

## ORIGINAL ARTICLE

**Factors Associated with the level of Knowledge about the Management of Traumatic Brain Injury in Health Personnel of a Hospital in Northern Peru**ANTHONY MEZONES VARGAS<sup>1</sup>, DANAI VALLADARES GARRIDO<sup>1</sup>, MARIO J. VALLADARES-GARRIDO<sup>2</sup><sup>1</sup>Universidad Cesar Vallejo, Piura, Perú<sup>2</sup>Universidad Continental, Lima, PerúCorresponding author: Mario J. Valladares-Garrido, Email: [mvalladares@ucontinental.edu.pe](mailto:mvalladares@ucontinental.edu.pe), Cell: +51-944655396**ABSTRACT****Objective:** To identify the factors associated with the level of knowledge about the management of traumatic brain injury (TBI) in health personnel of the emergency service of a hospital in northern Peru.**Materials and methods:** A prospective analytical cross-sectional study was carried out on physicians from the emergency service of Hospital Santa Rosa, Piura, using a validated instrument. The factors associated with the level of theoretical and practical knowledge about the management of head trauma were identified. Prevalence ratios and 95% confidence intervals were estimated. P-values less than 0.05 were reported.**Results:** Of a total of 72 participants, it was found that 55.6% were male, 48.6% were specialist doctors, and 51.4% worked in the surgery emergency service. 61.1% (44) presented a high level of knowledge in theoretical and practical aspects while 38.9% (28) obtained a low level of knowledge. The factors positively associated with a higher frequency of theoretical-practical knowledge about TBI were having completed a master's degree or doctorate (PR=2.56), working in the Surgery service (PR=1.66), presenting previous training on TBI (PR=1.37), and manage more than 5 cases of TBI in the emergency during the last 2 weeks (PR=2.20).**Conclusion:** The level of knowledge in theoretical-practical aspects in TBI was high and this was associated with having a master's degree or doctorate, presenting previous training on TBI, working in the emergency medicine service and managing more than 10 cases of TBI in the emergency during the last 2 weeks.**Keywords:** Traumatic brain injury, doctors, Peru, knowledge, practices.**INTRODUCCIÓN**

Head injury is a serious public health problem worldwide (1,2) since it is considered the first cause of traffic accidents and the most common cause of death and disability in young people (3). It has been defined as that alteration of brain function or some evidence of brain pathology, caused by some external force, causing focal and diffuse brain injuries; and classifying as mild, moderate and severe TBI (4). The world incidence of TBI is 200 cases per 100,000 people, of which 10 to 15 are serious TBI (5) The neurological damage caused by TBI not only occurs at the moment of impact (primary brain injury), but also it also subsequently evolves into a secondary brain injury, this being the main cause of death at the hospital level, after traumatic brain injury. Therefore, early identification of a traumatic brain injury at the scene of the accident, as well as its subsequent evaluation and treatment by emergency medical personnel, is vital to reduce secondary injury (6).

Similar studies have been carried out that have evaluated knowledge about traumatic brain injury in other populations (6-10), however, not enough studies have been evidenced in health personnel in Latin America (11-14), much less in Peru. Due to this reason, it is of vital importance to be prepared in the cognitive and practical aspect for a good diagnosis and management of this pathology, with the purpose of measuring these important aspects in health personnel of emergency care at Hospital II-2 Santa Rosa, Piura.

For all of the above, the objective of this research was to identify the factors associated with the level of knowledge and practices on the management of traumatic brain injury in health personnel of the emergency service of a hospital in northern Peru.

**MATERIALS AND METHODS****Study design:** A analytical cross-sectional study was carried out.**Population and sample****Population:** Health personnel (doctors, residents, medical interns) of the Internal Medicine and Surgery emergency service of Hospital II-2 Santa Rosa, Piura**Sample:** 72 health personnel (doctors, residents, medical interns) from the Internal Medicine and Surgery emergency service of Hospital II-2 Santa Rosa, Piura. Health personnel who accept to participate voluntarily in the investigation of the Hospital II-2 Santa Rosa, Piura, health personnel belonging to the emergency

services of Medicine and Surgery of the Hospital II-2 Santa Rosa, Piura and those who complete the questions of the applied instrument that contain the main variables of interest of the study Those who unsatisfactorily completed the applied instrument on the subject were excluded. Non-probabilistic convenience sampling was used.

**Procedures:** An adapted and validated self-administered instrument used in a similar study carried out in Asian (8) and Latin American health personnel for medical students (14) was applied. This instrument consisted of 36 questions on theoretical knowledge and management of TBI, divided into two sections: 1) 8 questions on socio-educational data, 2) 19 questions on knowledge of TBI, 3) 9 questions on TBI practices. The instrument was reviewed and approved, in order to obtain its validation. An application document was submitted to the research office of Hospital II-2 Santa Rosa, Piura to obtain permission to carry out the study on selected health personnel from the emergency service. The self-applied questionnaire was administered to the doctors who agreed to participate in the research according to the respective service shifts in which they were working, for a period of approximately 15 minutes. The information collected through the questionnaires was recorded in a data collection form, the data obtained became part of a computer database for registration purposes in the Microsoft Excel program and statistical processing in the STATA program.

**Variables:** The dependent variable was the level of knowledge in theoretical-practical aspects of TBI, operationally defined as the degree of knowledge related to theoretical aspects, identification of TBI, evaluation of severity and practices of TBI in health personnel.

The independent variables were: age in years, sex (female, male), profession (general practitioner, specialist physician, resident physician, medical intern), department where he works (medicine, surgery), university of undergraduate graduation (national, private), postgraduate (master's, doctorate, none), emergency work time in monthly hours, emergency work experience in years, previous training on TBI management (no, yes), TBI cases handled in the last 2 weeks (0, 1-5, 5-10, 10-15, more than 15)

**Instrument:** The validation of the instrument was carried out in three phases: 1) design of the instrument construct 2) revision process of the instrument by 3 experts with more than 5 years of experience in emergency, therefore within it was the management

of TBI, through of the Delphi Methodology, sending the instrument to said experts to make the respective observations and achieve a final consensus. The questions were evaluated according to their relevance and clarity through a scale of 1-5 (totally agree, agree, neither agree nor disagree, disagree, totally disagree). Clarity was evaluated as follows: -1: Clarity absent, 5: Very clear. Relevance was evaluated as follows: 1: Little Relevance, 5: Very Relevant. Phase 3 was the validation through the application in a pilot population to detect errors, for which the instrument was applied in 30% of the total population of the health personnel of the Medicine and Surgery service (doctors, residents, interns). Medicine) of Hospital II-2 Santa Rosa in 2016; making the selection of 24 participants randomly. Likewise, the verbal approval of said pilot test participants was considered to obtain their participation in the study, thus surveying 24 people during the month of May 2016. Thus, reliability was determined with the Cronbach's Alpha coefficient of 0,98 (value greater than 0.7 defines acceptable reliability). Additionally, the Kaiser-Meyer-Olkin statistical test was performed (a value greater than 0.8 defines an acceptable value), resulting in a value of 0.92 for said statistical test. Bartlett's sphericity test (value greater than 0.05 defines an acceptable value), resulting in a value of 0.08

**Data analysis:** The statistical analysis was performed with the Stata v. 11.1 (StataCorp LP, College Station, TX, USA).

**Descriptive statistics:** For the categorical variables, the distribution of absolute and relative frequencies was used. In the case of numerical variables, means with standard deviation or median with interquartile range were presented, as appropriate.

**Analytical statistics:** For the hypothesis test analysis, the chi-square test was used for qualitative variables. Simple regression analysis was performed to estimate prevalence ratio and 95% confidence intervals; using generalized linear models, Poisson distribution family and log link function with robust variance. P-values less than 0.05 were reported as statistically significant.

**Ethical aspects:** The study was reviewed and approved by the Ethics Committee of the César Vallejo-Piura University. The confidentiality of the participants' data was preserved, since the questionnaires were anonymous. Verbal informed consent was requested from each participating health worker.

**RESULTS**

We found that the median age was 30 years (interquartile range: 21-62), 55.6% were male, 48.6% were medical specialists, 58.3% graduated from a national university in undergraduate studies, 62.5% had not completed a postgraduate degree, 51.4% worked in the emergency surgery service, the average working time in hours in the emergency room was 72 hours per month. While regarding previous training in TBI, 66.7% reported having done some. 65.3% had a high level of theoretical knowledge about TBI, according to the theoretical questions evaluated. 56.9% of the health personnel evaluated presented a high level of knowledge about practices in the management of TBI. 61.1% presented a high level of knowledge in theoretical and practical aspects. Table 01.

Regarding the questions about knowledge about TBI, the most correct questions were the Glasgow scale and the imaging study of choice for TBI with 100% and 83.3%, respectively. On the other hand, the questions with the lowest frequency of correct answers were the calculation of cerebral blood flow and the normal value of intracranial pressure with 48.6% and 53%, respectively. Regarding the questions answered correctly about the identification of TBI in health personnel, we found that the most correct questions were the identification of TBI and the symptoms that allow evaluating TBI with 95.3% and 80.6%, respectively. The least correct questions were the evaluation of the original injury point of the TBI and the important problems in the evaluation of the TBI with 51.4% and 62.5%, respectively. Regarding the questions about the evaluation of the severity of the TBI, it was found that the evaluation of the severity of the TBI in emergency and the traumatic brain injury were the most correct questions with 65.6% and 52.8%, respectively.

Table 1: Socio-educational characteristics and level of theoretical-practical knowledge about TBI in health personnel

Characteristics	N (%)
Age (years)*	30(21-62)
Sex	
Male	40(55,6)
Female	32(44,4)
Profession/Occupation	
Non-specialist doctor	5(6,9)
Medical specialist	35(48,6)
Resident doctor	14(19,4)
Medicine intern	18(25)
Type of university of graduation in undergraduate	
Public	42(58,3)
Private	30(41,7)
Postgraduate	
Master	24(33,3)
Doctorate	3(4,2)
No postgraduate	45(62,5)
Emergency service where work	
Internal Medicine	35(48,6)
General Surgery	37(51,4)
Emergency work experience (years)	5 (1-9)
Emergency work time (hours)	72(18-150)
Previous training on TBI	
Not	24(33,3)
Yes	48(66,7)
TBI cases treated in the last 2 weeks	
0	20(27,8)
1 – 5	21(29,2)
5 – 10	24(33,3)
10 – 15	7(9,7)
Más de 15	0(0)
Level of theoretical knowledge about TBI	
High	47(65,3)
Low	25(34,7)
Level of practical knowledge on handling TBI	
High	41(56,9)
Low	31(43,1)
Level of knowledge and practices on TBI	
High	44(61,1)
Low	28(38,9)

\*Median (25th percentile - 75th percentile)

Table 2: Percentage distribution according to the correct question of the questions of the questionnaire on the theoretical aspects, identification and evaluation of the severity of the TBI

Theoretical Aspects about TBI	Correct answers n(%)
1. Mortality due to severe TBI in Latin America	40(55,6)
2. Definition of TBI	58(80,6)
3. Importance of TBI	53(73,6)
4. Damage caused by TBI	44(61,1)
5. Definition of Cushing's Triad	50(69,4)
6. Definition of Intracranial Hypertension Syndrome	48(66,7)
7. TBI imaging study of choice	60(83,3)
8. Glasgow Scale	72(100)
9. Normal value of intracranial pressure	38(53)
10. Calculation of cerebral blood flow (CBF)	35(48,6)
11. High impact factors in TBI	41(56,9)
TEC Identification	Correct answers n(%)
1. Identification of the TBI	69(95,3)
2. Patient injury information	54(75)
3. Evaluation of the original injury point of the TBI	37(51,4)
4. Symptoms that allow evaluating the TBI	58(80,6)
5. Important problems in the evaluation of the TBI	45(62,5)
Evaluation of the severity of the TBI	Correct answers n(%)
1. Evaluation of the severity of TBI in Emergency	47(65,6)
2. Scalp injury	37(51,4)
3. Traumatic brain injury	38(52,8)

According to the questions asked about the TBI practices, it was found that the one related to the practices carried out before a

patient with TBI (81.9%) and objectives for the management of TBI together with the medications frequently used in patients with TBI (76.4 %). The other results are shown in Table 03.

Table 3: Percentage distribution according to the correct question of the questions of the questionnaire on knowledge of TBI practices in health personnel

Prácticas del TBI	Correct answers n(%)
1. Objectives for the management of TBI	55(76.4)
2. Practices carried out before a patient with TBI	59(81.9)
3. Use of muscle relaxants before intubation	30(41.7)
4. Practices when treating patients with TBI	44(61.1)
5. Medications frequently used in patients with TBI	55(76.4)
6. Glucose level measurement in suspected brain injury	38(52.8)

When performing the bivariate analysis, it was found that the socio-educational factors associated with having a high level of knowledge and practice of TBI in the evaluated emergency physicians were having completed a postgraduate degree (p<0.001), type of emergency service where they work (p=0.009), present previous training on TBI (p=0.027); having managed more than 5 cases of TBI during the last 2 weeks (p=0.003) as shown in Table 04.

Table 4: Socio-educational factors associated with the level of theoretical-practical knowledge of TBI in health personnel, in bivariate analysis.

Variables	Theoretical-practical knowledge of TBI		p*
	Alto (n=44) n(%)	Bajo (n=28) n(%)	
Sex		Z	0.787
Male	25 (62.5)	15 (37.5)	
Female	19 (59.4)	13 (40.6)	
Profession/Occupation			0.774
Medical Intern	23 (57.5)	17 (42.5)	
Medical specialist / Non-specialist	9 (64.3)	5 (35.7)	
Resident doctor	12 (66.7)	6 (33.3)	
Type of university of graduation in undergraduate			0.513
Public	27 (64.3)	15 (35.7)	
Private	17 (56.7)	13 (43.3)	
Postgraduate			<0.001
No postgraduate	15 (33.3)	30 (67.7)	
Master / Doctorate	23 (85.2)	4 (14.8)	
Emergency service where work			0.009
Internal Medicine	16 (45.7)	19 (54.3)	
General Surgery	28 (75.7)	9 (24.3)	
Previous training on TBI			0.027
Not	15 (62.5)	9 (37.5)	
Yes	41 (85.4)	7 (14.6)	
TBI cases treated in the last 2 weeks			0.003
Less than 5	12 (29.3)	29 (70.7)	
More than 5	20 (64.5)	11 (35.5)	

\*Valor p obtenido con prueba chi cuadrado de independencia

In the simple regression analysis, we found that having a master's/doctorate degree increases the frequency of a high level of theoretical-practical knowledge of TBI by 156% (PR=2.56; CI95%: 1.64-3.980). The health personnel of the General Surgery emergency service present a 66% higher frequency of high level of theoretical-practical knowledge of TBI (PR=1.66; 95% CI: 1.10-2.48). While having received previous training on TBI is associated with a 37% higher frequency of high level of theoretical-practical knowledge of TBI (PR=1.37; 95% CI: 0.98-1.90). In addition, having treated more than 5 cases of TBI in the last two weeks increases the frequency of a high level of theoretical-practical

knowledge of TBI by 120% (PR=2.20; CI95%: 1.28-3.79). Table 05.

Table 5: Factors associated with the level of theoretical-practical knowledge of TBI in health personnel, in simple regression analysis

Variables	Regresión simple		
	PR	IC 95%	p*
Sex			
Male	Ref.		
Female	0.95	0.65-1.38	0.789
Profession/Occupation			
Medical Intern	Ref.		
Medical specialist / Non-specialist	0.86	0.57-1.31	0.509
Resident doctor	0.96	0.58-1.60	0.888
Type of university of graduation in undergraduate			
Public	Ref.		
Private	0.88	0.60-1.30	0.513
Postgraduate			
No postgraduate	Ref.		
Master / Doctorate	2.56	1.64-3.980	<0.001
Emergency service where work			
Internal Medicine	Ref.		
General Surgery	1.66	1.10-2.48	0.009
Previous training on TBI			
Not	Ref.		
Yes	1.37	0.98-1.90	0.028
TBI cases treated in the last 2 weeks			
Less than 5	Ref.		
More than 5	2.20	1.28-3.79	0.003

\* p-values obtained with Generalized Linear Models (GLM), Poisson family, log link function, robust variance

## DISCUSSION

In this study, we found that the health personnel who work in the emergency service have a high level of knowledge in theoretical-practical aspects of the management of TBI (61.1%). These results are supported by what was found in the similar study carried out in China by Kou et al. ; Since a self-administered questionnaire in physicians who worked in Chinese pre-hospital establishments showed high scores in the TBI evaluation (0.80, SD = 0.14) (8). While another similar investigation carried out in Thailand, states that only 33.3% correctly answered the questionnaire on knowledge and clinical management of TBI; This difference may be due to the fact that in this study the population enrolled was only nursing staff, in contrast to this research from Piura where all health personnel (doctors, medical interns, residents) were evaluated (10). On the other hand, a report carried out in a population closer to this research (Cuba) showed that the average score of primary care professionals was 60.5 points (11). Also, Flores et al carried out a similar investigation in a purely medical student population in Latin America, where through the online application of a questionnaire it was found that 44% and 38% of the students presented a good and very good level of TBI knowledge. (14); which is similar to the findings reported in this thesis report. This may also be due to the clinical skills of medical personnel in trauma management, since Loría Castellanos et al in their Mexican study carried out on 141 emergency medicine residents showed that 61% of the residents had low attitudes towards the subject under study (13), however this variable was not explored in this research.

The socio-educational factors that were associated with presenting a high level of knowledge about TBI were: having a master's degree or doctorate, working in a general surgery service, presenting previous training on TBI, and handling more than 5 cases of TBI in the emergency during the last 2 weeks. Kou et al, in their recently published Chinese study, state that the level of education is positively associated with higher TBI identification scores in the emergency department (8), which differs from what was found in this research, since no differences were observed

among the group of doctors and medical interns to present a high level of knowledge about TBI. However, in the percentage distribution of questions related to the identification of TBI in health personnel, those answered correctly more frequently went to identification of TBI and the symptoms that allow evaluating TBI with 95.3% and 80.6% respectively, as well as the least correct questions were the evaluation of the original injury point of the TBI and the important problems in the evaluation of the TBI with 51.4% and 62.5%, respectively.

Other similar studies in which knowledge on medical issues related to emergencies have been evaluated have shown the importance of addressing even more in this type of research, such as that carried out by Aranzábal et al. ; In which he identified the factors associated with the level of knowledge in cardiopulmonary resuscitation in 25 Peruvian hospitals, finding that being a doctor and/or sick as well as having previously taken an OCR course was associated with presenting a good knowledge of CPR (15). This is similar to what was found in this research, where having previous training on TBI was associated with presenting a high level of knowledge in the questions about the theoretical and practical part of TBI. Likewise, what was done by Kou in two Chinese hospitals affirms that presenting an appropriate continuing medical education program allows improving the quality of the emergency service, especially that destined for pre-hospital ambulance care (8).

The annual training experience on a regular basis was also a socio-educational factor of special relevance in those doctors, interns and residents at the time of presenting a good level of knowledge about TBI, since it increased the frequency of knowledge about TBI. This is similar to that reported in China, where participants' TBI treatment scores were positively associated with training frequency (8). Likewise, the study carried out on Latino medical students reveals the importance of prior training and previous experience with respect to the subject under study, since this can demonstrate a statistically significant relationship at the time of carrying out the theoretical and/or practical evaluation (14).

Likewise, another important finding in this research affirms that if the health personnel manages more than 10 cases of TBI in the emergency during the last 2 weeks, it is associated with presenting a high level of knowledge about the management of TBI. This is contrary to what was described by Kou et al in their Chinese study where this socio-educational variable was not associated (8). Thus, it is important that from undergraduate, medical students present a theoretical-practical training based on scientific evidence on the management of various pathologies in the emergency, in this case the TBI, which has been addressed through academic activities. -extracurricular scientists in Latin America (11).

This research has some limitations. First, selection bias, since it is not possible to infer our findings to the entire health population since only one hospital site was evaluated. Second, due to the cross-sectional design of the research, it is not possible to attribute causality between the variables that were associated with a higher frequency of knowledge of TBI. Third, measurement bias, since it was not possible to evaluate the practices on TBI in situ during the medical attention of the health personnel. However, this research opens the conduct of future prospective studies that allow improving the theoretical-practical knowledge about TBI of health personnel; mainly those who work in the emergency of hospital centers.

## CONCLUSIONS

The level of theoretical knowledge of traumatic brain injury was high in health personnel of the emergency service of Hospital II-2

Santa Rosa, Piura during the period April-August of the year 2017. The factors positively associated with a higher frequency of theoretical-practical knowledge about TBI were having completed a master's or doctorate, working in the Surgery service, presenting previous training on TBI, and handling more than 5 cases of TBI in the emergency during the last 2 weeks

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