

Experience of two first level hospitals in the southwest region of Colombia on the implementation of the Panamerican Trauma Society International Trauma Registry

Experiencia en dos hospitales de tercer nivel de atención del suroccidente de Colombia en la aplicación del Registro Internacional de Trauma de la Sociedad Panamericana de Trauma

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A B S T R A C T

Objective: Describe the experience of the implementation of a Trauma Registry System (TRS) in two hospitals in Cali, Colombia
Methods: The TRS includes prehospital, hospital and discharge status information of the trauma patient. Each hospital has its own electronic data capture (EDC) strategy. A descriptive and exploratory data analysis is presented during a three month pilot phase.
Results: A total of 3,293 patients were registered; 1,626 (49.4%) from the public hospital and 1,613 (50.6%) from the private. 67.2% were males; with a mean age of 30.5±20 years, 30.5% were under 18 years old. The overall mortality rate was 3.52 %. The most frequent causes of consult were falls (33.7%); and gunshot wounds (11.6%), mortality in this group was 44.7%.
Conclusion: The need for implementation and mechanisms to provide continuity to the TRS was determined. The registry becomes an information source for research development. The causes of consult, morbidity and mortality due to trauma were identified, allowing improved planning of emergency services and the regional trauma system in order to optimize and reduce health care costs. Through this trauma information system the necessary adjustments to redesign trauma and emergency systems in southwestern Colombia will be acknowledged.

Key words: Wounds and injuries. Emergencies. Database. Registries. Electronic health records.

INTRODUCTION

Trauma is a global epidemic, especially in developing countries. The region of Latin America has an approximate 11% incidence of the overall mortality due to trauma¹. During the last decade trauma due to external causes and violence represented the leading cause of death in the population under 44 years old in Colombia. In 2010 Cali had a personal injury mortality rate of 81 per one hundred thousand inhabitants², generating a serious public health problem.

Knowledge of the epidemiology of trauma is essential for identifying the associated factors of the generation of external causes of injury and the development of solutions from the standpoint of public health. One of

the available monitoring tools for the tendency of these events is the Trauma Registry System (TRS), used primarily to identify and evaluate trauma care at all levels; hospital, local, regional and state wide. In the U.S., the National Trauma Data Bank is a legally based institution that generates reliable and accurate statistics of health-related events of that country^{3,4}, allowing easy access to information in order to develop research studies and statistical analysis. In addition, it allows for real-time statistics and maps with a description of the multiple health related events, including trauma. Through this system the United States monitors these events and guides public health policies in relation to these findings⁴.

Despite the impact of trauma on morbidity and mortality in Latin America and Colombia, to date there are

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no tools available that will allow to systematically observe and monitor these events. The current epidemiology surveillance systems are carried as paper records which are unreliable and have no continuity. During 2005 the pilot phase of the Panamerican Trauma Society International Trauma Registry (ITR / PTS-ITSDP) was established in Ecuador, however, this experience was not successful and was discontinued due to lack of resources⁵. With this background, during November 2011, the second Latin American initiative was carried out in the framework of the ITR / PTS-ITSDP in the city of Cali, Colombia. This scenario corresponds to the need for efficiently and reliably registering trauma events, given the conditions of the city and the interest of strengthening the current regional trauma system². The experience is strengthened by the ease provided by an electronic information system, tested in different countries, presenting the existent trauma tendencies in the region for contemplating the organization of a trauma system in the southwest region of Colombia. The objective is to describe the experience on the implementation of a Trauma Registry System (TRS) in two hospitals in Cali, Colombia.

METHODS

In October 2011 a collaborative agreement between the ITR/PTS-ITSDP was established. The agreement included travel of Virginia Commonwealth University (VCU) instructors to Colombia for training of the electronic data capture (EDC) staff, regional trauma registry coordinators, medical students and the clinical leader in charge of each institution. Once this training ended, the ITR/PTS-ITSDP was committed to monitor data collection, provide platform technical support and resolve problems through teleconferences. The capture of information was conducted in two phases: from November 21st 2011 to January 4th, 2012 on a test platform and a definite platform starting January 5th, 2012.

International Trauma Registry platform

The *International Trauma Registry* is an electronic web based data system, belonging to the Panamerican Trauma Society through the International Trauma Systems Development Program (ITR/PTS- ITSDP); the international component of the division of Trauma, Critical Care and Emergency surgery at Virginia Commonwealth University (VCU) ⁶. The ITR software is a digital tool developed to function through Internet, with a total of 244 variables distributed in 11 windows, that groups data into operational modules such as: demographic information, chief complaint; past history and injury location, injury mechanism, prehospital information, physical exam, imaging, laboratory, ED management and diagnosis, hospitalization, reference and counter-reference. This allows daily inpatient monitoring, specifying whether they underwent surgery or

other procedures, automatic calculations such as age according to birth date, scales and scores such as the Glasgow Coma Scale, Revised Trauma Score (RTS), Injury Severity Score (ISS) and discharge status of each patient. It generates fixed and specific reports as needed. All clinical diagnoses and mechanisms of injury are coded according to the International Classification of Diseases (ICD-10)^{7,11}.

Sites

The public hospital (Hospital 1) is a state entity, classified as a level III (Equivalent to level I in the U.S.) center and is the referral hospital in the public network. There are a total of 750 beds, 143 designated for the care of trauma patients and 38 intensive care unit beds. It is estimated that the total number of admissions per year in the emergency department due to trauma is of 8,450 patients. In this institution, the patient can be hospitalized in 13 different places during management such as the trauma bay, emergency department, observation, general hospitalization, intensive care, among others. For the Trauma Registry System (TRS) a general clinical coordinator (Trauma Fellow) was established, 5 full time staff for EDC with an EMT background, distributed in 12 hour shifts every day, including weekends and holidays. The EDC is made from the emergency and once the patient is transferred to different wards, the data is acquired from paper medical records. Information for the TRS is captured on portable devices equipped with wireless networking.

The private hospital (Hospital 2) is a private nonprofit entity, consisting of 448 beds, of which 120 are from the intensive care units (ICU), 10 of them exclusively for trauma. Approximately 10,000 visits due to trauma are held annually in this institution. It is also equipped with a reanimation unit for adult and pediatric emergencies. The medical record is electronic. The TRS strategy includes a general clinical coordinator (trauma surgery fellow), a general practitioner in social service and an EMT; the last two are full-time staff. Two part-time medical students help the described staff. The incoming trauma, surgery, hospitalization and discharge information is captured directly from the electronic medical record system (SAP Net Weaver Business Client 1.0 SAP ®). Information for the TRS is captured both on portable devices equipped with wireless networking and desktop computers connected to the network. Both hospitals are University affiliated. The study was approved by the Ethics Committee of both institutions.

Data Analysis

For the statistical analysis the data base was exported to a binary file, with prior approval of the coordinating center in Virginia. This file was transferred to the statistical analysis software STATATM 10 (StataCorp, Texas, USA). A descriptive exploratory analysis was performed, the categorical variables are presented in proportions, comparisons between them are made using

chi squared distribution or Fisher's exact test. Continuous variables are expressed as mean, median, mean, \pm standard deviation and interquartile ranges and were analyzed with Student's t test or Mann-Whitney test, whether or not the assumptions of normality were met.

RESULTS

Between November 21st, 2011 and February 18th, 2012; a total of 3,239 patients were registered; 1,626 (50.2%) in the public hospital and 1,613 (49.8%) in the private, corresponding to 36 ± 13 subjects per day. The overall mean age was 30.5 ± 20.3 years; 68.3% were males. The main causes of consult were falls (33.7%), traffic accidents (20.7%) and personal injuries from external causes (19.8%) (Figure 4). There were 114 deaths (3.5%). Table 1 shows the general characteristics of the registered population. The recollection shows that in the month of January-2012 37.6% of the information was captured. The

days of the week with higher number of patients admitted were Sunday (17%), Saturday 477 (14.7%) and Wednesday 465 (14.3%) (Figures 1-3).

Socio-demographic characteristics by hospital

The public hospital in comparison to the private hospital had an average age older than (31.8 ± 21.8 vs. 29.1 ± 19.2 , $p = 0.006$), there were more males (73.5% vs. 62.9%, $p < 0.001$), table 2.

Severity and trauma mechanisms

Overall, the public hospital in comparison to the private hospital, admitted a greater number of severely injured patients, as assessed with the Injury Severity Score ISS (median 9 (interquartile range 5-13) vs. 3 (1-6), $p < 0.001$) and with the proportion of subjects with an ISS > 15 (8.5% vs. 5.8%, $p = 0.002$), whereas care for critically ill patients with ISS > 25 had a greater tendency in the private hospital (3.2% vs. 2.1%, $p = 0.059$). See table 2.

Table 1 - General Characteristic of the registered population.

Variable	General	
Males. n (%)	2212	(69.5)
Age (years). (Mean \pm SD)	30.5 \pm	20.3
>18 years	2251	(69.5)
Age range. years. n (%).		
0-14	709	(21.8)
15-24	747	(23.1)
25-34	645	(19.9)
35-44	382	(11.8)
45-54	269	(8.3)
55-64	172	(5.3)
65-74	91	(2.8)
75+	224	(6.9)
Trauma Mechanisms		
Falls	1091	(33.7)
Traffic Accidents	671	(20.7)
Gunshot Wounds	377	(11.6)
Stab Wounds	267	(8.2)
Poisoning	49	(1.5)
Burns	126	(3.9)
Other Mechanisms	544	(16.8)
Hospital Stay days. Median (IQR)	4.5	(1-10)
ICU Stay Days. Median (IQR)	3.5	(1-8)
Total deaths. n (%)	114	(3.5)
Cause of death. n (%)		
Traffic accidents	24	(21.1)
Falls	23	(23.2)
Stab Wound	6	(5.2)
Gunshot Wound	51	(44.7)
Other Mechanisms	10	(8.7)
Total Subjects	3239	

Patients with higher ISS corresponded to gunshot wounds (11.6%), stab and blunt trauma (8.2%). Trauma classified as others included patients with aggressions, contusions and explosives. The total hospital stay was longer in the public hospital versus the private (5.5 (1-9) days vs. 5 (1-11), $p < 0.001$), the intensive care unit stay was similar in both sites ($p = 0.18$). See table 2.

Mortality

Overall mortality was 3.52% (n = 114), being higher in the public hospital than the private (4.6% vs. 2.4%, $p < 0.001$). The main cause of mortality in both institutions were personal injuries from external causes (49.9% distributed as follows: gunshot wounds 44.7% and 5.3% stab wounds), followed by traffic accidents (21.1%) and falls (23.2%). Stratification by severity with an ISS > 15, showed a similar mortality rate in the two hospitals; 29.7% in the public and 36.5% ($p = 0.27$) in the private; as for most critical patients defined as ISS > 25, the public hospital mortality rate was higher than the private (77.1% vs. 53.8%, $p = 0.027$).

DISCUSSION

The implementation of an electronic registry in its pre-pilot and pilot phase was successful. Real-time and reliable registry information was achieved using two different strategies in two different types of hospitals.

History and facts about electronic trauma registries

The first Electronic Trauma Registry was developed in 1969 at Cook County hospital in Chicago¹² which was the basis for the Illinois Trauma Registry in 1971, later during 1989, the National Trauma Data Bank was institutionalized by the American College of Surgeons, this

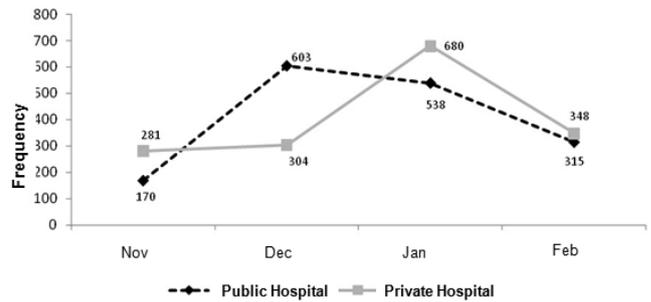


Figure 1 - Patient admission volume registered per month of operation of the trauma registry.

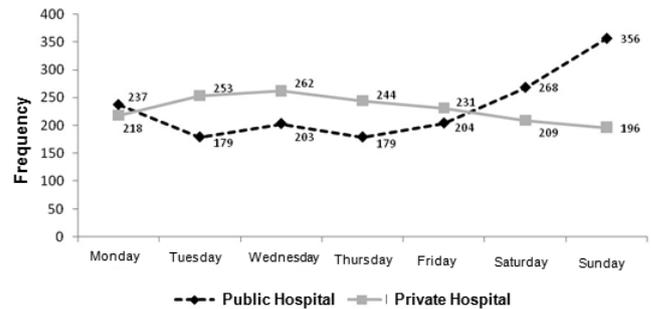


Figure 2 - Patient admission volume registered per day of the week of operation of the trauma registry.

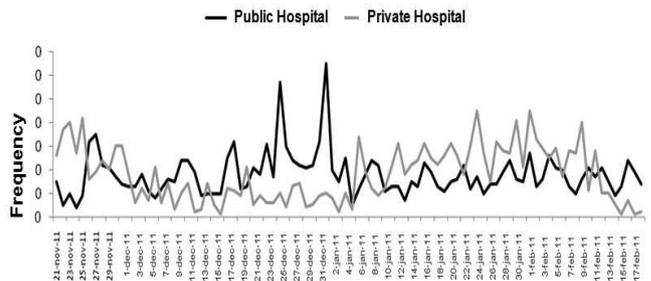


Figure 3 - Patient admission distribution registered per each of the 90 days of operation of the trauma registry.

Table 2 - Characteristic of the subjects registered per institution.

Variable	Institution		P Value
	PUBLIC HOSPITAL (N = 1626)	PRIVATE HOSPITAL (N = 1613)	
Males. n (%)	1196 (73.5%)	1016 (62.9%)	<0.001
Age. years. mean ± SD	31.8 ± 21.8	29.1 ± 19.2	0.006
>18 years. n (%)	1145 (70.4)	1107 (68.6)	0.26
ISS. Median (IQR)	9 (4-13)	3 (1-6)	<0.001
ISS>15. n (%)	138 (8.5)	93 (5.8)	0.002
ISS>25. n (%)	35	(2.1) 52 (3.2)	0.059
Hospital stay. days. median (IQR)	5.5 (1-9)	5 (1-11)	<0.001
ICU stay. median (IQR)	3.5 (2.5-6.5)	4 (1-9)	0.18
Deaths. n (%)	75 (4.62)	39 (2.4)	<0.001
ISS>15. n (%)	41/138 (29.7)	34/93 (36.55)	0.27
ISS>25. n (%)	27/35 (77.1)	28/52 (53.8)	0.027

bank currently has over one million entries in its database and in collaboration with the CDC is extended to the entire North American nation^{4, 12, 13}. While it is true that the NTDB is currently functioning, it took twenty years to consolidate a National Trauma Registry in the U.S., with all the difficulties present at that time. Several countries besides the United States carry their own trauma registries, such as Canada, Australia, Israel, Italy, Germany, Japan, Netherlands and the United Kingdom¹⁴⁻¹⁶. They all have an established classification and data acquisition protocol starting from pre-hospital care, training of the registrars, provision of necessary equipment, system financing, and software development tailored to the needs of the region and a clear link between the registered activities and objectives for improvement in the system¹⁵.

However in developing countries, there are few experiences with real time electronic trauma registries. The experiences documented are based on retrospective records, data repositories of cadavers or population surveys^{17, 18}. In Pakistan, an initiative to develop a TRS supported by the United States Agency for International Development (USAID) was presented in order to keep a registry of the data obtained in the emergency room, as in some African countries, but none have been able to effectively consolidate¹⁵. In Latin American countries there are reports of an attempt for the implementation of the International Trauma Registry in Ecuador during 2005, a project that was ended due to the lack of resources⁵.

Initiative in Colombia

The initiative between the PTS and VCU, which included two hospitals in the city of Cali, is the first of its kind. Experiences in Colombia are similar to those identified in developing countries, where presentation of retrospective reports are referenced, with review of clinical records according to a specific type of patient. For its part, the Epidemiological Surveillance System of the National Institute of Health monitors about 114 mandatory events that only include infectious and chronic non-communicable diseases. This is the first experience in Colombia that combines several of the key features of a real time web based health record, providing agility and credibility to the data¹⁹.

We emphasize that this is not a local or national government initiative, but is given as an academic proposal of the Universidad del Valle and health institutions that serve several of the trauma events occurring in Cali. The experience and excellent clinical outcomes in trauma management are recognized nationally and internationally^{20, 21}.

Characteristics of health care facilities

The preliminary results observed in each institution reflects coverage of each one according to the type of patients admitted and how it is classified in the health care network of the city. Health institutions of the State (or public) manage a large volume of patients, most of which belong

to affiliated systems subsidized by the State (SISBEN 1 and 2) or who are not affiliated with any Healthcare Program (also called linked) living in areas with high rates of unemployment, low education, poverty and youth gangs.

In private hospitals the care is characterized by patients in the contributory scheme and prepaid medical groups, managed in different public institutions. They also have the advantage of the organization of health care computerized information, providing greater availability of information. Furthermore there is an agreement with the Colombian army to care for the wounded in combat where the hospital assumes all costs.

Effectiveness of collected information

The main causes of consult are falls and minor trauma resulting from occupational and school injuries. Minor trauma mortality is similar to other populations such as Australia and the United States^{16, 22, 23}. Cali, being one of the cities with the highest incidence of violence, assault and secondary personal injuries, would expect this being the first cause of consult in both hospitals; however external causes of injury secondary to gunshot wounds and stab wounds are the third leading cause of consult after traffic accident injuries including pedestrians and motorcycle injuries. These three causes are distributed similarly in both institutions, with gunshot wounds being the second leading cause in the public hospital (36%) and third in the private (13.1%).

CONCLUSIONS

While gunshot wounds were not the main cause of consult, they generate the highest mortality in the population. Half of the deaths in the TRS: 44.7% were secondary to gunshot wounds and stab wounds 5.2% (Table 4). The second cause of death was traffic accidents, followed by falls and other mechanisms (contusions, aggressions, poisoning, etc.). Overall mortality was higher in the public hospital (4.62%), where there were more severely compromised patients: ISS > 15 (8.5% vs. 5.8%, $p = 0.002$) and higher percentage of patients injured by firearms (36% vs. 13%). Mortality in patients with ISS > 25 was lower in the private hospital (53.8% vs. 77.1%, $p = 0.027$). The average hospital and ICU stay at both institutions was similar (Tables 1 and 2).

Other benefits

In the first ninety days of the application of the ITR / SPT-ITSDP pilot phase, significant advantages were found such as reliability and organization of indexed data, taking as the source of documentation the medical history as well as providing immediate access of these with security to the platform, the ease of generating reports using the report generator, as well as ease of access to the system from any point with internet connection. Similarly, the project

allowed comparisons of the versatility of EDC in a digital medical record system versus one with no digital medical record. We found that the institution with digital medical records has greater ease in finding data, is less time consuming and provides a reduced process to access medical records.

The trauma registry initiates a process of trauma quality improvement. Given the versatility of the International Trauma Registry, the benefits that can be drawn from it, the availability and organization of data, justifies the cost of operation, it's a feasible and necessary investment in the mid and long term, with important medical, social and economic implications in the diverse institutions.

Limitations

From the operational standpoint, every hospital, during the development of the experience, achieved awareness of the hospital staff for this process, counting with their collaboration on data capture; which is a new process that requires the use of medical records and establishment of improved work coordination among all personnel performing activities around this document.

Another technical difficulty was the adaptation of the electronic equipment for the EDC. Resolution of the incompatibility of the webpage with the explorers was resolved in each of the computers so that all the information could be registered. In addition the prehospital section described several difficulties: such as not counting with a written report in the medical record of the activities performed by emergency medical technicians (EMT) in the ambulance or at the scene, therefore the EMTs have to be surveyed upon arrival to the emergency room to complete

the pre-hospital section. Difficulties were experienced on registering this information due to updates of the software in order to adapt the database to capture the needs of local information, which were made simultaneously during the collection.

It is noteworthy that the time requirements and data collection are different when the source of documentation is a paper medical record such as in the Public Hospital, where its availability, the legibility of the document and the interpretation of the notes mean more time in the EDC, compared to the Private Hospital, where the medical record is an electronic format which facilitates and expedites the process.

During the pilot phase of the implementation of the international trauma registry system in Cali, strengths and weaknesses were identified to achieve an optimal and useful information system. Identification of the necessity of implementation of the Trauma Registry System and the mechanisms to provide continuity were met.

The record becomes an important source of information for development of academic research and intellectual productivity of students and professors at the Universidad del Valle.

Each hospital achieved implementation of the TRS and identified the causes of consult, morbidity and mortality due to trauma. Trauma secondary to fall was the leading cause of consult in these referral hospitals, representing one third of the total consults.

Availability of epidemiological trends in the management of trauma of each center will allow better planning of emergency services and regional trauma system in order to optimize and reduce healthcare costs in the city. It allows the need to project a trauma care and emergency system in the pacific area.

R E S U M E N

Objetivo: Describir la experiencia en la implementación de un Sistema de Registro de Trauma (SRT) en dos hospitales en Cali, Colombia. **Métodos:** El SRT incluye información prehospitalaria, hospitalaria y estatus de egreso del paciente. Cada hospital tiene una estrategia para la captura electrónica de datos. Se presenta un análisis descriptivo exploratorio durante un piloto de tres meses. **Resultados:** Se han registrado 3293 pacientes, 1626(49.4%) del Hospital Público y 1613(50.6%) en el Privado. 67.2% fueron hombres; edad promedio 30,5±20 años, 30,5% menores de 18 años. Mortalidad global 3,52 %. Causa más frecuente de consulta fueron las caídas (33,7%); 11.6% fueron heridas por arma de fuego, la mortalidad en este grupo fue del 44.7%. **Conclusión:** Se determinaron las necesidades para la implementación del SRT y los mecanismos para darle continuidad. El registro se convierte en una fuente de información para el desarrollo de la investigación. Se identificaron las causas de consulta, morbilidad y muerte por trauma que permitirá una mejor planeación de los servicios de urgencias y del sistema regional de trauma con el fin de optimizar y de reducir los costos de atención. A partir de este sistema de información de trauma se podrán plantear los ajustes indispensables para rediseñar el sistema de trauma y emergencias del suroccidente colombiano.

Descriptores: Heridas y traumatismos. Urgencias médicas. Base de datos. Sistema de registros. Registros electrónicos de salud.

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