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An analysis of risk classification in a public hospital in Brazil: an approach basing in nurses' work

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ABSTRACT
In this paper, the main idea is presented how the nurses do the risk classification in a public hospital, since, although there is a set of rules for defining each patient's classification, in practice it is a very subjective activity. The present study was performed at the Dr. Miguel Riet Corrêa Junior University Hospital, in Rio Grande city, in south Brazil. The data were collected from patients between the year 2012 and 2017 in emergency department during the risk classification. The Brazilian protocol to risk classification in emergency department was defined as a law just in 2009 by Healthy Ministry. However, the university hospital just putted into operation its system in 2012. As results of our study, we can conclude that the risk classification is very subjective, since the classification is dependent of each nurse and the time of the work, because when there are many people in the emergency department, the classification differs.

Palavras-chave:
Classificação de risco; trabalho dos enfermeiros, hospital público

Análise da classificação de risco em um hospital público no Brasil: uma abordagem baseada no trabalho de enfermagem

RESUMO
Neste artigo, a principal contribuição é apresentar como enfermeiros realizam o processo de classificação de risco em um hospital público, visto que existe um conjunto de regras para definir a classificação de cada paciente, mas na prática, este processo é muito subjetivo. O presente estudo foi realizado junto ao Hospital Universitário Dr. Miguel Riet Corrêa Junior, na cidade de Rio Grande, no sul do Brasil. Os dados analisados são de pacientes no período de 2012 a 2017, do setor de emergência do hospital, durante o processo de classificação. O protocolo de classificação de risco em emergências brasileiro foi definido por lei pelo Ministério da Saúde em 2009, mas o hospital universitário o colocou em prática apenas em 2012. Como resultados do nosso estudo, concluímos que a classificação de risco é bastante subjetiva, visto que esta classificação depende de cada enfermeiro e também do momento do dia em que o atendimento está sendo realizado, pois quando há muitas pessoas para serem atendidas na emergência, a classificação é realizada de forma diferente.

1. Introduction

The risk classification is the first critical step in giving care to the patients of an emergency department since this process could prioritize patients at different classification levels base on the severity of their critical conditions (1,2).

The idea of the use a risk classification is to facilitate rapid decision-making through three primary questions: 1. Does this patient require an immediate life-saving intervention? 2. Is this a high-risk situation? and 3. How many resources are required to care this patient? Even though the algorithm of risk classification to be simple, there is subjective and relies heavily on nursing intuition to facilitate rapid decision-making (3).

According to Mistry et al. (3), nurses routinely perform the risk classification since they have received extensive practical and academic training on the employment of the risk classification. However, the occurrence of miss-classification arises in the form of under-classification (much worse) or over-classification, which might negative results

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for patients to receive care. In Despont-Gros et al. (4), the authors affirm that risk classification nurses had heterogeneous approaches towards taking care of the patient during this process. Consequently, there was a great variability in the risk classification.

Currently, the patient undergoes at emergency department of Miguel Riet Corrêa Jr University Hospital, located in Rio Grande city, Brazil (the hospital is part of Universidade Federal do Rio Grande - FURG), s/he has his/her information inserted to a computerized system by a nurse, that defines the priority for his/her care. This system aims to record the patient's vital data and symptoms, where the nurse is totally responsible by to set the priority.

After inserted the patient information, the system suggests the patient classification, but the nurse makes the decision on the priority level of the care. Based on the information entered in the system by nurses, the system suggests a possible classification. However, actually, the system diverges around 52% of the classification given to the patient by the nurse.

The main goal of this paper is to present the nurses do the risk classification in Miguel Riet Corrêa Junior Hospital, since the classification depends of each nurse and the time of the work.

The paper is structured as following: In Section 2, the risk classification in the University Hospital is presented. Section 3 presents the related works and Section 4 the analyzed data in our case study. Section 5 concludes the paper.

2. Risk Classification in the University Hospital

The risk classification aims to regulate the demand for care in the hospital emergency department, identifying immediate medical care. In this way, its organization helps in the flow of patients seeking these units (5,6). In spite of the excess demand that these type units suffer, using risk classification, the patient risks could be minimized (7) .

In this sense, the evaluation of risk classification aims to have more agility in the patient care, according to a protocol and the degree of the need of the individual, not only considering the order of arrival. As describes the Brazilian Healthy Ministry (8):

> The patient reception with risk classification and his/her classification is one of the potentially decisive interventions in the reorganization and implementation of network health promotion, since it is based on the analysis, problematization and proposition of the team itself, which constitutes subject of all process. In its implementation, the reception extrapolates the space of local management in the quotidian of health practices, the coexistence of macro and micropolitics.

The risk classification used in Brazil is based in the Manchester Protocol, where they use five levels of patient classification and the time of waiting is varied (9). In Brazil, one of the pioneer hospitals to adopt this form of care was the Dr. Mario Gatti Municipal Hospital, in Campinas, which implemented the system in 2000, after receiving an invitation from the Health Ministry, which had the objective of implanting a humanization program in all Brazilian hospitals.

The implementation of the risk classification in all emergency units was proposed by Ministerial Order 2048/2009 of the Health Ministry, where this classification process should be performed by a health professional with graduate level, usually a nurse, with specific training (10).

In this protocol, which the health professional has a critical judgment and experience, the patient can be classified in the following colors (6):

- RED: emergency, the patient will be taken immediately in the emergency room;
- ORANGE: very urgency, the patient will be taken faster as possible to emergency room;
- YELLOW: urgency, the patient will have the prioritized attendance on patients classified as GREEN, in the emergency department;
- GREEN: no risk of immediate death, the patient will be attend after all patients classified as RED and YELLOW;
- BLUE: chronic pain without serious disease or social case, the patient should preferably be referred to care in Basic Health Unit or assisted by Social Work. It is not an emergency situation.

In the first version of the Ministerial Order of the Health Ministry, in 2009, just 4 colors were presented (red, yellow, green and blue). Just in 2014, the orange was incorporated in the official documents as optional classification color.

Finally, it is important to point out that this practice is not characterized by the diagnosis of the disease, but rather by determining the priority of care, according to the severity of the patient (5).

The system for risk classification developed to university hospital started working in July 2012 at the emergency department and it was initially based on the Healthy Ministry protocol that is an adaptation of Manchester Protocol, with four levels (red, yellow, green and blue).

However, the system allows the responsible nurses to register new symptoms, relate them to qualifiers, and finally define their classification, thus allowing it to adapt to the local reality.

For example, the Diabetes symptom is currently configured according to the Table 1, i.e., for each related symptom there are several associated qualifiers with this symptom, indicating a classification.

Table 1 – Example of qualifiers and their classifiers for the Diabetes symptoms

Symptom	Qualifier	Classifier
Diabetes	Profuse sweating (hypoglycemia)	RED
	Change in mental state (lethargy, mental confusion, agitation, coma)	RED
	Changed vital data	RED
	Glycaemia 250 mg/dl and dehydration signs	YELLOW
	Normal vital data	YELLOW
	Glicemia 250mg/dl e asymptomatic	GREEN
	Glycaemia 250mg/dl and asymptomatic	BLUE
	History of diabetes and needing medication (prescription)	BLUE

In this system, the classification interface is divided into four distinct steps: initially, the nurse records the patient's basic data (name, sex, date of birth, medications in use, etc), as shown in Figure 1 (All figures about the system are in Portuguese. We do not think appropriate change the language of the system. However, we numbered in red the fields and translated them for each figure).

Next, according to Figure 2, the patient's vital data, his/her pain and coma scales (Glasgow scale) are inserted into the system.

In the sequence, as shown in Figure 3, the nurse can choose the symptoms that s/he identifies in the patient (blue frame) and their respective qualifiers (green frame). It is possible to choose several symptoms and qualifiers. Both the symptoms and the qualifiers were defined a priori (based in nurses' experience) and appear in a fixed list and will assist doctors during the consultation. However, qualifiers serve to generate an

automatic risk classification, which is shown in Figure 4. Each qualifier has a classifier (a color), as presented to Diabetes in Table 1.

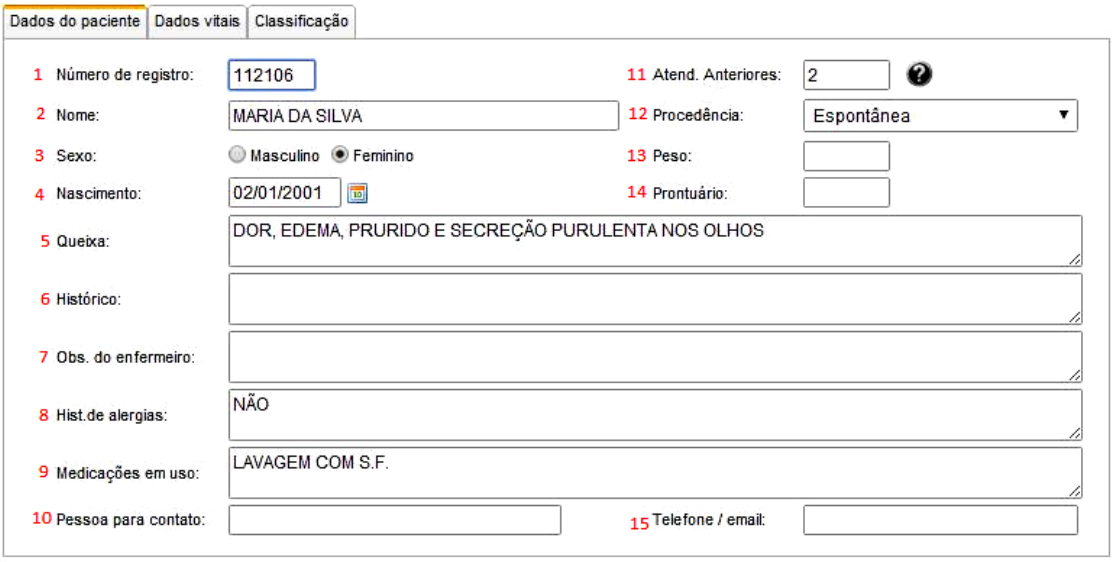

Figure 1 – First step of risk classification - Basic information, where (1) is the register number, (2) is the patient name, (3) the patient sex, (4) the patient's date of birth, (5) the patient's complaint, (6) the patient history, as other diseases, (7) some observation of the nurse during the procedure, (8) the patient's history of allergies, (9) medications in use of the patient, (10) some contact people, as necessary in emergency, (11) previous patient visits, it is automatic, the system registers, (12) origin of the patient, for example, home or health clinic, (13) patient weight, (14) medical record number, the system automatically generates, (15) the patient phone/email .

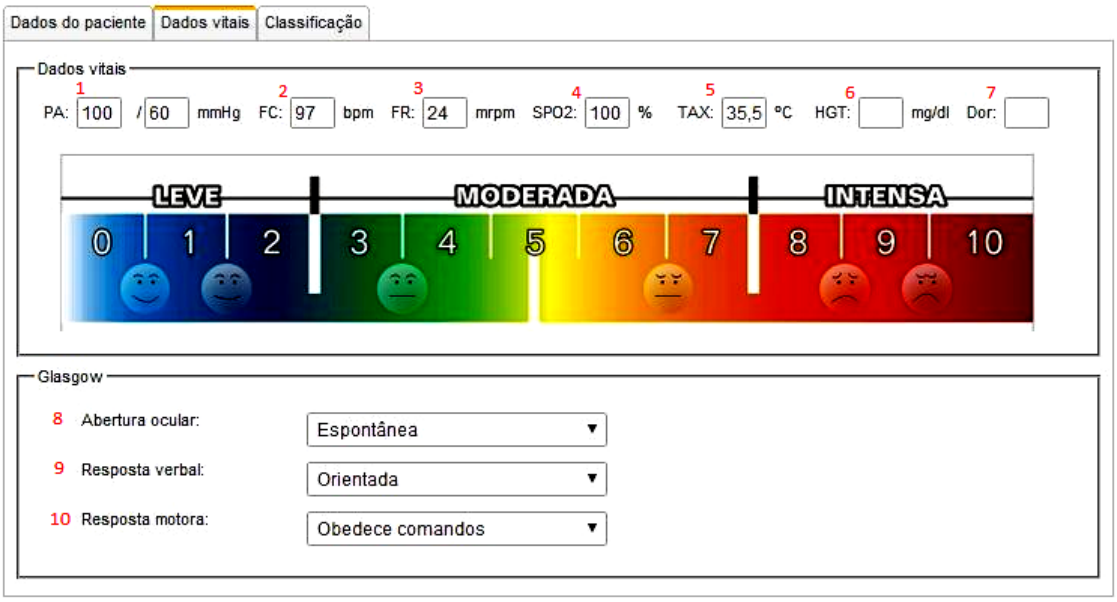

Figure 2 – Second step of risk classification - Vital data, where (1) PA means blood pressure, (2) FC means heart rate, (3) FR means respiratory frequency, (4) SPO2 means Oxygen saturation, (5) TAX means body temperature, (6) HGT means hemo glucose test, (7) the patient's pain level, from 0 to 10, as shown in images below, (8) the eye opening of Glasgow, (9) the best verbal response of Glagow, (10) the best motor response of Glagow.

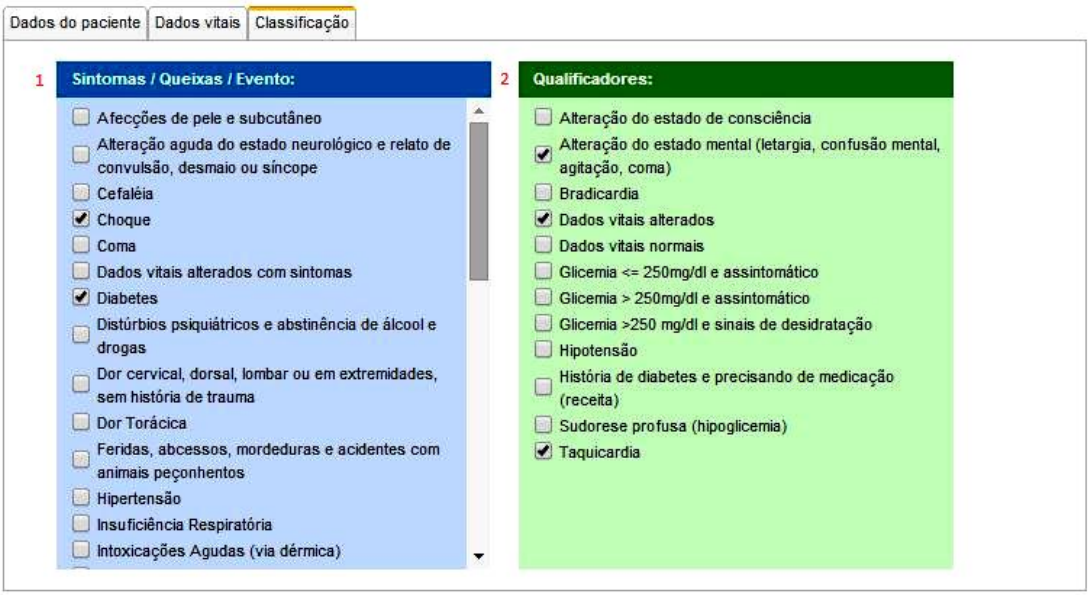

Figure 3 – Third step of risk classification - symptoms and qualifiers, where (1) the symptoms are listed, as shock, diabetes or headache, (2) the qualifiers are listed, as changes in mental status (lethargy, confusion, agitation, coma) or tachycardia, in this case, the qualifier to Diabetes symptom.

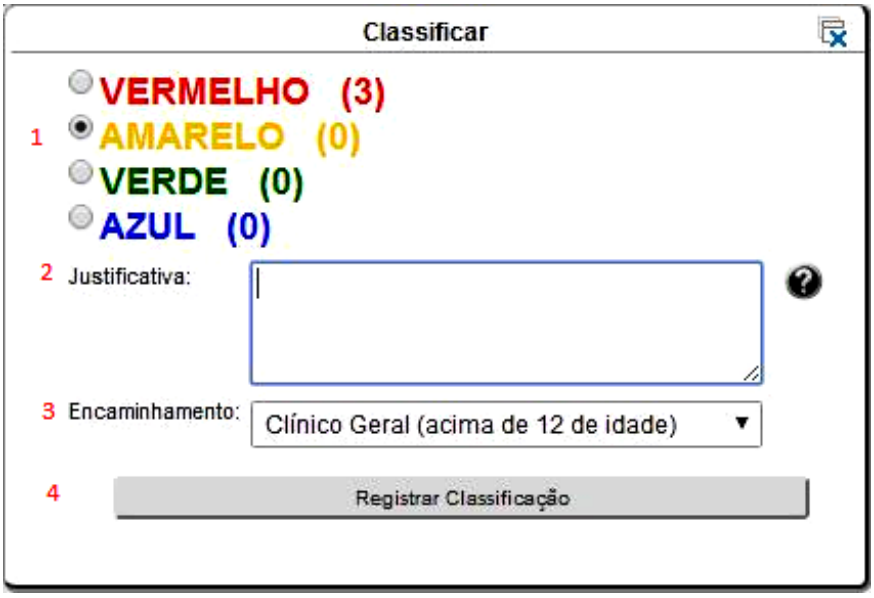

Figure 4 – Fourth step of risk classification - Defining the classifier and register the final information, where (1) the system patient evaluation (in this case, red with 3 points), but the nurse could choose any classification, (2) a field to insert a justify, if necessary, (3) indication of medical referral (in this case, non-specialist adult doctor), (4) a bottom to register the classification.

The last step, as shown in Figure 4, the system counts the number of classifiers related to the selected qualifiers (number in parentheses) and given the highest number suggests a rating. It is a simple sum of the qualifiers that the nurse chose in the third step (Figure 3). However, the final decision is the nurse, who has the possibility to choose the classification that s/he finds relevant to the case.

The risk classification system has been in use since June 07, 2012, with an average of one service registered every 15 minutes.

3. Related Works

According to Despont-Gros et al. (4), the introduction of new computerized systems contributes of a reduction of performance of nurses in emergency rooms. In this way, the authors introduced a digital pen to fill the classification paper forms. After this, a computational system scans these forms and all data are inserted to future analysis. However, this approach has problems, because some data are confused (there are many false positives) and many important data are not included, as vital signs.

In the work of Soufi et al. (11), a hybrid system for classification management is presented. This system is composed by rule-based reasoning (RBR) and fuzzy logic. The authors used just five physiologic parameters to define fuzzy and RBR rules and it presented an accuracy of 99.44% in clinical decision-making.

A multicenter analysis of risk classification is presented in the work of Mistry et al. (3). The work presents a study in three countries: Brazil, the United Arab Emirates and the United States. The authors concluded that the nurse's classification was universally poor and variability of score assignment was high within and across sites. Other important conclusion was that there is not any association between nursing experience and accuracy of risk classification.

Rates et al. (12) tried to understand the reception in risk classification, using as case study an emergency care unit with 22 nurses who perform this reception during the day and night. However, 20 nurses participated in the survey. The authors highlighted from the analysis, that the reception in risk classification constitutes a process that involves rules and attributions to be followed, in addition to a flow to be followed by users and handled by professionals. In addition, they observed that the emergency care unit professionals create spaces, through dialogue, which has its origin in defining behaviors and organizing the flow in patient care, intersecting with others.

In Rezende et al. (13), the authors aimed to verify the flow of patients who during the risk classification with the Manchester Protocol in an emergency room at a university hospital. The work consisted of a descriptive and documentary study, in which the data were taken from the attendance files during the year of 2014. The data were analyzed through descriptive analysis, using simple and relative frequency calculations, in addition to measures of central tendency and measure of variability. As results, the authors found that the majority of classified patients were female with an average age of 44 years, the main complaint was related to the musculoskeletal system and general practice consisted of the specialty with the greatest need. The green color was the classification of the Manchester Protocol with greater regularity. As conclusion, the authors said that the most people should go to a primary care unit, because most of them were not urgency cases.

The work of Roncalli et al. (14) aimed to understand the view of nurses and user population about the use of the Manchester Protocol to risk classification in emergency care unit. The case study were 15 nurses who work in the risk classification in located in Belo Horizonte/MG. The work consists of a qualitative study with individual interviews. To participate in the interview, nurses should have a role in risk classification for at least 6 months. Based on data analysis, the authors discovery that emergency care unit has users who are unaware of the risk classification criteria and are dissatisfied with their classification. They also highlight the lack of information disclosed about the risk classification protocol. In the work, it is emphasized that the nurses participating in the research, act with empathy and humanization in caring for the patient, not making this process mechanical. Nurses indicated that the Manchester Protocol is approved at the institution, providing more security with regard to initial

patient care. As a conclusion, the authors emphasize that even initial difficulties of implementing the risk classification, it brings security to nurses in their practices and in the care provided.

4. Data and Analysis

In this section, we briefly discuss the database, selection and preprocessing of the information set used (the database was obtained through an authorization from the University Hospital, where only information regarding risk classification was received, not containing information or personal data of the patients or the nurses).

In our project, the PostgreSQL Database Management System (DBMS - http://www.postgresql.org/) was used for data storage and preprocessing. The relation of the main entities of the base is shown in Figure 5 and the Table 2 resumes each entity of the database and its main information.

Table 2 – Main information of entities in database

Entity	Description	Information
symptoms	symptom registration	headache, respiratory complaints, etc.
provenances	provenances registration	ambulance, spontaneous, etc.
qualifiers	qualifiers registration	nausea and vomiting, severe pain, etc.
classifiers	classifiers registration	blue, green, yellow, red
qualifiers class	symptom, qualifier and classifier relationship	it has the relation of which classificati to use when a certain symptom and qualifier exists
forms	patient registration in emergency department	stored information of vital data, as wel as registered classification
forms qualifiers	relationship with the symptoms and qualifiers reported during risk classification, as well as the suggested classifier of this relationship	

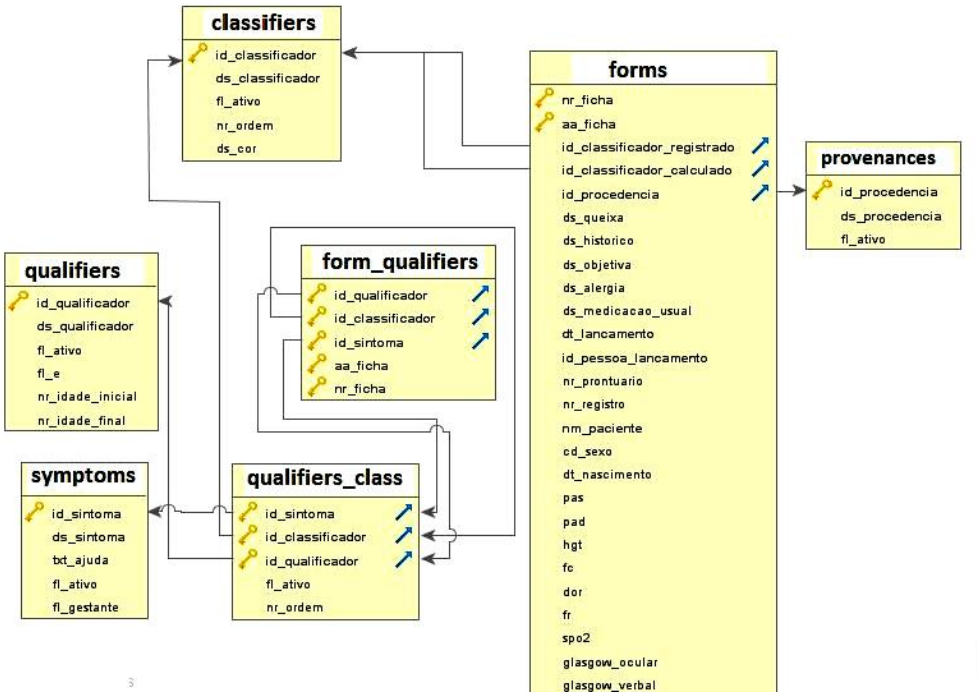

Figure 5 – Entity-relationship model of risk classification system from university hospital

After identifying the main entities of the database, we tried to understand the scenario in which the data were found. Initially, the classification relationships of patients were identified, as Figure 6 presents.

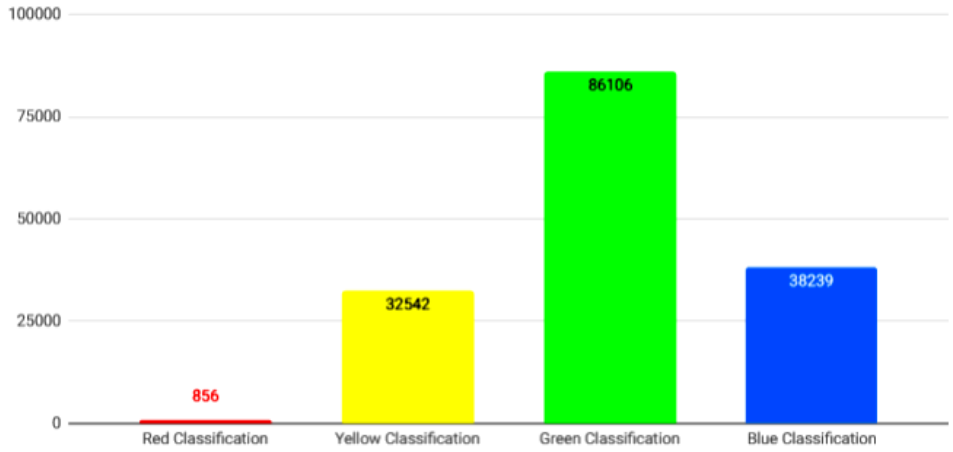

Figure 6 – Classification of each type of risk classification system.

These data are based in database instances from June 27, 2012 to June 02, 2017. The classification more recurrent is GREEN, that represent 54.6% of all instances (86,106 instances). On the other hand, the RED classification has less 0,54% of the instances (856 instances). The BLUE classification has 24.24% of the instances (38,239 instances) and the YELLOW classification has 20,63% of the instances (32,542 instances).

In the Figure 7, the symptoms reported in the patient's classification are presented. Therefore, 66.6% of reported cases are related to the symptoms of abdominal and urinary complaints (53,930 instances) and respiratory complaints (51,180 instances), i.e., more than half of patients are related to only two symptoms.

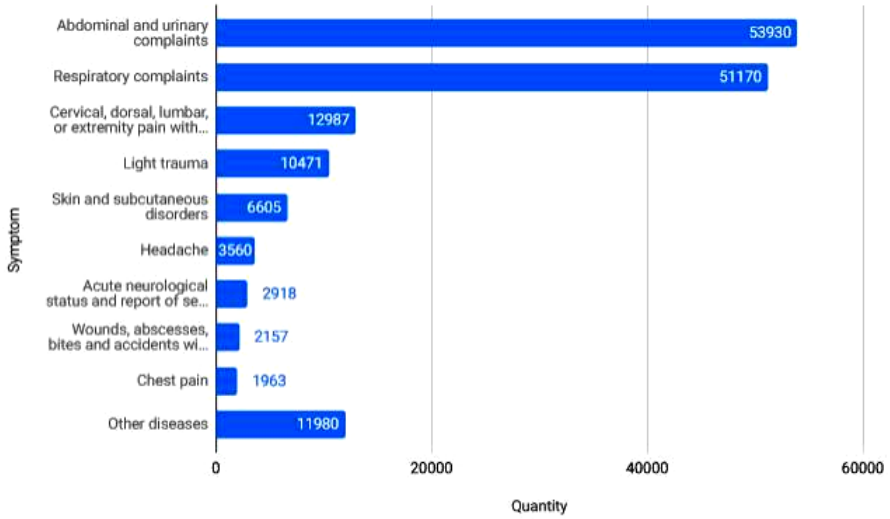

Figure 7 – Quantity of registered symptoms.

Also, we have identified the time of the day in which the highest frequency occurred for each classifier, in order to verify if the classification of the patient would also depend on the number of patients. The Figure 8 presents the number of patients

classified by the 24 hours of the day. To RED classification appears in the graphic, we have multiplied the instances by a constant value of 10, since their quantity is very small in relation to the other classifiers. However, in very serious cases, where the patient arrives by ambulance, the risk classification process is not performed. In this way, the number of RED cases may be slightly higher, but their number remains much lower than that of YELLOW, GREEN and BLUE cases.

In Figure 8, it is possible to see that the patient classification with more severe cases (RED) tends to occur between 18:30 and 00:00 hours (the peak at 20:00, with 70 appointments recorded). Other important aspect is that the YELLOW classification tends to decrease as the number of attendances increases, including getting smaller than the BLUE classification in the intervals from 06:30 to 15:00 hours and from 18:30 to 20:30. Apparently, when there are high peaks of the other classifications, the YELLOW classification tends to decrease.

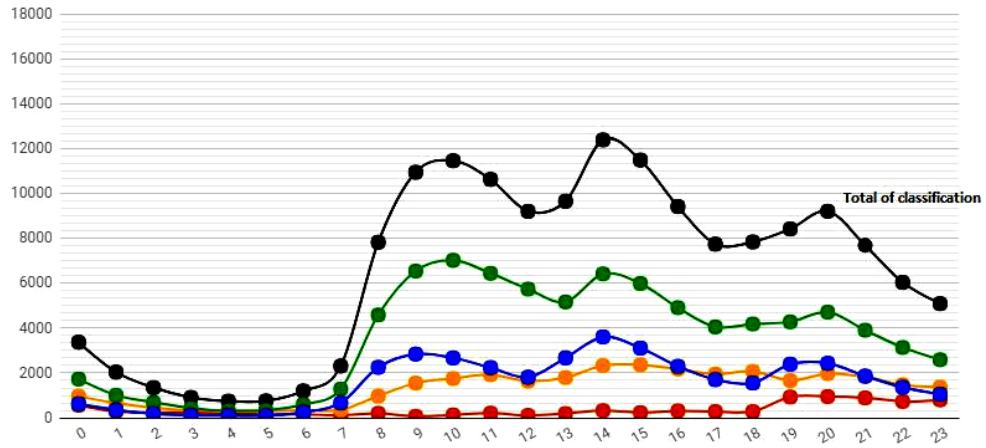

Figure 8 – Relationship between patient classification per hour

In order to verify the agreement rate between the current system and the nurse classification, we have analyzed the number of patients classified with the same classification as the system. We discovered that the nurses have classified on average 52.77% of instances in different classification that the indicated to the system. This behavior becomes even more evident when the records were separated by a nurse, as shown in Figures 9, 10 and 11 (the identification of personal data from each nurse is not possible, just the code of each instance).

The lines highlighted in bold in the columns "Nurse" and "N.Classif." represent the nurses who classified more than the general average (2,630 patients) in all period. According to data, 60 nurses worked in the emergency department, but only 11 performed more than 2,630 classifications.

Nurse	N.Classif.	%Dif.Classif.	BLUE	GREEN	YELLOW	RED
Enf 1	521	79,65%	3,07%	68,14%	28,41%	0,38%
Enf 2	290	27,59%	5,86%	62,41%	25,86%	5,86%
Enf 3	546	48,17%	3,85%	66,67%	28,39%	1,10%
Enf 4	**17478**	**15,08%**	**35,03%**	**48,61%**	**15,35%**	**1,01%**
Enf 5	527	14,61%	2,85%	65,09%	27,70%	4,36%
Enf 6	**6606**	**52,30%**	**28,38%**	**52,10%**	**19,42%**	**0,09%**
Enf 7	2424	45,96%	18,77%	52,02%	28,80%	0,41%
Enf 8	**45527**	**58,36%**	**25,44%**	**59,04%**	**15,39%**	**0,13%**
Enf 9	**3911**	**40,37%**	**20,02%**	**54,79%**	**24,34%**	**0,84%**
Enf 10	244	60,25%	6,97%	66,39%	25,41%	1,23%
Enf 11	**23020**	**64,82%**	**33,65%**	**46,24%**	**19,82%**	**0,26%**
Enf 12	2324	38,17%	8,56%	65,88%	24,70%	0,13%
Enf 13	289	55,71%	22,49%	48,79%	28,72%	0,00%
Enf 14	378	67,72%	38,89%	39,42%	21,69%	0,00%
Enf 15	1840	43,21%	20,82%	66,14%	13,04%	0,00%
Enf 16	45	66,67%	2,22%	77,78%	20,00%	0,00%
Enf 17	**7225**	**45,92%**	**27,76%**	**43,31%**	**28,57%**	**0,33%**
Enf 18	587	67,80%	21,64%	51,79%	26,41%	0,17%
Enf 19	497	53,92%	9,46%	78,07%	12,27%	0,20%

Figure 9 – Relationship between nurses classification, where N.Classif. = Total Number of Classification of this nurse; %Dif.Classif= Percentage of Different Classification of Nurse and System; BLUE, GREEN, YELLOW and RED = Percentage of Classification for each type.

Nurse	N.Classif.	%Dif.Classif.	BLUE	GREEN	YELLOW	RED
Enf 20	46	63,04%	8,70%	86,96%	4,35%	0,00%
Enf 21	263	46,39%	27,00%	46,77%	25,10%	1,14%
Enf 22	75	68,00%	22,67%	46,67%	29,33%	1,33%
Enf 23	104	42,31%	5,77%	56,73%	37,50%	0,00%
Enf 24	29	44,83%	27,59%	41,38%	24,14%	6,90%
Enf 25	666	42,49%	17,72%	64,26%	17,57%	0,45%
Enf 26	199	51,26%	8,04%	65,33%	26,63%	0,00%
Enf 27	546	26,19%	4,58%	74,18%	21,06%	0,00%
Enf 28	156	77,56%	2,56%	85,26%	11,54%	0,64%
Enf 29	659	77,09%	6,98%	71,02%	20,64%	0,15%
Enf 30	148	63,51%	12,84%	41,22%	45,95%	0,00%
Enf 31	253	34,39%	2,37%	58,50%	39,13%	0,00%
Enf 32	95	60,00%	33,68%	54,74%	11,58%	0,00%
Enf 33	153	50,98%	11,76%	64,71%	23,53%	0,00%
Enf 34	41	58,54%	21,95%	43,90%	34,15%	0,00%
Enf 35	124	83,87%	59,68%	19,35%	20,97%	0,00%
Enf 36	1335	54,23%	16,85%	48,61%	33,18%	1,35%
Enf 37	3	66,67%	0,00%	0,00%	100,00%	0,00%
Enf 38	217	53,00%	23,04%	45,62%	29,95%	1,38%
Enf 39	460	52,61%	8,26%	57,39%	34,35%	0,00%

Figure 10 – Relationship between nurses classification, where. N.Classif. = Total Number of Classiffication of this nurse; %Dif.Classif= Percentage of Different Classification of Nurse and System; BLUE, GREEN, YELLOW and RED = Percentage of Classification for each type.

Nurse	N.Classif.	%Dif.Classif.	BLUE	GREEN	YELLOW	RED
Enf 40	88	73,86%	45,45%	17,05%	36,36%	1,14%
Enf 41	**3505**	**28,56%**	**5,42%**	**70,58%**	**23,71%**	**0,29%**
Enf 42	440	31,59%	3,41%	50,45%	34,32%	11,82%
Enf 43	**5655**	**32,89%**	**10,82%**	**63,13%**	**25,20%**	**0,85%**
Enf 44	11	27,27%	0,00%	27,27%	72,73%	0,00%
Enf 45	**7811**	**17,14%**	**20,19%**	**46,19%**	**31,78%**	**1,84%**
Enf 46	1024	53,91%	2,34%	60,55%	32,42%	4,69%
Enf 47	556	65,47%	5,22%	59,35%	35,07%	0,36%
Enf 48	360	66,67%	25,83%	45,83%	28,33%	0,00%
Enf 49	**7978**	**33,19%**	**17,70%**	**54,58%**	**27,04%**	**0,69%**
Enf 50	1459	69,29%	17,75%	57,57%	24,67%	0,00%
Enf 51	**5611**	**54,20%**	**17,25%**	**61,40%**	**20,91%**	**0,45%**
Enf 52	56	33,93%	5,36%	41,07%	53,57%	0,00%
Enf 53	297	60,27%	16,84%	62,96%	20,20%	0,00%
Enf 54	443	63,21%	16,70%	62,53%	20,54%	0,23%
Enf 55	298	29,19%	5,37%	73,15%	18,79%	1,01%
Enf 56	397	77,08%	42,57%	35,01%	22,42%	0,00%
Enf 57	25	80,00%	40,00%	48,00%	12,00%	0,00%
Enf 58	9	55,56%	55,56%	33,33%	11,11%	0,00%
Enf 59	1514	79,13%	11,16%	65,46%	22,39%	0,33%
Enf 60	417	70,74%	27,10%	48,20%	23,50%	1,20%

Figure 11 – Relationship between nurses classification, where N.Classif. = Total Number of Classiffication of this nurse; %Dif.Classif= Percentage of Different Classification of Nurse and System; BLUE, GREEN, YELLOW and RED = Percentage of Classification for each type.

The "% Dif.Classif." column informs the percentage of difference between the nurse's registered patient and the system's suggested classification. The red records highlighted in this column identify which are above the overall divergence average (52.77%).

In the list of nurses who most classify patients, 3 of 11 are above the mean of the different classification of the system. It was also sought to identify from the set of specialist nurses the divergence between them and the system over the years in the use of the system. Figure 12 shows a slight increase in the divergence between the patient's classification by the nurse and the system suggestion (in 2012, the divergence was 42.56%; in 2013, 40.38%; in 2014, 44.86%; in 2015, 50.65%; in 2016, 51.98%; and in 2017, 54.72%).

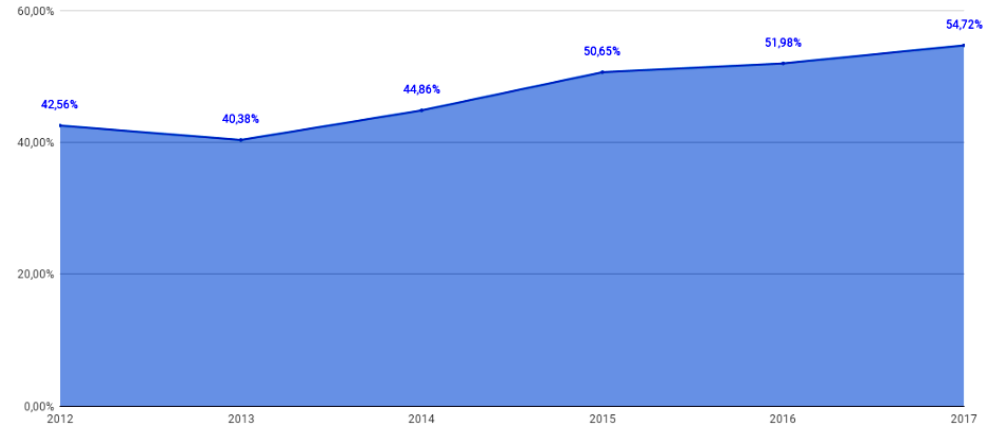

Figure 12 – Relationship between nurses classification and system classification.

5. Conclusions and Future Works

In this paper, our main goal was presented how the nurses do the risk classification in a public hospital at Brazil. Specifically, Miguel Riet Corrêa Junior Hospital, in Rio Grande city, south of Brazil. The risk classification is crucial to all emergency department of a hospital, because the incorrect classification could have negative implications to patients' care.

In our analysis, we can observe that the classification depends of each nurse background and the time of the day, because when the hospital has "peaks" of people, the classification changes, independent of the nurses.

The Figure 8 presents the results of this demand: the GREEN classification assumes the biggest numbers in specific period of the day, that suggests that the risk classification do not work, because the vast majority of the patients are considered low risk.

About the classification system and nurse classification, the Figures 9, 10 and 11 presented the results of each nurse and we can conclude that the more the nurse classifies, more s/he disagrees of the system. And, over the years, general disagreement has increased (see Figure 12).

Another aspect is related to the training, because Mistry et al. (3) and Healthy Ministry (10, 5) suggest a previous training before work in emergency department with risk classification. However, about our case study in university hospital, we did not receive any information about training for them and according our data, 60 nurses did the risk classification, which represents a large part of the hospital's staff of nurses and they did not have a homogeneous and fair classification, that training could help to minimize. We tried to reduce it "bringing" this training through practice in on-site classification, based on the number of attended patients, analyzing only nurses with more than 2,630 records on average throughout all period (2012-2017). However, this does not guarantee that these nurses have, in fact, adequate training to perform the risk classification. For example, the more experienced nurses, some have high rates of disagreement (in Figure 9, Enf 11 with 64,82%), which represents a high level of degradation of the system. Or the rules in the systems are incorrect or there is a lack of training. One possibility is the constant training of the group of nurses in the hospital, seeking to improve them and improve care.

As future works, we intend to apply data mining techniques to discovery some patterns in data to improve the classification system, to adapt the system to the risk classification performed by nurses.

6. Compliance with Ethical Standards

Conflict of Interest: The authors declare do not have any conflict of interest.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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