Original Article

Trauma care systems in healthcare facilities of an Indian District: Assessment and future directions

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Abstract

Introduction: With a long-term vision to strengthen the evidence-based trauma care programme in the Kolar district, an objective assessment and grading of the trauma care system (TCS) in public and private hospitals was undertaken. **Methods:** This cross-sectional assessment used a specifically developed TCS assessment tool to collect data from all Level 2, 3, and 4 hospitals in the Kolar district using a review of records, observation of facilities, and interviews with stakeholders. Data were collected regarding macro areas, human resources, infrastructure, equipment, and drugs in ER, in an objective manner. TCS was scored and compared against criteria set in WHO essential guidelines for Trauma Care. The functioning of TCS was expressed as 'percentage of expected standards' and graded accordingly. Ethical clearance and informed consent were obtained. **Results:** All available and eligible Level 2, 3, and 4 hospitals in the district (39 hospitals) covering the public and private sector were assessed. TCS in Level 2 and 3 hospitals was functioning at 56% and 59% of expected standards, respectively. TCS was better in Level 4 hospitals, at 83% of expected standards. Scores were lower for macro areas and human resources. **Conclusion:** TCS in the district is functioning sub-par to expected standards. There is a need for comprehensive strengthening of TCS in both public and private healthcare facilities, especially in macro areas and human resources. Systematic monitoring and periodical TCS assessments are recommended at district levels throughout the country for improved outcomes in India.

Keywords: Emergency care, India, injury prevention, system assessment, trauma care

Introduction

Globally, an estimated 4.3 (95% UI 3.9,4.6) million people succumbed to injuries in the year 2019, with nearly one-fifth (0.95 million—22%) from India.[1] In Karnataka, a southern Indian state with a population of 60 million, around 25,443 injury deaths were reported by the State Crime Records Bureau[2] in the year 2019. These numbers are underestimated by nearly 42% when compared with 59619 estimated injury deaths by the Global Burden of Disease (GBD) study in the same year.[1] Based on a 1:30 ratio of deaths to severely injured, nearly 920,000 persons are estimated to require trauma care services in the state.[2,3]

A well-organized trauma care system (TCS) nationally and at the state and district levels provided early, efficient, and quality trauma care services to reduce fatality, morbidity, and disability. Post-crash care (TCS) is a key component of the five pillars to reduce road deaths as advocated by The United Nations Decade for Road Safety.[4] To enable uniformity in TCS development across different levels of healthcare facilities (HCFs), WHO guidelines for essential trauma care (WHO-GETC) are available.[5]

Delivery of trauma care services is the responsibility of the state and district administrative units in the Indian healthcare system.

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Few studies have indicated that current trauma care services, within the public sector, are grossly inadequate.[6–8] However, these studies do not objectively quantify the extent of system inadequacy or its adequacy, measured in terms of compliance with the widely accepted WHO-GETC.[6–8] Moreover, the private sector HCFs are often not included in many of these studies.

Thus, there is a clear unmet need for a valid, reliable, comprehensive, and quantifiable district-level TCS assessment, covering all private hospitals (PH) and government hospitals (GH). This would strengthen trauma care monitoring, surveillance, district-level trauma programme implementation, and research. Hence, an assessment of TCS was conducted in the Kolar district, which is the public health observatory of the Centre for Public Health (CPH), National Institute of Mental Health and Neuro Sciences (NIMHANS). The aim of the study was to undertake an objective assessment and grading of trauma care facilities in PHs and GHs in the Kolar district. Findings from such assessments at a district level can be used to strengthen TCS by engaging with health administration and policymakers to facilitate required changes in health systems and enable regular monitoring of TCS.

Material and Methods

Study setting

This assessment was conducted in the Kolar district, located 80 kms from Bengaluru city and home to nearly 1.5 million.[3] Official sources reported 611 injury deaths in the district in the year 2019, based on which nearly 20,000 persons with severe injuries, are estimated to require emergency care in the district.[2]

Study duration and design

This cross-sectional study was conducted between November 2018 to January 2019.

Sample size and sampling

The district health infrastructure includes 69 primary health centres (PHC), 2 community health centres, 4 sub-divisional hospitals (TH), and one district hospital (DH) as per 2019 data from the District Health Office (DHO). At the time of this assessment, there were 69 registered PHs in Kolar which included one medical college and hospital (MCH). A complete resource mapping of PHs and GHs served as the sampling frame.

Each hospital was visited by a trained investigator (Master in Public Health scholar) who categorized the hospital as either Level-1,2,3,4, depending on the availability of full-time Emergency & Casualty services (ER) and specialty medical services. This categorization criteria, based on the Clinical Establishments Act 2010 of the Government of Karnataka, are listed in Table 1.[9]

Hospitals having a functional ER were classified as Level-2 Hospitals. Specialty hospitals with ER and Intensive care unit facilities were categorized as Level-3 hospitals. Hospitals having super-specialty services and being involved in academic training were categorized as Level-4 hospitals. The Level of Hospitals as presented in Table 1 corresponded to levels of HCFs used in WHO-GETC,[5] hereby enabling comparisons. Complete enumeration of all consenting Level-2,3,4 GHs and PHs was done. Level-1 hospital (PHC and clinics) were not included in this study as they did not have an ER to provide emergency trauma care.

In total, 145 hospitals were included into the sampling framework (76 public and 69 private), of which 39 eligible and consenting hospitals in Kolar district (Public = 6, Private = 33) were included for detailed assessments. Six GHs (1 DH at Level-3, 4 THs and 1 civil hospital at Level-2) and 33 PHs (31 Level-2 and 2 Level-4 hospitals) were qualified for inclusion in the assessment and were included. Permissions, approvals, and consent were obtained from concerned authorities after explaining the purpose of the study.

Study instrument

A 'Tool for trauma care assessment for different levels of HCFs' was used to collect data from the hospitals. The tool consisted of seven sections, namely, macro areas, infrastructure in ER, human resources, equipment, drugs, information systems, and utilization section.

The tool was developed by a systematic process. A review of WHO-GETC,[5] Tamil Nadu Accident and Emergency Care

Table 1: Definition of healthcare facilities according to the Clinical Establishment Act 2010[9]

Hospital level	Services	Studied/Excluded	Equivalent in public sector
Hospital Level-1	General medical services + Basic specialist medical services (Medicine, Paediatric, and OBG) + First Aid + Pharmacy + Laboratory. (Bed strength <30)	Not studied	PHCs
Hospital Level-2	Level 1 + Specialty support services (Orthopaedics, ENT, Ophthalmology, Dental, Emergency services, Anaesthesia, Psychiatry, Skin, Pulmonary Medicine, Rehabilitation), Operation Theatre, Diagnostic Imaging facility Focus: Secondary healthcare services	Included for study	Taluka Hospital
Hospital Level-3	Level 2 + Multi-specialty care through distinct departments + dentistry + Intensive care unit Focus: Tertiary care	Included for study	Civil Hospital Taluka Hospital District Hospital
Hospital Level-4	Level 3 + Multiple super-specialty care + teaching/training institute. Includes requirement of MCI/other registering body Focus: Tertiary care	Included for study	NIL

Initiative (TAEI) study tool,[10] and Clinical establishment act checklists[9] was done following which a draft tool consisting of seven sections and 136 items was developed. Five domain experts rated the content validity of each item on a scale of three (Not necessary and may be removed = 0; Useful, may be retained = 1; Essential, to be retained = 2). Content validity ratio (CVR) was calculated for each item using Lawshe's content validity ratio (Formula i.e., CVR = $(N_e - N/2) \div (N/2)$ where N_e is the number of experts indicating 'essential', and N is the total number of experts). Based on content validity assessments, 21 items were removed from the study instrument.

The final instrument consisted of 115 items of which 92 items were considered for scoring. The instrument was digitalized, and a pilot study was conducted in one hospital to understand operational issues in data collection. A smart phone containing digital version (Epi info 1.4.3) of the assessment tool was used for data collection. Sections and variables used in final tool are presented in Table 2.

Data collection

Trained investigator visited each eligible hospital after prior appointment and collected data using a combination of interview and observation (records and facilities) methods [See Table 2]. Every attempt was made to inspect and observe the facilities. ER physical infrastructure (building, signages, triage, OT, beds, and others), emergency equipment, drugs, and availability of human resource were assessed by observation. Rest of the data was collected by interview and inspection of records [See Table 2].

Data analysis

Post data collection, data were exported from Epi-info and analysis was done using SPSS version 23. Categorical data were summarized as frequency and percentages. Discrete quantitative data (number of patients and number of beds) were presented as mean and standard deviation.

Unweighted TCS scoring for each hospital was done. A maximum number of items used for scoring and the maximum score possible varied for each hospital Level-2,3,4 as WHO-GETC also varied by level of the hospital. Each applicable item in the study instrument was scored (one point) in case of a positive observation or if a facility is present. (For example, if trauma care policy is present, Score = 1, if not present = Score = 0.) The sum of scores of all applicable items in a section is the section score. Sum of all section score's is the overall TCS score for the hospital.

TCS status of each hospital is expressed as 'percentage of expected standard score' for the same level of hospital. The expected score (standard) is the WHO-GETC [See Table 3]. TCS status is calculated as [(Score obtained by the hospital/Expected maximum score for same level hospital) *100]. It is inferred as 'TCS is functional at a certain percentage of the expected essential standard'. The number of items expected scores and section wise scores for each level of hospital is presented in Table 3.

Based on percentage of expected standards, hospitals were further categorized into three categories (TCS at <50% of expected standards (Category C), 51–74% (Category B), and >75% of expected standards (Category A). The Chi-square test of significance was applied to test for differences categories of expected standards.

Ethical issues

All procedures of the study were approved by the Institutional ethical Review Board of the National Institute of Mental Health and Neurosciences, Bengaluru, letter NIMH/DO/(BS&NS DIV.)/2018 dated 3-01-2019

Results

We assessed 39 eligible and consenting hospitals in the Kolar district. Of the 39 hospitals, 33 (85%) were PHs and six (15%) were GHs. From secondary data, we estimated that the doctor–nurse ratio in the district was 1.73 and the number of allopathic doctors and nurses per 100,000 population was 37.6 and 53.8, respectively.

TCS and services in Kolar

Macro areas

None of the hospitals had an exclusive trauma care policy nor dedicated funding for TCS. Only 5% of hospitals had

Table 2: Sections and variables used in study instrument

Sections (Hospital)	Variables	Data collection method
General Information of the hospital	Name of the Hospital, Key Informant, Type of hospital, Level of hospital, Address, Number of Beds	I, R
Macro Areas in the Hospital	Trauma Care Policy, Trauma Care committee, Budget, Capacity building, Health insurance	I, R
Human Resources	Manpower statistics-Doctors, Specialist doctors, Casualty Medical Officers, Nurses, Paramedical staff, and others	I, O
Utilization/caseload	Number of cases seeking care in ER-All cases and trauma cases; number of ER admissions and ER trauma admissions,	I, R
Physical Infrastructure in Emergency Room	Exclusive Trauma Care Centre building, Triage facilities, OT, Number of beds in ER, Observatory ward, Burns ward	I, O
Emergency Equipment	Equipment (s) for airway, breathing, and circulation	I, R, O
Emergency Drugs	Drugs for anaesthesia, anaphylaxis, blood and plasma expanders, cardiovascular, and what	I, R, O

Interview=I, Inspection of records=R, Observation=O

a functional trauma care committee (an enlisted committee that had met at least once in the last year). SOPs/guidelines for trauma care or algorithm for the management of specific cases were reportedly present in 5% and 15% of hospitals, respectively, mostly in Level-3,4 hospitals. In nearly 50% of the Level-2 hospitals, there was no signage providing directions to, or indicating the location of ER in the hospital. Around 79% accepted payments from health insurance schemes for trauma care of patients [Supplementary Table 1].

Human resources in ER

[See Table 4] None of the GHs had a Casualty Medical Officer (CMO) at the time of assessment. The sanctioned CMO post in the DH was vacant and the CMO post was reportedly not sanctioned for Level-2 GHs. The doctor–nurse ratio in the ER was 1:1.5. Around 41% of the total doctors and 14% of the total nurses in ER were reportedly trained in BTLS. There were five doctors and 10 nurses for every 100 ER trauma registrations every month.

Physical infrastructure

Beds in the ER

We identified 161 beds in ER in the Kolar district, of which 43% were in Kolar taluka. Within each ER, there were no beds exclusively designated or allotted for trauma cases. The average number of beds in ER in Level-2,3,4 hospitals was 3, 5 and 23, respectively. Beds in ER accounted for 6.9% of all beds in the assessed hospitals.

Emergency equipment and drugs in ER

Equipment in ER for airway, breathing, and circulation management was present in all hospitals, except chest tubes (36%) and arterial blood gas testing facilities (33%). Mechanical ventilators were not present in 53% of ERs in Level-2,3 hospitals. All hospitals reported that emergency drugs, IV fluids, and pain control medicines were available as much as required (Details in Supplementary Table 2 and 3).

Information systems

Around 26% of hospitals have a computerized information system in ER. Indicators to monitor ER care systems and services were not present in all Level-2,3 hospitals.

Utilization of ER services

Hospital records revealed that 190,930 outpatients and 36075 inpatients (including 1529 (4.2%) trauma inpatients) sought care monthly in Level-2,3,4 hospitals in the Kolar district. Of total trauma inpatients, 78% were admitted in the Kolar and KGF talukas. Nearly 43% of all-cause hospital deaths occurred in the ER and 21.4% of all ER deaths were due to trauma.

Status of TCS as against expected standards

TCS in Level-2,3,4 hospitals were functioning at 56%, 59%, and 84% of expected standards, respectively [Table 5]. In Level-2,3 Hospitals, lower levels than expected standards were observed for macro areas, human resources availability, and ER infrastructure. Systems were better for the availability of drugs and equipment. The situation of TCS is relatively better in Level-4 hospitals where all sections were functioning at >50% of expected standards [Table 5].

Table 3: Expected maximum scores (standard) for each level of HCF

	Level 2	Level 3	Level 4
Number of items considered for scoring	74	92	92
Expected standard score	74	92	92
Scores by section			
Macro areas	7	7	7
HR in hospital	10	10	10
ER information	8	8	8
ER infrastructure	11	11	11
HR in ER	11	11	11
Equipment and drugs	5	5	5
Emergency equipment	17	21	21
Emergency drugs	5	19	19

Table 4: Human resources in ER in HCFs in the Kolar district

Human resources in ER	Total
Casualty Medical Officer	9
CMO's trained in trauma care **	7
Trained Specialized Doctor's in Emergency Medicine	30
Total Specialist Doctors	82
Staff Nurses	138
Staff Nurses trained in trauma care ***	20
Nursing Attendants	14
Radiographers	7
OT Technicians	13
Lab Technicians	13
CT Technicians	1
Hospital Attendants	96

**Trained in Trauma care implies MBBS doctors who have undergone Advanced Trauma Life support training or any fellowship courses in Trauma care. (Does not include doctors who have MD/MS/DNB/DM/M. Ch degrees). ***Implies staff nurses who have completed Basic Trauma Life support or Advanced Trauma Life support training or fellowship/certificate course in trauma care)

Categorization of hospital TCS

Most hospitals (76.9%) had TCS which was between 51 and 74% of expected standards (Category B). All Level-4 hospitals (100%) had systems ≥75% of expected standards (Category A). Nearly 19% of Level-2 hospitals had systems that were <50% of expected standards (Category C). They are the priority hospitals for strengthening TCS.

Discussion

Strengths of the study

As per our knowledge, this is the first district-wide assessment of TCS covering all GHs and PHs Level-2,3,4 hospitals comparing the existing TCS with WHO-GETC in Kolar.[5] This assessment is in line with WHO Global Emergency and Trauma Care Initiative (GETCI), which seeks to assess national

Table 5: Status and functioning of TCS in the Kolar district (mean score and % of expected standards)

	Level 2			Level 3			Level 4		
	Expected Max score (standard)	Mean±SD	% of expected standards	Expected Max score (standard)	Mean±SD	% of expected standards	Expected Max score (standard)	Mean±SD	% of expected standards
Macro areas	7	0.64±0.63	9.2%	7	2±0	28.6%	7	3.5±0.5	50.0%
ER general facilities	8	2.89±0.99	36.1%	8	4±0	50.0%	8	6±2	60.0%
ER infrastructure	11	4.14±0.79	37.6%	11	5±0	45.5%	11	6.5±0.5	59.1%
HR in ER	11	4.53±1.38	41.2%	11	4±0	36.4%	11	9±1	81.8%
Equipment & drugs	5	4.14±0.35	82.8%	5	5±0	100.0%	5	5±0	100.0%
Emergency equipment	17	12.64±2.15	74.4%	21	18±0	66.7%	21	25.5±2.5	88.1%
Emergency drugs	5	4.78±50	95.6%	19	17±0	73.7%	19	20.5±1.5	97.4%
Overall trauma systems in ER	74*	39.08±4.31	56.1%	92*	55±0	59.8%	92*	77±5	83.7%

*Including 10 points for HR in the hospital level, apart from ER, for all hospitals; Expected standard criteria=WHO guidelines for trauma care, essential criteria. TCS status = (Score obtained by the hospital/Expected maximum score for same level hospital) *100]

emergency care systems, identify shortcomings, and implement proven interventions to address gaps in low- and middle-income countries.[11] The assessment was conducted using a specifically developed tool with requisite content validity to objectively quantify the level of functioning of TCS of each hospital against WHO guidelines for essential trauma care.[5] The objective and quantitative nature of this study has scope for longitudinal assessments to monitor change and assess the effectiveness of interventions implemented to strengthen TCS. Data were collected using digital methods and the study recorded a 100% response rate owing to support from the district health administration.

Macro-level components for trauma care

Trauma care policy, action plans, SOPs, capacity building, and dedicated funding which are vital to catalyse and sustain TCS development had low functional scores in the Kolar hospitals. Macro areas are better in larger PHs (Level-3,4) as they are involved in various accreditation processes. The status of DH is largely influenced by national and state directives and needs implementation strengthening. The situation in other districts is no different as evidenced by other studies which also highlighted the lack and need for a trauma care policy for HCFs.[7,8,12,13] Even at the national level, trauma care policy is not existent, though there is a National Programme For Prevention & Management Of Trauma & Burn Injuries.[14] There are operational guidelines for trauma care centres on national highways which could be modified for use in Level-3,4 hospitals in India.[15]

Surveillance and information systems for trauma care

They are essential to plan, implement, monitor, and evaluate trauma services but were not present in three-fourths of the hospitals in Kolar. Existing trauma information systems, sourced from police records, mostly cater to medico-legal needs rather than patient care and health system needs[16,17] and are prone to under-reporting.[17,18] There is much benefit in strengthening the macro-environment for hospital-based trauma and injury surveillance to complement the existing police record-based system. The Bengaluru Injury/Road Traffic Injury Surveillance Project (2008–10) and studies from Tumkur,[19] Kolar,[20] Bangalore,[16] have demonstrated the feasibility and benefits of the hospital-based injury surveillance[16] and this needs implementation on a larger scale. Currently, efforts are in progress for National Injury Surveillance System and Trauma Registry at national level.

SOPs for trauma care

Available SOPs in ER were mainly related to the assessment and management of head injuries and poisoning. Shortcomings are observed in GHs in the district, and this could be attributed to their dependence on the state to develop and circulate SOPs and guidelines. With the absence of district-level trauma care coordinator (or officer), efforts to develop SOPs at the district level depend on commitment of the district surgeon or CMO, who are burdened with multiple administrative responsibilities.

Case-load and human resources

ER Utilization data may be an underestimate of case-load in ER as well as the adequacy of doctors, as recent data from national survey of trauma care in DH in India indicated that emergency and injury cases annually accounted for nearly 19–36% of admissions in hospital trauma[6] and the actual caseload is at least 20% higher.[17,18] Studies often report inadequacy of manpower in the ER.[6,7,21] Issues pertaining to unequal distribution of doctors and paramedics in the district are observed. Less than 50% nurses and doctors in ER were trained in basic trauma life support (BTLS) courses, hereby compromising quality of trauma care[6,8,18] and indicating an imminent need for capacity building of doctors and nurses in BTLS and ATLS training. CMO, key person to coordinate trauma care in ER in Indian hospitals, was either absent or not available full time in the Kolar hospitals. A nodal person for coordinating trauma care is vital to organize, implement, and sustain systems at hospital level, and this gap needs to be bridged.

Systems in ER

Only 15% of hospitals in Kolar had a functional triage system in the ER and there was no distinction between medical and surgical emergencies. Observations indicate a need to establish and pilot triage systems in ER, based on learnings from other

states. One example is the TAEI model which is based on 3Ts (triage, treatment, and training). In TAEI model, triage services in ER are coordinated by a trained nurse coordinator who further trains new nurses to sustain the system.[10] TAEI model has demonstrated improved treatment outcomes in ER.

Per bed availability of oxygen cylinder and suction apparatus was inadequate in ER. The unavailability of mechanical ventilators in ER was reported as a common reason for referral to a higher centre. Only Level-4 hospitals had minor operation theatres in ER. Similar findings were echoed in studies in other places in Karnataka in the past.[7,22] Similar observations were also recorded in the recently published survey which indicated that the availability of recommended critical care equipment was satisfactory in PHs (86–93%) and Govt MCH (68%), with deficiencies found largely in smaller GH (45–60%).[6]

Need for TCS strengthening

Nearly 21.4% of all ER deaths were due to trauma in the Kolar. Strengthening ER in Kolar district has the potential to reduce 25–40% of all hospital deaths. Data from the Bengaluru Injury Surveillance project (2007–2012) observed that nearly 50% of injury deaths occurred in hospitals, clearly indicating that a reduction in trauma deaths would not be tangible without effective TCS in hospitals.

Our assessment revealed that TCS in Kolar is at 53–60% of WHO guidelines for essential trauma care, signifying a need for improvement. However, systems in Level-2,3 were relatively better in terms of availability of drugs and equipment (68–90% of expected) as against human resources, infrastructure, and macro areas (30–50%). Level-3,4 hospitals (DH and MCH) had better TCS as they are referral centres, comply with norms set by National Medical Council, participate in the accreditation process, and are involved in academics and capacity building. Referrals to Level-3,4 hospitals can be decreased by strengthening Level-2 hospitals. Results indicate a need to focus on strengthening macro areas, human resources, and general infrastructure in ER rooms as a priority in Level-2,3 hospitals.

Trauma care services in Karnataka is provided through a network of 2844 GHs and 20431 PHs (1:7). Of the 2844 GHs, 470 hospitals are Level-2,3 trauma care facilities (CHC and above).[3] Though essential guidelines for trauma care for the state were developed in the year 2015 under Karnataka Health Systems Development and Reforms project (KSHDRP) and circulated to all the hospitals,[23] there have been monitoring and implementation gaps, as reflected in our study results. Regular district-level monitoring and objective assessment of TCS is key to ensure compliance to WHO-GETC at the state level, as well as to strengthen trauma care programming.

Limitations

This study had some limitations, as some observations were dependent on available hospital records, which is questionable in many smaller PHs. Information derived from such hospital records related to manpower, drugs, and equipment could be an overestimate. However, we expect the record quality to improve overtime if TCS assessments are conducted periodically. Social desirability bias might have influenced favourable reporting by key informants. Nevertheless, this study highlights the modest status of systems in ER and builds a strong case for system development.

Conclusion

Overall, TCS in the Kolar falls short of the criteria specified in WHO-GETC and there is a need for comprehensive strengthening of TCS in both GHs and PHs in the district. Based on the observations, we recommend yearly TCS assessment using the tool developed in our study. As this study has demonstrated feasibility and objectivity to conduct district-level TCS assessments, we recommend upscaling this assessment to all districts in the State.

To improve TCS in the district, we recommend the implementation of a district-level trauma care programme with clearly defined policy, action plan, targets, activities, and coordinated by a dedicated programme officer with a focus to achieve 100% compliance to existing WHO-GETC. Strict accreditation of all HCFs as per national norms and guidelines should be mandatory to improve standards of care

As a short-term measure, we recommend creating adequate space for emergency and TCS in hospitals, phase-wise BTLS and ATLS training of all nurses and doctors, set up triage and trauma care information systems in all hospitals, and develop exclusive infrastructure for trauma care in Level-3,4 hospitals. The findings and recommendations of this study, which has comprehensively covered public and PHs, can be considered by the vision group for health, recently formed by the Karnataka state government, to further strengthen district-level TCS in the state.

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Ethical Approval and/or Institutional Review Board (IRB)

National Institute of Mental Health and Neurosciences, Bengaluru, letter NIMH/DO/(BS&NS DIV.)/2018 dated 3-01-2019

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Conflicts of interest

There are no conflicts of interest.

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Table S1: Macro areas pertaining to trauma care in ER

	Total *n*=39 (%)
Emergency services available (Casualty)	39 (100)
Signage for casualty	27 (69)
Trauma care policy	0 (0)
Designated trauma care in-charge	16 (41)
Trauma care committee	2 (5)
Trauma care review meeting	1 (2.5)
Capacity building system of staff	3 (8)
Specific funding	0 (0)
Computerised information system	10 (26)
SOP for trauma care*	2 (5)
SOPs for Mass casualty management	2 (5)
Algorithm for trauma care**	6 (15)
Schemes for BPL for trauma care	13 (33)
Health Insurance acceptance for trauma care	31 (79)

*SOP for trauma care: Standard Operating Protocol's for trauma care (Example SOPs for management of patient with burns, head injury, unconscious patient etc). **Algorithm for trauma care: Refers to any presentation/books/posters depicting process of case management Example: Conduct triage. Management of head injury cases. Management of poisoning etc

Table S2: Emergency Equipment in ER in HCFs in Kolar District

	Total
Equipment for Airway Management	
Oral or nasal airway	31 (79)
Suction device: electric	39 (100)
Suction tubes	38 (97)
Yankauer suction tip	12 (31)
Laryngoscope	32 (82)
ET tube	36 (92)
Oesophageal detector	4 (10)
Ambu Bag	39 (100)
Basic trauma pack	16 (41)
Magill forceps	30 (77)
Capnography	27 (69)
Equipment for Breathing Management	
Stethoscope	39 (100)
Oxygen supply (Cylinder)	28 (72)
Oxygen supply (Central)	11 (28)
Nasal prongs	33 (85)
Needle &syringe	39 (100)
Chest tubes	14 (36)
Underwater seal bottle	11 (28)
Pulse oximetry	38 (97)
Arterial blood gas analyser	13 (33)
Mechanical ventilator	19 (49)
Equipment for Circulation of blood	
Clock	39 (100)
BP cuff	39 (100)
Gauge &bandage	39 (100)
Arterial tourniquet	19 (49)
Defibrillator	28 (72)
ECG Machine	39 (100)
Nebulizer	39 (100)

Table S3: Select emergency drugs in ER in HCFs in Kolar

	Total
Anaesthesia	
Bupivacaine	36 (92)
General Anaesthesia	35 (90)
Ketamine	23 (59)
Lidocaine	36 (92)
Nitrous-oxide	34 (87)
Oxygen	39 (100)
Thiopental	31 (79)
Diazepam	37 (95)
Atropine	39 (100)
Pain, fever, inflammation	
Morphine	6 (15)
Codeine	4 (10)
Acetyl salicylic acid	34 (87)
Ibuprofen	35 (90)
Paracetamol	39 (100)
Anaphylaxis	
Dexamethasone hydrocortisone	39 (100)
Epinephrine	31 (79)
Blood Products and plasma expanders	
Heparin	31 (79)
Warfarin	20 (51)
Dextran70	25 (64)
Factor IX concentrate	5 (13)
Factor VIII concentrate	5 (13)
Cardiovascular disorders	
Dopamine	35 (90)
Antiseptic & Disinfectant	
Antiseptics chlorhexidine ethanol polyvidone or equivalent	39 (100)
Disinfectants chlorine base compound chloroxylenol equivalent	39 (100)