffed with 1-2 less nurses or paramedics at night. In addition, there is only one senior consultant, who works day time only. This relatively considerably lower coverage of staff per patient during night shifts may explain the lower triage percentage at night.

The triage room

The triage room is not used by the ER staff. This may be due to the unfavorable position of the triage room and that there are other possible entry points to the ER. Ideally, patients would only be able to enter the ER from the triage room, ensuring that the triage post was the first point of contact. Having this kind of controlled ER entrance would increase the amount of triaged cases.

Strengths and weaknesses

Dhulikhel hospital is s relatively well equipped and well staffed hospital in a low-income country. It is a non-profit hospital, health care is inexpensive and most of the patients are poor. The pre-hospital systems are still underdeveloped.

This study is representative for Nepal and other low-income and developing countries, particularly urban hospitals. We studied an unselected patient population presenting to the ER, thus makes this study comparable in similar populations in other settings.

Chief complain and/or working diagnosis when patients presented in the ER were not registered. Subsequently, the burden of diseases within each triage category cannot be studied. Neither was time from triage to treatment documented. Hence, whether the patients were seen within the recommended benchmark times for their RETTS category were not studied. This would provide valuable information regarding the quality of emergency care.

The ER paper records from February 1st 2015 to September 30th 2015 were kept in a locked cabinet outside the ER sorted by month, with the dates attached together by string. Since the records only were in paper and not electronically registered, it is difficult to know if any records were missing.

As the handwriting sometimes was quite difficult to understand, there might be some collected data errors based on wrong interpretation.

Our aim was to look at the whole implementation process from the training of triage in October 2014 and onwards, but there was no documentation on triage before February 2015. Unfortunately, we were not able to identify the cause(s) for this, in despite of asking several of the hospital staff. In addition to our findings there may also be other factors that have affected the implementation process, which we do not know of.

Conclusion

Many countries are lacking training in basic lifesaving protocols and triage-systems, where lack of the latter has shown to result in potentially harmful delays in treatment. Therefore, the focus on sharing the knowledge of emergency medicine in the developing world has gained increasing priority.

This quality improvement project evaluation show that when implementing a new triage-system in a developing country, it is crucial with a dedicated staff who see the value of triage. Ownership of the RETTS-system did not accrue in the beginning of the implementation process; a serious event and change of staff assignments were necessary in this setting. We believe that the implementation of triage some months in advance had a positive impact on the way the staff at DH handled the earthquake in April 2015.

In spite of a relatively high share of triaged patients one year after implementation, several errors in performance and documentation of RETTS were revealed, especially considering ESS algorithms and pediatric triage. To improve triage knowledge and skills among the staff further training is needed. It may be essential to rebuild the ER, mainly the triage room, to assure performance of triage and enhance efficiency.

The RETTS might be too complex and time-consuming in a setting with limited medical resources. In Nepal and in other similar settings, it is important that the triage system is quick and easy to use. Consequently, a possible solution is introduction of a validated triage-system for resource-poor settings, such as the South African Triage Scale. This is ought to be discussed by the DHECARE team and the ER staff.

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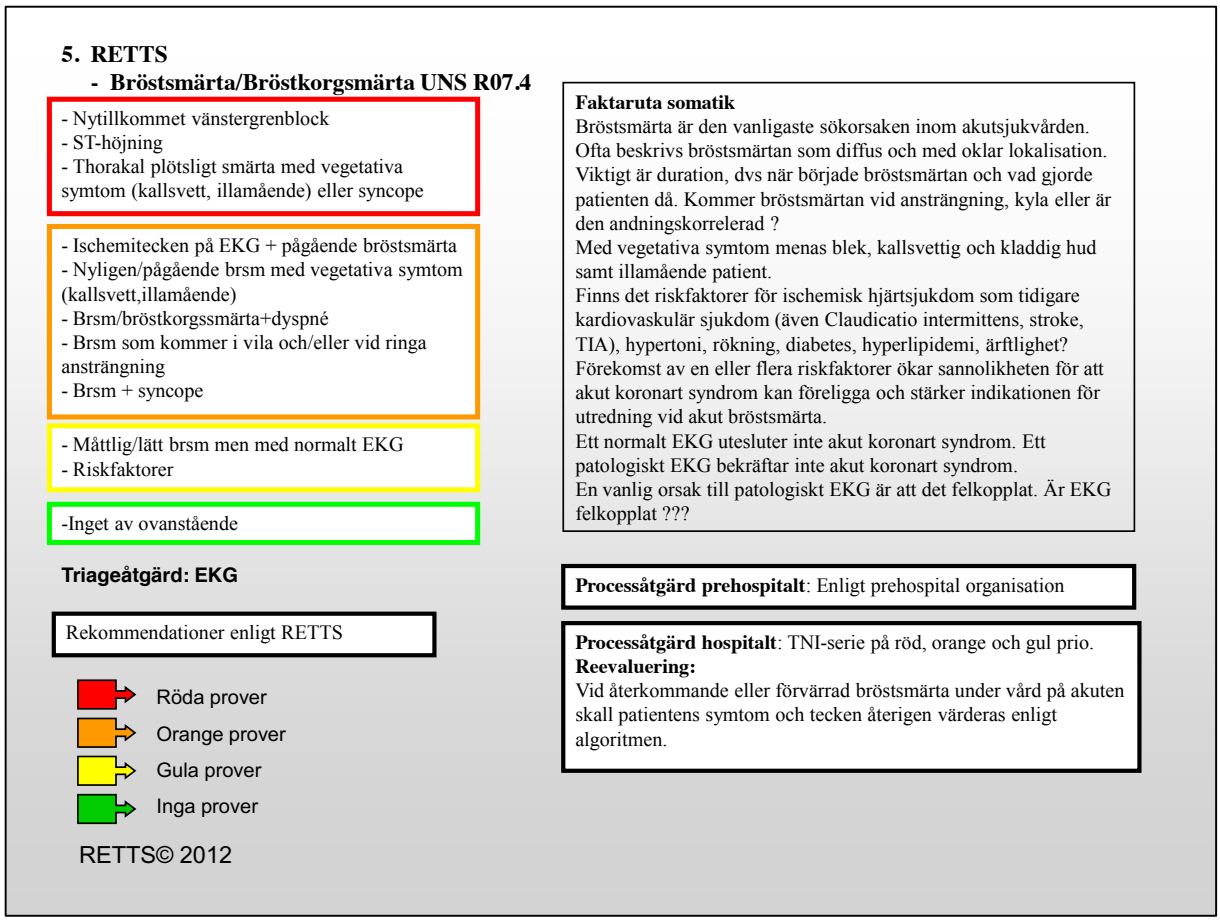
Appendix

Appendix 1: Example of an ESS algorithm (no. 5 of 43) specific for RETTS [In Swedish].



Appendix 2: RETTS paper "Emergency assessment and treatment record", p. 1/5
In use from February to end of July 2015

EMERGENCY ASSESSMENT AND TREATMENT RECORD

DHULIKHEL HOSPITAL
KATHMANDU UNIVERSITY HOSPITAL

GPO 11008, Kathmandu, Nepal
Email. dhos@mail.com.np
Tel. (977)-11-661497
Fax. (977)-11-661707

Regd No. _____ Date _____

Name _____ Age _____ Sex _____

Address _____ Accompanied by _____ Contact No. _____

Time at Presentation _____

TRIAGE

A	Airways:		☐ Obstructed airway ☐ Stridor			☐ No comment
B	O_2 SAT:	RR:	☐ RR>30 or <8 ☐ SpO_2 <90% with O_2	☐ RR>25 ☐ SpO_2 <90% without O_2	☐ SpO_2 90-95% without O_2	☐ RR8-25 ☐ SpO_2 <95% without O_2
C	Pulse:	BP:	☐ Pulse > 130r. or >150irs. ☐ BP <90mm Hg	☐ Pulse > 120 or <40	☐ Pulse > 110 or <50	☐ Pulse 50-110
D	GCS:		☐ Unconscious/GCS<9 ☐ Seizures	☐ Somnolence/GSC 9-14	☐ Acute desoriented	☐ Alert
E	Temp:	☐ ECG	.....	☐ Temp. >41° or <35°	☐ Temp. >38.5°	☐ Temp. 35-38.5°
ESS-algorithm RETTS			☐ ESS	☐ ESS	☐ ESS	☐ ESS
NRS-pain		Triage level	☐ *Red priority*	☐ *Orange priority*	☐ *Yellow priority*	☐ *Green priority*

Triage: Time: Sign:

Retriage:

Time: Sign: Time: Sign:

DH 18

Appendix 2: RETTS paper "Emergency assessment and treatment record", p. 2/5

EMERGENCY ASSESSMENT AND TREATMENT RECORD

DHULIKHEL HOSPITAL
KATHMANDU UNIVERSITY HOSPITAL

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Email. dhos@mail.com.np
Tel. (977)-11-661497
Fax. (977)-11-661707

Regd No. _____ Date _____

Name _____ Age _____ Sex _____

Address _____ Accompanied by _____ Contact No. _____

Time at Presentation _____

TRIAGE

A			☐ Obstructed airway			☐ No comment
B	O_2 SAT:	RR:	☐ SpO_2 ☐ RR	☐ SpO_2 ☐ RR	☐ SpO_2 ☐ RR	☐ SpO_2 ☐ RR
C	Pulse: Pulse korr:	BT (map): Cap.time:	☐ Pulse	☐ Pulse	☐ Pulse	☐ Pulse
D	GCS:	V M	☐ Unconscious ☐ Seizures	☐ Somnolence ☐ Tired/unwilling to feed	☐ Tired/week ☐ Alert 0-2 months	☐ Alert
E	Temp:	Pain		☐ Temp	☐ Temp	☐ Temp
ESS Retts-p:			☐ Red ESS	☐ Orange ESS	☐ Yellow ESS	☐ Green ESS
Triage level						

Other observations:

Retractions: jug./sub./inter.	Moaning ☐	Dry skin ☐	Skin colour:
	Wheezing ☐	Sunken eyes ☐	
Stridor: Expir./inspi	Stuffed nose ☐	Dry mucus membrance ☐	
Cough: Dry/mucus/«barking»	Nasal flaining ☐	Sunken fontanelle ☐	Skin temp:
Rash			

Appendix 2: RETTS paper "Emergency assessment and treatment record", p. 3/5

RETTS-p vitale signs

Heart rate should be corrected for temperature.
Pulse by rebel child should generally not be used as the basis for triage

0 - 2 months

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RR<20 or >80 SpO2 <93% With O2	RR<30 or >65 SpO2 <93% Without O2	RR30-65 SpO2 93-100%	-
C	Pulse < 80 or >210	Pulse < 100 or >180	Pulse 100-180	(Pulse 100-165)*
D	GCS <11 Ongoing seizures	GCS <11-13 Tired/unwilling to feed	Alert	-
E	-	<36ºC or >38ºC	Temp 36ºC-38ºC	-

1 year

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RR<15 or >55 SpO2 <93% With O2	RR<20 or >65 SpO2 <93% Without O2	RR <20 or > 45 SpO2 93-94%	RR 25-40 SpO2 95-100%
C	Pulse < 60 or >190	Pulse < 75 or >170	Pulse <90 o >140	Pulse 90-140
D	GCS <11 Ongoing seizures	GCS <11-13	Tired/week	Alert
E	-	<35ºC or >41ºC	-	35ºC-41ºC

3 - 5 months

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RR<20 or >75 SpO2 <93% With O2	RR<25 or >65 SpO2 <93% Without O2	RR <30 or >55 SpO2 93-94%	RR 30-55 SpO2 95-100%
C	Pulse < 70 eller >210	Pulse < 80 or >180	Pulse <100 or >160	Pulse 100-165
D	GCS <11 Ongoing seizures	GCS <11-13	Tired/week	Alert
E	-	<36ºC or >39ºC	-	36ºC - 39ºC

2 year

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RR<12 or >45 SpO2 <93% With O2	RR<18 or >40 SpO2 <93% Without O2	RR <20 or > 35 SpO2 93-94%	RR 20-35 SpO2 95-100%
C	Pulse < 60 or >175	Pulse < 75 or >145	Pulse <85 eller >135	Pulse 85-135
D	GCS <11 Ongoing seizures	GCS <11-13	Tired/week	Alert
E	-	<35ºC or >41ºC	-	35ºC-41ºC

6 - 12 months

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RR<15 eller >70 SpO2 <93% With O2	RR<20 or >60 SpO2 <93% Without O2	RR <25 or >50 SpO2 93-94%	RR 25-50 SpO2 95-100%
C	Pulse < 70 eller >210	Pulse < 80 or >170	Pulse <90 or >150	Pulse 90-150
D	GCS <11 Ongoing seizures	GCS <11-13	Tired/week	Alert
E	-	<35ºC or >41ºC	-	35ºC - 41ºC

3-5 year

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RF<10 or >40 SpO2 <93% With O2	RR<14 or >30 SpO2 <93% Without O2	RR <18 or > 28 SpO2 93-94%	RR 18-28 SpO2 95-100%
C	Pulse < 60 or >175	Pulse < 60 or >140	Pulse <85 eller >125	Pulse 85-125
D	GCS <11 Ongoing seizures	GCS <11-13	Tired/week	Alert
E	-	<35ºC or >41ºC	-	35ºC-41ºC

12 - 18 months

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RR<8 or >30 SpO2 <93% With O2	RR<10 or >24 SpO2 <93% Without O2	RR <12 or >20 SpO2 93-94%	RR 12-20 SpO2 95-100%
C	Pulse < 40 or >130	Pulse < 45 or >120	Pulse <55 or >110	Pulse 55-110
D	GCS <11 Ongoing seizures	GCS <11-13	Tired/week	Alert
E	-	<35ºC or >41ºC	-	35ºC - 41ºC

6-11 year

	RED	ORANGE	YELLOW	GREEN
A	Obstructed airway	-	-	-
B	RF<8 or >32 SpO2 <93% With O2	RR<12 or >28 SpO2 <93% Without O2	RR <15 or > 24 SpO2 93-94%	RR 15-24 SpO2 95-100%
C	Pulse < 45 or >140	Pulse < 55 or >130	Pulse <65 eller >115	Pulse 65-110
D	GCS <11 Ongoing seizures	GCS <11-13	Tired/week	Alert
E	-	<35ºC or >41ºC	-	35ºC-41ºC

Appendix 2: RETTS paper "Emergency assessment and treatment record", p. 4a/5
Emergency sheet

EMERGENCY ASSESSMENT AND TREATMENT RECORD

DHULIKHEL HOSPITAL
KATHMANDU UNIVERSITY HOSPITAL

GPO 11008, Kathmandu, Nepal
Email. dhos@mail.com.np
Tel. (977)-11-661497
Fax. (977)-11-661707

Regd No. _____ Date _____

Name _____ Age _____ Sex _____

Address _____ Accompanied by _____ Contact No. _____

Time at Presentation _____ Triage Level (1) (2) (3) (4) (5)

Temperature	Pulse	Respiration	Blood Pressure	O_2 Sat.	Weight

EYE OPENING	MOTOR RESPONSE	VERBAL RESPONSE		MOTOR POWER
4 Spontaneous	6 Obeys Commands	3 Flexion to pain	5 Orientated	2 Inappropriate sounds	Arm (R)
3 To voice	5 Localize to pain	2 Extention to pain	4 Disorientated	1 No response	(L)
2 To pain	4 Withdraws to pain	1 None	3 Incomprehensible words		Leg (R)
1 None					(L)

PUPILS
LEFT Size .....Reaction.....
RIGHT Size .....Reaction.....

1 2 3 4 5 6 7 8

C-Spine Precautions:

Presenting Complaint
1.
2.
3.
4.

Initial history and physical assessment

Past medical history

Menstrual history LMP _____ Cycle/Period _____

ALLERGIES

PROV. DIAGNOSIS

INVESTIGATION	EMERGENCY PROCEDURE
HB/TC/DC/BLOOD GROUPING BLOOD SUGAR/UREA CREATININE/Na, K+ AMYLASE/SGOT/SGPT/CK-MB ECG/CXR/X-RayABD./KUB USG Others:	

DH 18

Appendix 2: RETTS paper "Emergency assessment and treatment record", p. 5a/5
Emergency sheet

Time	Medicine/IV Fluids	Dose/Route/Frequency	Sign.

Time	T	P	R	BP	O2 Sat.	Urine	Others	Plan/Advice on discharge

TRANSFER INFORMATION		
Report to	Given by: Report time:	Transfer to: Time:

Expired:	Time :
Cause of death :	
Next of kin Notified ☐Yes ☐No	Relationship/Contact information

ER Paramedic

ER Physician

Consultation by

Appendix 2: RETTS paper "Emergency assessment and treatment record", p. 4b/5
Trauma sheet

EMERGENCY TRAUMA ASSESSMENT AND TREATMENT RECORD

GPO 11008, Kathmandu, Nepal
Email. dhos@mail.com.np
Tel. (977)-11-661497
Fax. (977)-11-661707

DHULIKHEL HOSPITAL
KATHMANDU UNIVERSITY HOSPITAL

Regd No. _____ Date _____

Name _____ Age _____ Sex _____

Address _____ Accompanied by _____ Contact No. _____

Time at Presentation _____ Time of transport accident _____

Primary treatment outside Dhulikhel _____

Occupation (Farmer, driver, School, etc.) _____ Mode of transport to hospital (Ambulance, car, motorcycle, etc.) _____

Temperature	Pulse	Respiration	Blood Pressure	O_2 Sat.	Weight

EYE OPENING	MOTOR RESPONSE		VERBAL RESPONSE		MOTOR POWER	
					Arm R/L	Leg R/L
4 Spontaneous	6 Obeys Commands	3 Flexion to pain	5 Orientated	2 Inappropriate sounds	Ext.	
3 To voice	5 Localize to pain	2 Extention to pain	4 Disorientated	1 No response	Flex.	
2 To pain	4 Withdraws to pain	1 None	3 Incomprehensible words		GCE score ☐☐	
1 None					Triage	

PUPILS
LEFT Size .....Reaction.....
RIGHT Size .....Reaction.....

1 2 3 4 5 6 7 8

C-Spine Precautions:

Loss of consciousness?	☐ YES	☐ No	☐ Unknown	Duration .....
Amnesia?	☐ YES	☐ No	☐ Impossible to asses	
Seizure	☐ YES	☐ No	☐ Unknown	
Influenced by alcohol?	☐ YES	☐ No	☐ Suspected	☐ Unknown
Influenced by drugs?	☐ YES	☐ No	☐ Suspected	☐ Unknown

Normal bowel function ☐ Yes ☐ No

Normal bladder function ☐ Yes ☐ No

Mechanism of injury:

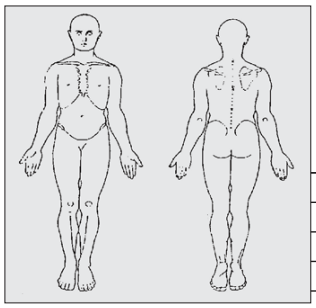
- ☐ Road Traffic accident
  - Hit and run? ☐ Yes ☐ No
  - ☐ Pedestrian
  - ☐ Bicycle
  - ☐ Moped/Scooter
  - ☐ Motorcycle
  - ☐ Car/Jeep/delivery Van
  - ☐ Minibus
  - ☐ Mini Truck
  - ☐ Bus/Truck/Lorry/Tipper
  - ☐ Other .....
- ☐ Fall
  - ☐ From own height and <2m
  - ☐ From a height >2m
- ☐ Fighting/aussalt
- ☐ Burns
- ☐ Work accident
- ☐ Other .....

Where did the injury occur?

- ☐ Home
- ☐ Work
- ☐ Street
- ☐ Leisure activity
- ☐ Other .....

Emergency procedures

- ☐ Dressing
- ☐ Suturing
- ☐ Spliting
- ☐ Bladder catheter
- ☐ IV connection
- ☐ CVP
- ☐ Blood gas
- ☐ Intubation
- ☐ Tracheotomy
- ☐ Thoracic drain
- ☐ Abdominal paracentesis
- ☐ Diagnostic thorcocentesis
- ☐ Relocation of joints
- ☐ Other:.....



Exposure, history and physical assessment

• Head	☐ No	☐ Yes	.....
• Thorax	☐ No	☐ Yes	.....
• Abdomen	☐ No	☐ Yes	.....
• Pelvis	☐ No	☐ Yes	.....
• Extremity	☐ No	☐ Yes	.....
• Spine	☐ No	☐ Yes	.....

Prov diagnosis: _____

Investigation requested: _____

Appendix 2: RETTS paper "Emergency assessment and treatment record", p. 5b/5
Trauma sheet

IV/Medication	Doses	Time	Notes	Signature

Time	T	P	R	BP	O2 Sat.	Urine	Others	Plan/Advice on discharge

Comment/notes/consultation by related Department: _____

Radiology results: _____

Final diagnosis: _____

TRANSFER INFORMATION		
Report to	Given by: Report time:	Transfer to: Time:
Report to	Given by: Report time:	Transfer to: Time:
Deceased:		Time: Date:

Cause of death :
Information:

Relationship/Contact

Next of kin Notified
☐ Yes ☐ No

Patient is admitted to or discharge

Date of discharge

ER Paramedic

ER Medical Officer

ER Physician

Consultation by

Appendix 3: "New" RETTS paper "Emergency assessment and treatment record", p. 1/2
In use from August 201

EMERGENCY ASSESSMENT AND TREATMENT RECORD

GPO 11008, Kathmandu, Nepal
Email. dhos@mail.com.np
Tel. (977)-11-490497
Fax. (977)-11-490707

DHULIKHEL HOSPITAL
KATHMANDU UNIVERSITY HOSPITAL

Regd No. _____ Date _____

Name _____ Age _____ Sex _____

Address _____ Accompanied by _____ Contact No. _____

Time at Presentation _____ Triage Level (1) (2) (3) (4) (5)

TRIAGE-A

A		☐ Obstructed airway ☐ Stridor				☐ No comment
B	O_2 SAT: RR:	☐ RR>30 or <8 ☐ SpO_2 <90% with O_2	☐ RR>25 ☐ SpO_2 <90% without O_2	☐ SpO_2 90-95% without O_2		☐ RR8-25 ☐ SpO_2 <95% without O_2
C	Pulse: BP:	☐ Pulse > 130r. or >150irs. ☐ BP <90mm Hg	☐ Pulse > 120 or <40	☐ Pulse > 110 or <50		☐ Pulse 50-110
D	GCS:	☐ Unconscious/GCS<9 ☐ Seizures	☐ Somnolence/GSC 9-14	☐ Acute desoriented		☐ Alert
E	Temp: Pain	.....	☐ Temp. >41° or <35°	☐ Temp. >38.5°		☐ Temp. 35-38.5°
ESS-algorithm RETTS		☐ ESS	☐ ESS	☐ ESS		☐ ESS
NRS-pain	Triage level	☐ *Red priority*	☐ *Orange priority*	☐ *Yellow priority*		☐ *Green priority*

Triage: Time: Sign:

Retriage:

Time: Sign:

Time: Sign:

TRIAGE-P

A	Airways:	☐ Obstructed airway				☐ No comment
B	O_2 SAT: RR:	☐ SpO_2 ☐ RR	☐ SpO_2 ☐ RR	☐ SpO_2 ☐ RR		☐ SpO_2 ☐ RR
C	Pulse: BT (map): Pulse korr: Cap.time:	☐ Pulse	☐ Pulse	☐ Pulse		☐ Pulse
D	GCS: V M	☐ Unconscious ☐ Seizures	☐ Somnolence ☐ Tired/unwilling to feed	☐ Tired/week ☐ Alert 0-2 months		☐ Alert
E	Temp: Pain		☐ Temp	☐ Temp		☐ Temp
ESS Retts-p:		☐ Red ESS	☐ ESS	☐ ESS		☐ ESS
Triage level		☐ *Red priority*	☐ *Orange priority*	☐ *Yellow priority*		☐ *Green priority*

Other observations:

Retractions: jug./sub./inter.	Moaning ☐	Dry skin ☐	Skin colour:
	Wheezing ☐	Sunken eyes ☐	
Stridor: Expir./inspi	Stuffed nose ☐	Dry mucus membrance ☐	
Cough: Dry/mucus/«barking»	Nasal flaining ☐	Sunken fontanelle ☐	Skin temp:
Rash			

DH 18

Appendix 3: "New" RETTS paper "Emergency assessment and treatment record", p. 2/2

Time at treatment: Weight:

EYE OPENING	MOTOR RESPONSE		VERBAL RESPONSE		MOTOR POWER
4 Spontaneous	6 Obeys Commands	3 Flexion to pain	5 Orientated	2 Inappropriate sounds	Arm (R)
3 To voice	5 Localize to pain	2 Extention to pain	4 Disorientated	1 No response	(L)
2 To pain	4 Withdraws to pain	1 None	3 Incomprehensible words		Leg (R)
1 None					(L)

PUPILS
LEFT Size .....Reaction.....
RIGHT Size .....Reaction.....

1 2 3 4 5 6 7 8

C-Spine Precautions:

Presenting Complaint 1. 2. 3. 4.

Initial history and physical assessment

Past medical history

Menstrual history LMP Cycle/Period

ALLERGIES

PROV. DIAGNOSIS

INVESTIGATION	EMERGENCY PROCEDURE
HB/TC/DC/BLOOD GROUPING	
BLOOD SUGAR/UREA CREATININE/Na, K+	
AMYLASE/SGOT/SGPT/CK-MB	
ECG/CXR/X-RayABD./KUB	
USG	
Others:	

Time	Medicine/IV Fluids	Dose/Route/Frequency	Sign.

Time	T	P	R	BP	O2 Sat.	Urine	Others

Comment/notes/consultation by related Department:

Radiology results:

Final diagnosis:

Plan/Advice on discharge

TRANSFER INFORMATION		
Report to	Given by: Report time:	Transfer to: Time:

Expired: Time :
Cause of death :
Next of kin Notified Relationship/Contact information
☐Yes ☐No

ER Paramedic

ER Physician

Consultation by

Appendix 4: Questionnaire

Questionnaire. Triage

What is your profession/title
ex: nurse, triage officer, doctor

Do you know about triage?
☐ Yes
☐ No

What is triage?
☐ Admitting patients to correct ward
☐ Prioritizing patients according to urgency
☐ Electronic registration of patients

Have you worked with triage?
☐ Yes
☐ No

How much do you agree with these statements regarding the introduction of triage? *Please mark the alternative you find the most accurate*

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
The triage system was easy to learn	○	○	○	○	○
The triage system is easy to use	○	○	○	○	○
The introduction of triage made the emergency department more efficient	○	○	○	○	○
Using triage improved my job performance in some tasks of my work	○	○	○	○	○
The triage makes it more safe for the patiens to be admitted to the hospital	○	○	○	○	○
It it meaningful to continue triage in the future	○	○	○	○	○

Appendix 5: The South African Triage Scale (SATS) chart, adult version