Designing a comprehensive needs assessment of the critical and injured pediatric patient in Belize.

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Abstract

Objective: Describe the process of designing and implementing a comprehensive needs assessment of the critical and injured pediatric patient in a low middle income country in order to address internal country identified improvement goals.

Setting: Belize's Ministry of Health hospital healthcare system

Process: Design and application of a country-wide healthcare needs assessment adapted from World Health Organization (WHO) framework on mental healthcare needs assessment and the Systems Engineering Initiative for Patient Safety (SEIPS).

Results: A comprehensive framework for guiding collaborative work to improve neonatal and pediatric resuscitation care throughout the country of Belize.

Conclusions: Using principles of population-specific needs assessment in a low-middle income country, with public health level questions and systems engineering principles, a comprehensive needs assessment tool can be established to identify specific health related improvement projects for critical and injured children throughout a healthcare system. To successfully perform this type of assessment, country wide collaboration and regional discussions are necessary.

BACKGROUND

Following the construction of the Karl Heusner Memorial Hospital in Belize City in 1995, the Government of Belize in November of 1997 requested consultation to provide information to the Health Policy Reform Project. This was provided by Professor Samir N. Bannob, Professor of Health Policy and Management from the University of South Florida in his role of Consultant for the Cambridge Consulting Corporation. The final report entitled "Karl Heusner Memorial Hospital Governance, Organization and Management as a Public Authority", was submitted in July 1998. Preliminary data indicated a high rate of injury and death from trauma in both adults and children. The efforts to improving early care and stabilization at the Emergency Department of KHMH were prioritized.

Beyond the neonatal period, trauma related to road traffic accidents, drowning, respiratory infections, sepsis and diarrhea are the leading causes of death in children of all ages [1]. Injury in children aged 1 to 4 years accounts for the highest proportion of pediatric deaths. Land transport (motor vehicle) crashes accounted for 11.5% and drowning for 8.3% of deaths in this age group over the period from 2001 to 2005.[1]

The 2010 infant mortality rate in Belize is estimated at 14.2 per 1,000 live births. During the same period of time, the infant mortality rate in Mexico was 14.1 and in the United States, 6.5.[2] Belize ranks 109th for under- 5 mortality with a rate estimated at 22.2 per 1,000.

Based on a request from leadership at the Ministry of Health (MoH) in Belize and its flagship hospital Karl Heusner Memorial Hospital (KHMH), the Medical College of Wisconsin (MCW) in Milwaukee, Wisconsin, embarked on a longitudinal project in 2010 with multiple partners in Belize and Wisconsin to strengthen emergency care throughout Belize. The

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collaboration would focus on three components:
a. Strengthen Emergency Care and Disaster Preparedness at KHMH
b. Strengthen Injury Prevention and Control within Belize
c. Strengthen Perinatal and Pediatric Acute Care
- Outpatient Management
- Inpatient Management

A needs assessment was required to understand the necessary steps to accomplish the partnership goals. Needs assessments are a common foundation for systems planning. They occur in fields such as education and technology and are critical for strategic thinking in public health where the design of a system with many parts influences the ability to close healthcare gaps. Roger Kaufman, regarded as a father of needs assessment, describes "need" as a noun which presupposes a gap, as opposed to "need" as a verb, which presupposes a solution, "you must make an accurate determination of the needs to be addressed and the gaps to be closed before you can do anything about guaranteeing high performance."[4]
Our needs assessment was conducted in February of 2011. It identified and detailed the challenges that affect the care of critical and injured patients in regional settings, in inter-hospital transport and referral, and in the referral hospital, KHMH, with particular focus on pediatrics.

The purpose of this paper is to describe the method and result of combining a public health needs assessment framework with systems engineering concepts for evaluating need. This paper did not involve human-subjects research.

Materials and Methods: Needs Assessment Framework and Field Work
A PubMed query on "needs assessment" and "critical illness" using MeSH terms yielded 22 articles, 3 of which directly addressed the physical needs of critically ill patients, and one of which was pediatric.[5] Because of limited published work on defining needs for critically ill and injured children from the field to the hospital, the framework for this field study was adapted from the World Health Organization (WHO) needs assessment workbook on Psychoactive Substance Use Disorder Treatment [6], using systems engineering principles in patient safety (SEIPS) [7] to maintain a focus on integrating recommendations across components of the healthcare system.
The WHO framework focuses on 4 questions (Table 1) and details the burden of illness, considers types of services needed to support an improvement in care, examines the extent to which existing services are integrated and identifies areas for improvement within the existing healthcare system. Because the nature of relationships between components of the healthcare system determines emergent properties such as safety and quality, we integrated the SEIPS model [8] (Table 2) into the architecture of questions 3 and 4.

The SEIPS model focuses on system design and its impact on processes and outcomes, with the structure of the system divided into five components: people, organization, technologies and tools, tasks, and the environment in which care is delivered (Figure 1). Care processes can be defined as narrowly as needed (ambulance transport, medication administration, CT scanning). Outcomes can include outputs at the micro level (specific patient outcomes), the macro level (hospital mortality rate), or the mega level (child health in Belize) (Table 2 and Figure 1). Verbal and written staff surveys, review of floor plans, assessment of position descriptions, and structured employee and management-level interviews were included. A checklist was then designed from the systems engineering principles to specifically evaluate pediatric acute care services in Belize regional hospitals (available on request from the authors). A written survey of skills, training, and resources was developed for subjective assessment of needs reported by transport staff (available on request from the authors). Due to time and patient confidentiality concerns, patients were not shadowed as they transitioned through the healthcare referral chain.

With this framework in mind, the collaborative committee identified two MCW pediatric faculty members (co-authors) to join Belizean healthcare leaders in conducting a country wide needs assessment over a period of one month. The initial discussions with both the offices of the MoH (country-wide maternal-child heath director, regional MoH liaisons)

Table 1. Needs assessment question structure used in Belize, adapted from the WHO workbook on needs assessment for the UN Drug Control Program.[6]

Level of Inquiry	Targeted question
Country wide demographics	1. How many people in the region or community need pediatric emergency and critical care services?
Region specific demographics	2. What is the relative need for pediatric emergency and critical care services across different regions or communities?
Region specific healthcare resourses	3. What types of services are available across different regions or communities to support pediatric emergency and critical care?
Integration of resourses	4. Are existing services coordinated and what is needed to improve the overall level of system funtioning?

Figure 1. The SEIPS model of the health care system, reproduced from [Qual Saf Health Care, Carayon, P., et al., 2006. 15 Suppl 1: p. i50-8] with permission from BMJ Publishing Group LTD.

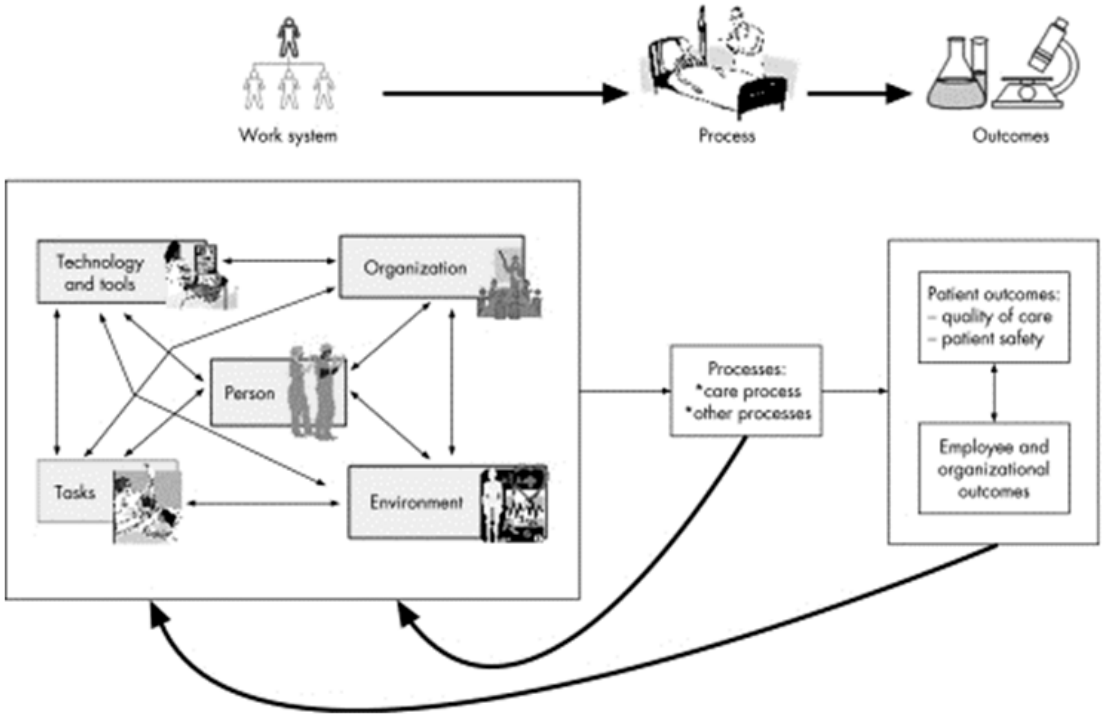

Table 2. Systems Engineering Initiative for Patient Safety model [8] applied to needs assessment questions:

Level	Components	Examples
Work system (Question 3)	People	Patients, physicians, nurses, pharmacists, engineers, statisticians
	Organization	Micro hierarchy within hospitals vs. macro hierarchy within public health system
	Technologies and Tools	Equipment available in each care area, radiology, data recording, electronic medical record
	Task	Medication administration, bag valve mask resuscitation, IV access
	Environment	Physical layout of hospital wards, emergency area, placement of sinks, ambulance bay, country level geography
Process (Question 4)	Integration of services	Ambulance system, medication administration, care transfer up health system hierarchy, communications systems
Outcomes (Question 1 and 2)	Patient outcomes	Avoidable mortality, road traffic crashes, pneumonia, diarrhea

and medical and nursing administration at KHMH were designed to better understand the population demographics and needs. Later discussions focused on field work with the private transportation company, Belize Emergency Response Team (BERT), the US Embassy, and regional hospitals. During the final days of the assessment period the preliminary findings were discussed with partners at the MOH, KHMH and MCW leadership.

Results – Applying the Framework

A report was prepared and organized using the 4 questions in the above adapted framework. The framework helped direct an inquiry identifying the gaps that could be addressed by the partnership established between MCW, KHMH, and the MOH. Providing objective answers to the WHO framework was augmented by focusing on system-level relationships detailed in the SEIPS model of healthcare delivery. Answering these questions with a focus on the macroscopic (decreased critical illness) and societal level results (healthy children) required attention to many of the components of the system. Through this process we gained an understanding of how these various components worked together to produce the larger outcomes.

Question 1, "How many people in the region or community need pediatric emergency and critical care services?" incorporated a review of national statistics for pediatric infant and under-five mortality. WHO level and district-level data were reviewed. These statistics were compared with published trends in the provision of critical care services for children[9, 10] to determine the gross need for the provision of emergency and critical care services: "Belize is among a category of countries that have seen dramatic improvements in perinatal and under-5 mortality in the last 20 years with limited GNP and is at a point of being able to seriously consider resource allocation for pediatric intensive care."[11]

To address Question 2, "What is the relative need for pediatric emergency and critical care services across different regions or communities?" KHMH was studied in particular. KHMH serves as the country's tertiary care hospital and receives transported critically ill patients from regional hospitals. Where available, region specific statistics on neonatal and child mortality were reviewed. To augment an understanding of the need for acute and critical care services at KHMH, we examined the general pediatric admission statistics as well as use of mechanical ventilation data.

Question 3, "Assessing services available for critically ill and injured pediatric patients across regions", proved challenging. Services were assessed according to the established hierarchy of healthcare, spending most time with the tertiary care center, KHMH, and subsequent time with all regional secondary care hospitals and some primary care hospitals that also functioned as clinics. The systems engineering framework from the CQPI (see methods) was used to organize inquiry into available "services", functioning on the premise that a "service" is affected by the five components of a healthcare system: people, organization, technologies and tools, tasks, and the environment in which care is delivered. A report on each regional hospital was generated, with particular attention to the types of training represented by the caregivers (number of midwives, nurses, physicians, engineers, laboratory technicians, etc.), organization of the hospital itself (how areas like pharmacy, radiology, and laboratory are structured for work flow, how shifts are organized, how trainees are incorporated into workflow at night), what particular technologies are available and routinely used (radiology equipment, monitoring, infant warmers, infusion pumps, etc), what tasks are involved in caring for patients (provision of nutrition, rounding practices, IV starts, weighing patients, triage, intubation, etc), and the environment in which the care is delivered (number of adult, maternity, and pediatric beds; presence of separate infant ward, location of infant ward relative to maternity ward, proximity of radiology, etc). KHMH was modeled in the same fashion with attention to the system-structure of the departments of accident and emergency, pediatrics, medicine and critical care, and nursing. We evaluated the services for critically ill children including surgical care, respiratory therapy, pharmacy, laboratory, blood bank, and quality and statistics. Public transport availability at each hospital was also assessed. The private transport company, BERT, was evaluated in the same fashion. In addition, an EMT (Emergency Medical Training?) survey was performed among 14 staff to identify self-reported gaps in training, resources, and performance.

The answer to Question 4, "How are services coordinated?", emerged as the elements in question 3 were being described. This understanding came from directed interviews and focus-group work on describing patient flow at the macro level (between a regional hospital and KHMH) and at the micro level (between the emergency department and the pediatric ward) with input from pharmacy, respiratory care, etc. Actual observation of patient flow from the regional hospital to the tertiary care hospital was not completed during this evaluation. Time and financial constraints did not allow for this process which would have served to validate the inputs from directed interviews with care providers at each level of the healthcare system.

DISCUSSION

We believe that with the present resources, Belize is engaging in a robust improvement process for the care of critically ill and injured patients. This work depends on an accurate assessment of the needs of patients and the providers who wish to improve care. This structured needs assessment has provided important information about the people involved, the organizational structure they work under, the tools and technologies at their disposal, the tasks they perform, and the environment within which it is accomplished. Combining systems engineering concepts to the theoretical framework for a WHO healthcare needs assessment structure provided a systematic framework for examining the healthcare needs of critically ill and injured pediatric patients in Belize. It also provided insight into the nature of the current healthcare system that will motivate quality improvements over time.

The framework established a broad view of patient needs and care provided throughout the tiered system (WHO mod-

el) as well as a more detailed look at the various components and interactions of the system at both a macro and micro level (CQPI model). It prompted inquiry across loose cultural lines and clear differences in training and hierarchy. The model motivated examination of the system in areas with distinct topography that poses practical challenges to the transport of patients up the chain of care. For example, fixed-wing transports along coastal regions of the country are often more efficient than ground transports. The results of this needs assessment are unique to the situation of public healthcare in Belize and are not the focus of this paper. However, the model achieved by combining systems engineering concepts to a broad public health needs assessment framework may be broadly applicable to a growing number of multi-institutional global health partnerships that have country-wide system improvements as their goal.

The fact that we did not shadow patients during the study period is a significant limitation. Following patients through the healthcare system would have validated the process and added a patient-centered dimension to the needs assessment. Funding and time were not allocated for this purpose prior to beginning the process. Another limitation is that we did not formally evaluate the referral process of acutely ill patients from the local clinics to higher-level care. Shadowing patients and directly observing interactions within the tiered referral system and the components of systems would have provided very valuable first-hand information. As the collaboration moves forward, we hope to be able to understand better how interventions improve the care of patients within a hospital and throughout the hospital system.

The outcome of this needs assessment is a strengthened collaborative relationship between the GOB, MOH, KHMH and MCW with a tight focus on continuing education:

- Pediatrics:
  - o Nationwide neonatal resuscitation program for nurses, midwives, and physicians is being considered;
  - o Openness to ongoing consultation and collaboration for the development of the new Special Care Baby and Pediatric Intensive Care Unit at KHMH.
- Emergency Medicine:
  - o Development of a system for enhanced triage
  - o Curriculum to strengthen the fundamentals of emergency care for care providers at KHMH.

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