Combined quality function deployment and the logical framework approach to improve quality of emergency care in Malta

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Structured Abstract:

Purpose: This article aims to develop an integrated patient focused analytical framework to improve quality of care in accident and emergency (A&E) unit of a Maltese hospital.

Design/Methodology/Approach: The study adopts a case study approach. First, a thorough literature review was undertaken to study various healthcare quality management methods. Second, a healthcare quality management framework was developed using combined Quality Function Deployment (QFD) and Logical Framework Approach (LFA). Third, the proposed framework is applied to a Maltese hospital to demonstrate its effectiveness, which has six steps, commencing with identifying patients' requirements and concluding with implementing improvement projects. All the steps were undertaken with the stakeholders' involvement.

Findings: The major and related problems faced by the hospital staff under study were overcrowding at A&E and beds shortage respectively. The combined framework ensures better A&E services and patient flow. Quality Function Deployment identifies and analyses the A&E issues and challenges and LFA helps develop project plans for healthcare quality improvement. The important outcomes of implementing the proposed quality improvement programme are fewer hospital admissions, faster patient flow, expert triage and shorter waiting times. Increased emergency consultant cover and faster first significant medical encounter were required to start addressing the problems effectively. Overall, the combined QFD and LFA method is effective to address A&E service quality.

Practical implications: The proposed framework can be easily integrated within any healthcare unit and within entire healthcare systems due to its flexible and user-friendly approach. It could be part of six sigma and other quality initiatives.

Originality/value: Although QFD has been extensively deployed in healthcare setups to improve quality, little has been researched on combining QFD and LFA to identify issues, prioritise them, derive improvement measures and implement improvement projects. Additionally, there is no research on QFD application in A&E. This article bridges these gaps. Moreover, little has been written on the Maltese health care system. Therefore, this study demonstrates Malta's emergency care quality.

Keywords: Quality function deployment; Logical framework; Healthcare; Accident and emergency unit; Malta

Article classification: Case study

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Introduction

In many tertiary care hospitals, accident and emergency (A&E) unit is the entry point for critical healthcare. The A&E unit is characterised by complexities in health care delivery that warrant a coordinated approach to quality assurance (Shah, 2006; El Sayed, 2012). These complexities include life threatening presenting conditions (e.g., trauma and cardiac arrest); high patient attendances and turnover; fluctuations in work demands and workload particularly when faced with not so common major disasters; shift rotations that cover full twenty four hours a day for whole week; and variations in A&E staff expertise (Oberklaid *et al.,* 1991). Doctors and nurses frequently work under substantial pressure to manage acute situations that necessitate fast medical decision-making and care in an environment with zero tolerance to error. By virtue of the acuity, unless A&E staff function appropriately, medical errors and patient safety issues are more likely to happen than in other units. In many healthcare systems, A&E is considered to be the first call for all emergencies and hospital admissions, thereby linking pre-hospital with hospital care.

Quality in healthcare has been widely defined. The Institute of Medicine (IOM, 2001, p.44) provides a simple definition: "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge". Specifically, the Institute of Medicine (IOM, 2006) identifies six patient-focused desired health outcomes - healthcare should be safe, effective, patient-centred, timely, efficient and equitable. These outcomes should apply to all services within any healthcare system and along the continuum from primary to secondary and tertiary, and from acute to chronic medical care. Additionally, specific to A&E, IOM (2006) in its report 'Emergency Medical Services at the Crossroads' recommends evidence-based and standardized key performance indicators that allow national/international comparisons. The IOM quality concepts, as applied to A&E units, require a well-functioning and well-resourced operating system that achieves high quality acute and emergency health care delivery.

Additionally, there is more pressure on hospital administrators to deliver improved and co-ordinated high quality patient care at lower costs. In particular at A&E, key performance indicators as part of quality improvement programmes enable management to continuously monitor, measure and evaluate emergency rooms' overall performance and effectiveness (El Sayed, 2012). Healthcare systems can use several valid quality measures that assess processes, (diagnostic or therapeutic interventions), or outcomes (Chassin, 1998). High quality A&E care should provide an ideal patient care experience, where safe, evidenced-based standardized processes supported by technology meet patients' needs. Although managers are familiar with several performance measures, most are used in isolation. Continuous quality improvement (CQI), total quality management (TQM), process reengineering, benchmarking, and Six Sigma are increasingly being used in healthcare (Dey and Hariharan, 2007).

A major problem that A&E staff face worldwide is over-crowding (Derlet and Richards, 2000; Coughlan and Corry, 2007; Steele and Kiss, 2008; Jayaprakash *et al.,* 2009)

that threatens public health by compromising patient safety and requires multidisciplinary system-wide support. The A&E overcrowding causes are complex. They include insufficient inpatient beds, increasing illness severity, downsizing and government regulations (Trzeciak and Rivers, 2003; Steele and Kiss, 2008; Travaglia *et al.,* 2011). As a result of technological advances, emergency medicine is now offering new time-critical treatment options: specialized intravenous thrombolysis in stroke, stent placement in acute myocardial infarction and bedside ultrasound, thereby enhancing resuscitation, stabilization, investigation and initial management in the A&E unit (Jayaprakash *et al.,* 2009). Many studies demonstrate managing those challenges in A&E through effective operations management and techniques such as process optimisation, scheduling, resource allocation, both supplier and customer relationship management, and communication management. Additionally, many A&E staff achieved good synergy between demand forecasting, resource allocation and inventory management.

Accident and emergency staff increasingly manage patients with conditions previously necessitating admission. While these technological advances allow for direct discharge and therefore save on in-patient costs, as well as offer faster often life-saving procedures on critically-ill patients, they present fresh challenges to A&E operating systems. There is the added challenge presented by the direct positive correlation between the ageing demography and A&E service use (Jayaprakash *et al.,* 2009). Indeed, Gold (2007) specifically emphasizes appropriate A&E use, which increasingly facing capacity constraints and throughput challenges. The literature points towards several specific but isolated initiatives that affect the emergency room time. Ruhcholtz *et al.* (2002) recommends a multidisciplinary quality management system for the early treatment of severely injured patients. Similarly, Bernhard *et al.,* (2007) recommend that an algorithm for early management of emergency patients significantly reduces the time spent in the resuscitation room. Philipp *et al.,* (2003) propose a more technologically advanced initiative when they recommended multidetector-row CT and the omission of conventional imaging such as plain film or angiography in multiple traumas to increase patients' survival and save time. The literature also provides reviews that evaluated A&E-based management interventions effectiveness.

In a systematic review on pediatric mental health emergency care, Hamm *et al.,* (2010) demonstrate that specialised care management models, such as crisis intervention teams, can reduce hospitalization, A&E return visits and A&E stay. Forero *et al.,* (2012) reviewed the existing literature on patients dying in the A&E and identified six areas where there is little research and/or suboptimal policy implementation (A&E treatment uncertainty; quality of life issues, costs, ethical and social issues, interaction between A&E and other health services, and strategies for non-hospital care). Forero *et al.,* (2012) recommend a structured approach to decision making and a proper infrastructure, information and forward-planning strategy, prompting the need for further research. Although this review focuses on end-of-life patients, the same recommendations may be applied across the entire A&E patient management spectrum.

Our main aim was to develop a patient-focused approach to A&E quality. The A&E under study suffers from and bottlenecks in patient flow (Times of Malta, 2012). The A&E department staff are constantly being pressured by various stakeholders to manage patients more effectively and to avoid unnecessary admissions. Our study addresses this issue using a conceptual framework that embraces a patient-focused and integrated analytical approach that combines quality function deployment (QFD) and logical framework approach (LFA). Quality Function Deployment has been deployed almost every business and management aspect including healthcare since its first application in new product development in the early 60's. It identifies and analyses A&E issues and challenges and LFA helps develop detailed

project plans for quality improvement. The combined QFD-LFA framework is therefore intended as a process-improvement technique to identify issues related to healthcare and preventable errors, analyse them and influence changes and improvements associated with care systems. This helps improve healthcare system performance substantially (Dey et al,, 2009).

This integrated approach can be considered as part of CQI and TQM, which have already been applied in healthcare by several researchers (Talib *et al.,* 2011). This approach also follows typical project management cycle – identifying issues and challenges within a system, analyse them to suggest improvement, develop an implementation and evaluation plan. Prior to this research, there was no study that combines QFD and LFA for improving A&E care quality.

QFD, LFA and their applications in healthcare system

Quality function deployment (QFD) is a method to transform user demands into design quality, to deploy the functions forming quality, to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific manufacturing processes (Akao, 1990). It is designed to help planners focus on new or existing products or services from a marketing viewpoint, or technology-development needs. The technique yields charts and matrices. It also helps transform customer needs (the customer voice [VOC]) into engineering characteristics (and appropriate test methods) for a product or service, prioritizing each product or service characteristic while simultaneously setting development targets for the product or service; e.g., Camgöz-Akdag *et al.*, (2013) used QFD to translate customer needs and expectations into the quality characteristics in a private healthcare setting. Other researchers published healthcare case studies using QFD (Mazur *et al.,* (1995), Einspruch *et al.,* (1996) and Lorenzo *et al.,* (2004).

However, Azam *et al.,* (2012) argue that QFD methods must be used with caution in healthcare and that in-depth clinical and management knowledge is needed to identify and classify quality parameters as core or associated. To avoid conflict between medical and management staff, it is beneficial in the patient's interest, to combine QFD and LFA. Logical framework analysis is a management tool mainly used to design, monitor and evaluate international development projects. It is also widely known as Goal Oriented Project Planning (GOPP) or Objectives Oriented Project Planning (OOPP). Quality function deployment (QFD) originated by Akao in Japanese Industry in 1960, translates customer requirements into the appropriate technical requirements and activities for products or services delivery (Chan and Wu, 2002). Logical framework analysis has been used in various projects in health care (Dey *et al.,* 2006; Dey and Hariharan, 2007).

A QFD system involves several phases, in which each phase's outputs, referred to as the 'hows', are generated from the inputs of the same phase, referred to as the 'whats'. The 'hows' become the new 'whats' in the next phase (Chan & Wu, 2005) and the QFD system is a series of matrices of 'whats' and 'hows'. The advantages of using QFD are many. First it is a comprehensive quantitative approach to capture patient and expert voices. Second, it uses a systems approach that helps identify and improve processes from design to implementation. Third, it provides trade-off information that helps organizations to prioritize processes for improvement (Dey *et al.,* 2009).

Quality function deployment therefore provides the process and service plans, which can then be implemented using the project management tool - LFA, which was developed in the US in 1969 by Practical Concepts Incorporated for the United States Agency for International Development (1979). It is an effective strategic planning and implementation project management tool, which has been applied widely. Logical framework analysis (Schmidt, 2009) can also be considered as an analytical management tool that helps to analyse existing

situations during project preparation. Additionally, it establishes a logical hierarchy by which objectives will be reached and identifies potential risks in achieving objectives and sustainable outcomes. Furthermore, LFA establishes how outputs and outcomes might best be monitored and evaluated. Documentation in LFA helps develop project plan in planning phase, and monitors and reviews projects during implementation phase. Moreover, LFA is ideal for adopting brainstorming sessions within a stakeholder participatory framework (Dey and Hariharan, 2007). It is objectives-oriented and can be used for planning, designing, implementing and evaluating projects, building stakeholder team commitment and capacity using workshops in which priorities are set. There are four main LFA steps, each with activities (UNDP Capacity Building Workshop for Dryland Management, 2000). These are situation analysis, strategy analysis, project planning matrix, and implementation.

We adopt a case study method to develop a conceptual framework using QFD and LFA to implement a patient-focused quality improvement programme in a Maltese hospital A&E unit – a major A&E department in the National Health Service that covers practically the whole country's demand. In parallel, there are two small emergency departments in two private hospitals, which cater for smaller emergencies.

Methodology

Gilmore *et al.,* (1986, p.161) explains that 'Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction. Accomplishing these twin goals requires the active collaboration of researchers and industry practitioners, and thus it stresses the importance of co-learning as a primary aspect of the research process'. Our objective were achieved via three steps – forming a conceptual framework; applying the proposed framework to the case study A&E unit with stakeholder involvement; and validating the proposed quality improvement framework for adoption within the A&E unit. The conceptual framework for improving quality is formed through thorough a literature review and subsequent informal discussions with a few researchers and practitioners. The proposed framework is then applied to the case study to demonstrate its effectiveness after which a validation survey was undertaken with the stakeholders (e.g., patients, doctors, nurses, support staff, hospital management, suppliers and contractors).

Combined QFD and LFA framework

The proposed patient-focused quality framework has six steps. The first five are related to QFD whereas the sixth step is LFA. Figure 1 depicts the proposed healthcare quality management framework.

Figure 1 here

Step 1: Capturing patient voices through structured approach: undertaken through sampling, questionnaire design and data analysis.

Step 2: Gathering expert voices through interviews or focus groups: identifying the most appropriate technical representatives within the A&E department, designing the interview guide, conducting the interviews and collating the outcomes.

Step 3: Establishing relationship between patient and expert voices: which co-related in QFD framework (House of Quality) using co-relation rules (strong relationship – 9, medium relationship – 3 and weak relationship – 1).

Step 4: Deriving patients' requirements and absolute weight from patients' perspectives: relative importance of patients' requirements are derived through a survey among the same patients in 1 – 10 scale (10 being highest importance and 1 being least). Target values and service points are determined through interviewing concerned stakeholders. The target values are 5 (better performance), 3 (equal), and 1 (inferior). The service points are 2 (if we address the specific requirement this will enhance patient's satisfaction) and 1 (no impact on patients' satisfaction). Third, the absolutely weights are calculated by multiplying importance, target value and service point.

Step 5: Deriving the most critical services that need attention/improvement: The absolute weight from overall (both patients and experts) perspectives is determined by multiplying importance and correlation factors (9, 3, 1 or 0) and adding across rows. Absolute factors are determined through normalisation. Relative weights are derived through multiplying absolute weights (patients' perspectives) with correlation factors and adding across rows. Relative factors are determined through normalisation. These help derive relative ranking of expert voices and identify the most critical thing that needs address to achieve patients' satisfaction.

Step 6: Developing improvement project plan using LFA: The QFD outcomes are presented to experts to develop an improvement project plan using LFA. They first form a problem tree and then objective tree, which develops a logical framework for project plan development (Dey and Hariharan, 2007).

Application

The proposed framework is then applied to the case study A&E. In step 1, the patient's voice was captured via 112 patient surveys over a six weeks. Their requirements were classified into two main groups, resource- and service-availability (Figure II). The resource availability requirements included 24-hour availability of experienced and competent emergency doctors and staff, clean/comfortable environment, state of the art and well-maintained facilities/equipment, and bed availability. The services availability requirements included faster patient flow, expert filter of emergency from non-emergency cases, reduced A&E waiting time, prompt services, timely medical and procedural information, responsive doctors and staff, friendly and courteous doctors/staff, comfortable stay, discharge letter from A&E to general practice (GP) for those not admitted, and faster admission to hospital. Patient information reliability was achieved through selecting a stratified sample along with a few informal interviews with patients. Additionally, the patient responses were made available to experienced doctors, nurses and management staff.

In step 2, expert voices were captured using three focus groups, the first had fifteen A&E doctors and two hospital administrators. The second focus group included an A&E doctor, nurse and manager. The third had three nurses and two hospital administrators. These have been done to capture stakeholders' requirements as explicit as possible and to gather participants' unbiased views. These professionals are collectively referred to as experts. Therefore, experts' services within A&E were classified into three major groups: human resources management (HRM); patient, guidelines and protocols management; and A&E facility management. Human resource management requirements included consultant-based emergency cover, first significant medical encounter, doctor and nurse recruitment, specialization and training. The second group included expert triage, guidelines and protocols, information to and from referring doctors, inter- and intra-departmental communication, and infection control. The third group included efficient hospital bed management, integrated information and communication technology, and maintaining facilities and equipment. Potential system or process failure is the complex communication

process within the A&E department as life-saving information is transferred from pre-hospital to hospital care presents many opportunities for breakdown and error. Therefore, the experts' requirements on communication were in line with what was already identified in the literature (Derlet and Richards, 2000; Coughlan and Corry, 2007; Creswick *et al.,* 2009).

In step 3, relationships between patients' requirements and A&E service provider voices were established by a group called the QFD team: two doctors, two nurses and hospital managers. This step focuses on the first matrix (Figure 2), house of quality (HOQ). This phase has strategic importance (Chan and Wu, 2005) as it is the basis for care quality improvement initiatives. The first matrix identifies the patients' voice on the service requirements for the A&E department and links these requirements with the expert voices. The HOQ left wall lists patients' requirements, whereas the roof lists experts' needs. The relationships have been depicted through strong relationship (9), medium relationship (3) and weak relationship (1).

Figure 2 here

In step 4, absolute A&E service weights are determined by multiplying the importance of patients' requirements with cross-relationships between patients' requirements and A&E service requirements as defined by experts. Figure III factor in three patients' ratings, namely requirement importance (patient importance) on a scale of 1-10; whether patients' requirements need to improve (target value) on a scale of 1-5; and whether the requirement will have an impact on service (service point) on a scale of 1-2. These ratings will then be used to calculate the absolute weight, using the formula: absolute weight = patient importance X target value X service point. Figure 4 shows the complete HOQ for the A&E department under study. In the QFD first phase, one can also factor in patients' perceptions of competing A&E Departments, in comparison with the A&E Department under study. Then one would need to also rate the competing department's performance using experts' technical requirements.

Figure 3 here

In step 5, analysing absolute and relative weights revealed a priority list, which was calculated. The most critical/important services that needed attention/improvement were: shift to consultant-based services within A&E, faster first significant medical encounter, guidelines and protocols of all the common medical conditions seen at A&E, more doctors and nurses, more efficient hospital bed management, better information to and from referring doctors, improved inter- and intra-departmental communication, and more triage expertise. In step 6, implementation plans for improvement projects are developed using LFA. In this study, LFA brought together hospital managers, healthcare professionals and other support staff to identify problems, analyse objectives and come up with tangible solutions. The major problem identified by the stakeholders was hospital admissions. There was an obvious bottleneck at A&E department; i.e., patients awaiting admission into hospital that was resulting into overcrowding particularly during the peak times and days. Therefore an objective tree (Figure IV) was prepared for the Maltese A&E department with the purpose to reduce the hospital admissions by all the stakeholders, assuming that patients would be satisfied with the overall services and adequately managed within the A&E unit. The objective tree then specifies the goal, namely identifying A&E process protocols, outputs and activities.

Figure 4 here

A logical framework is then drawn up, which identifies key performance indicators, verification methods and assumptions for all activities, outputs, goal and purposes. The indicators in this study are measured over 12 months. Figure 6 illustrates the logical framework matrix for the A&E unit. The project's purpose was fewer hospital admissions, which was measured by comparing hospital admissions compared to A&E patient reviews over a year. The project goal was a standardized A&E process protocols, with the indicator being patient turnaround time. The project outputs were a shift towards a consultant-based service; faster significant medical encounter; increase in the guidelines and protocols used by department staff; improvement in the hospital bed management functions; improvement in the information to/by referring doctors; better interaction with other departments within the hospital; more specialized and trained staff; and improvement in the triage system (Figure 5). The activities included mapping processes; identifying emerging issues; shifting the paradigms towards desired outputs; setting targets; re-engineering A&E processes; trialling changes, and implementing and evaluating the project.

Figure 5 here

Results

Currently the project is in various implementation phases. However some results are already evident. The study reveals that the top three patient requirements were faster patient flow, expert triage and shorter waiting time for both medical attention and hospital admission. It also reveals that emergency department consultant cover needs to improve. While patient reviews increased from 74,949 in 2010 (49% admitted and 51% discharged) to 76,153 for 2011 (32% admitted and 68% discharged), total hospital admissions decreased by 17% from 2010 to 2011. This can be explained by the shift towards consultant-based service. Additionally, the increase in patients reviewed could very well be explained by the ageing population, which showed an 1.6% increase of over 65 year olds from 2010 to 2011. The A&E patient turnaround time decreased from approximately eight to six hours. The targets in relation to UK benchmarks (UK NHS Trust, Imperial College Health Care, St Mary's Hospital A&E Clinical Quality Indicators, June 2012) are to reduce hospital admissions to 25 % of those reviewed and to increase patient turnaround time to four hours. Triage was changed from a three-tier system to the Emergency Severity Index (ESI) five-tier Triage Tool for Emergency Department (Zimmermann, 2001). The three-tier triage system was less accurate and put more demand on priority one category patients. Additionally, placing patients in a lesser urgent category was not possible and thus lacked flexibility. The ESI is more scientific and objective in its approach. It includes both acuity and need for resources in the system to categorize patients (more urgent cases need more resources). Nurse managers, with A&E consultants' approval chose ESI. The nurses had to go through the training programme that was purchased by the hospital. Consultants increased from four to nine and consultant coverage was extended from four pm until midnight. Additionally, managers designated a ward as a less than 24-hour-stay observation ward to reduce waiting time for medical attention and hospital admission. Guidelines and protocols for medical emergencies increased from one to twelve. Examples included: adult and paediatric triage guidelines based on early warning scores, chest pain management, asthma, pulmonary embolism and head injury. The availability of beds for patients waiting for admission at A&E in the hospital under study had not increased by 2011, the main reason being failure to transfer older people to long-stay institutions, following management of their acute medical conditions. . Official complaints about A&E services from patients to the customer care unit decreased from 513 in 2010 to 208 in 2011. There is no formal mechanism for staff within hospital to present

complaints. The A&E staffing is low in relation to patient throughput. Emergency physicians take approximately five year's postgraduate training, which will eventually add senior staff and consolidate the consultant-based service. The current study did not measure patient triage time, however a study conducted in 2007 (Azzopardi *et al.,* 2011) showed that 30.3% priority one , 86.3% priority two and 76.8% priority three patients waited more than one hour for first assessment, which is the UK benchmark (Hemaya and Locker, 2012).

Validating the proposed integrated QFD-LFA framework

Several measures were undertaken to ensure that the proposed method for improving A&E quality was accepted. All six framework steps were applied with the stakeholder involvement. Every effort was made to capture patients' requirements objectively through stratified samplling. Expert voices were captured from stakeholders using focus groups. Additionally, focus groups participants were involved in the workshops to validate the proposed integrated QFD-LFA framework for improving A&E quality. They were asked to evaluate the framework with respect to its utility, user friendliness, flexibility, robustness and rigour. While they were positive on the framework's every aspect, user friendliness was a concern. They suggested forming a dedicated team for performance improvement across the hospital and organising an analytical method's training programme. They also suggested giving opportunity to every employee in rotation to participate in the quality improvement team. This clearly indicates that the proposed framework was accepted. Participants were positive about the integrated model as a strategic decision-making and project management tool. Hospital managers also agreed its use for strategic decision-making (capital and revenue budgeting). All participants pointed out that the framework's effectiveness depends on quality data collection from patients and practitioners.

Discussion

High quality A&E care should provide an ideal patient care experience, where safe, evidenced-based standardized processes supported by technology meet patients' needs. Overcrowding is a major issue in today's A&E units (Velianoff, 2002). Derlet and Richards (2000) reveal that this is mainly due to patient complexity and acuity presenting to A&E, overall increase in patient volume due to population growth, managed care problems, delays in radiology, laboratory, and ancillary services, nursing and support staff shortages, insufficient on-call speciality consultants, physical space limitations and problems with language and cultural barriers. These problems are multifactorial and complex. Unless they are resolved, the entire healthcare system is going to be affected as for many tertiary care hospitals, A&E is the entry point for healthcare services. The CQI programs have been effectively implemented in many hospitals. However, the main CQI issue is that they are managed on a standalone basis and may not be directly linked with the strategic intents and they are not always patient focused.

This authors proposes an integrated QFD-LFA approach to promote continuous quality improvement by identifying key performance indicators that emphasize patient requirements, on-going measurement and evaluation in line with A&E's and the hospitals' strategic intents. The quality improvement programs are based on patient requirements and management commitment. Quality Function Deployment translates the patients' and experts' requirements into multiple evaluating factors to prioritise improvement measures using HOQ matrices. It also helps to identify, analyse and prioritise operating systems and quality issues that need attention through appropriate business decisions. The prioritised improvement measures are converted to clear project plans with cost benefit analysis through LFA, which facilitates the project plan by identifying activities, outputs, goals and project purpose. Additionally, LFA

explicitly reveals indicators, verification methods and assumptions for each activity, output, goal and purpose.

Most quality management frameworks applied to healthcare largely stem from systems approach (structure, process and outcome) (Donabedian, 1988). The integrated QFD-LFA model incorporates all three healthcare evaluation parameters. In A&E, where activity tends to be acute and often chaotic, one needs to take structured decisions that add value to the services and eliminate errors (O'Connor *et al.,* 2002). Clinical audits in health care involve mortality (Jarman *et al.,* 2010) and morbidity meetings (van Dillen *et al.,* 2010). These peer-review meetings are useful and retrospectively analyse patient care deficiencies. However, they only include one stakeholder group (clinicians) and exclude patients. These meetings are mostly clinical and are not usually focused on detecting operating system failures and often ignore issues related to human and material resource management. Studies reveal human and material management issues contribute to morbidity and mortality (Dey *et al.,* 2009). This is precisely the added value of also using the integrated QFD-LFA approach as it deals with the holistic healthcare quality improvement that considers patients' requirements.

Existent operating A&E systems have largely evolved in response to emergent health care services' needs, namely trauma, traffic accidents and non-traumatic cardiac arrest, rather than pre-planned A&E infrastructures (El Sayed, 2012). Therefore, adopting an integrated framework that identifies quality issues and provides improvement plans that benefit A&E settings. This approach would therefore satisfy quality assurance, which is largely retrospective and prospective quality improvement through continuous improvement processes and systems (Berwick *et al.,* 2002). Indeed, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) in 1992 has recommended A&E to shift their focus from pure quality assurance to quality improvement through continuous measurements and inputs using key performance indicators (El Sayed, 2012). The proposed QFD LFA framework facilitates continuous improvement, involves all stakeholders, commits managers, adopts a process approach and focuses on patients. It is integrated as it identifies, analyses and improves overall healthcare quality through appropriate interventions. The method is flexible and easy to adopt. This study contributes a holistic robust approach to healthcare delivery, which could be adopted in any hospital unit.

This authors adopt a single case study method to develop and demonstrate a combined QFD and LFA effectiveness for implementing patient focused healthcare. Future research could focus on empirical information from multiple cases. Additionally, entire quality management framework could be customised and computerised for specific hospital. Future research can also contribute to establish causal relationships among the constructs for healthcare quality improvement using structure equation modelling. Our study identified a several performance indicators for the A&E setting and their relative performance has been determined. Future studies may look into applying multiple criteria decision-making techniques such as analytic hierarchy process, analytic network process, fuzzy theory, etc. (Rahman and Qureshi, 2008) to convert qualitative factors (linguistic variables) into a format that can be used along with quantitative data. The aim would be to parameterize a multi-objective mathematical programming model by combining qualitative with quantitative data.

Conclusion

Although QFD has been extensively researched, its deployment in healthcare needs a slightly different approach than other quality management tools and techniques (Gremyr and Raharjo, 2013). Therefore, our study adds value to healthcare quality management research and practices by demonstrating real life application; i.e., a combined QFD and LFA framework. The proposed patient focused approach to improve quality in the A&E unit is effective as it captures patient requirements through a structured approach, objectively translates these to

determine improvement measures, identifies improvement projects objectively and plans and implement projects through effective cost-benefit analysis. Quality Function Deployment relates these requirements to A&E's healthcare practices by involving healthcare professionals. Patient and professional voices reveal the areas that need to be prioritised to improve quality. Improvements are then derived using LFA approach that helps develop project plans through cost-benefit analysis facilitates monitoring project progress all through its life. Staff in any health service unit can adopt the combined flexible and user-friendly QFD-LFA integrated patient-focused approach as a performance management initiative to improve service quality.

References

Akao, Y. (1990), 'History of Quality Function Deployment in Japan', *The Best on Quality, IAQ Book Series International Academy for Quality*, Vol. 3, pp. 183-196.

Azam, M., Rahman, Z., Talib, F. and Singh, K. J. (2012), 'A critical study of quality parameters in health care establishment: developing an integrated quality model', *International Journal of Health Care Quality Assurance*, Vol. 25 No. 5, pp. 387-402.

Azzopardi, M., Cauchi, M., Cutajar, K., Ellul, R., Mallia-Azzopardi, C. and Grech, V. (2011) 'A time and motion study of patients presenting at the accident and emergency department at Mater Dei Hospital', *BMC Research Notes*, Vol 4 No. 1, pp. 421-432.

Bernhard, M., Becker, T. K., Nowe, T., Mohorovicic, M., Sikinger, M., Brenner, T., Richter, G. M., Radeleff, B., Meeder, P. J., Buchler, M. W., Bottiger, B. W., Martin, E. and Gries, A. (2007), 'Introduction of a treatment algorithm can improve the early management of emergency patients in the resuscitation room', *Resuscitation,* Vol. 73 No. 3, pp. 362-73.

Berwick, D., Godfrey, A. R. and Roessner, J. (2002), *Curing Healthcare: New Strategies for Quality Improvement*, Jossey-Bass/Wiley Publishing, Hoboken, NJ.

Camgöz-Akdag, H., Tarim, M., Lonial, S. and Yatkin, A. (2013). 'QFD application using SERVQUAL for private hospitals: a case study', *Leadership in Health Services*, Vol. 26 No. 3, pp. 175-183.

Chan, L.K. and Wu, M.L. (2002), 'Quality function deployment: a literature review', *European Journal of Operations Research,* Vol. 143 No. 3, pp. 463–497.

Chan, L.K. and Wu, M.L. (2005), 'A systematic approach to quality function deployment with a full illustrative example', *Omega*, Vol. 33 No.2, pp. 119-139.

Chassin, M. R. (1998), 'Is health care ready for Six Sigma quality?', *Milbank Quarterly*, Vol. 76 No. 4, pp. 565-591.

Coughlan, M. and Corry, M. (2007), 'The experiences of patients and relatives/significant others of overcrowding in accident and emergency in Ireland: a qualitative descriptive study', *Accident and Emergency Nursing*, Vol. 15 No.4, pp. 201-209.

Creswick, N., Westbrook, J I. and Braithwaite, J. (2009), 'Understanding communication networks in the emergency department', *BMC Health Services Research*, Vol. 9 No. 247, pp. 1 – 9.

Derlet, R W. and Richards, J R. (2000), 'Overcrowding in the nation's emergency departments: complex causes and disturbing effects', *Annals of Emergency Medicine*, Vol. 35 No. 1, pp. 63 – 68.

Dey, P. K., Hariharan, S. and Brookes, N. (2006), 'Managing healthcare quality using logical framework analysis', *Managing Service Quality*, Vol. 16 No. 2, pp. 203-222.

Dey, P. K. and Hariharan, S. (2007), 'Integrated approach to healthcare quality management: A case study', *The TQM Journal*, Vol. 18 No. 6, pp. 583 – 605.

Dey, P. K., Hariharan, S. and Ho, W. (2009), 'Innovation in healthcare services: a customer-focused approach', *International Journal of Innovation and Learning*, Vol. 6 No. 4, pp. 387-405.

Donabedian, A. (1988), 'The quality of care: How can it be assessed?', *Journal of the American Medical Association*, Vol. 260 No.12, pp. 1743-1748.

Einspruch, E. M., Omachonu, V. K. and Einspruch, N. G. (1996), 'Quality function deployment: application to rehabilitation services', *International Journal of Health Care Quality Assurance*, Vol. 9 No. 3, pp. 42-47.

El Sayed, M. J. (2012), 'Measuring quality in emergency medical services: a review of clinical performance indicators', *Emergency Medicine International*, Vol. 2012 Article ID. 161630, pp. 1 – 7.

Forero, R., McDonnell, G., Gallego, B., McCarthy, S., Mohsin, M., Shanley, C., Formby, F. and Hillman, K. (2012), 'A Literature Review on Care at the End-of-Life in the Emergency Department', *Emergency Medicine International*, Vol. 2012 Article ID 486516, pp. 486-516.

Gilmore, T., Krantz, J. and Ramirez, R. (1986), 'Action Based Modes of Inquiry and the Host-Researcher Relationship', *Consultation: An International Journal*, Vol. 5 No.3, pp. 160-176.

Gold, K. S. (2007), 'Crossing the quality chasm: creating the ideal patient care experience', *Nursing Economics*, Vol. 25 No. 5, pp. 293-5, 298.

Gremyr, I. and Raharjo, H. (2013), 'Quality Function Deployment in healthcare: A literature review and case study', International journal of health care quality assurance, Vol. 26 No. 2, pp 135 – 146.

Hamm, M. P., Osmond, M., Curran, J., Scott, S., Ali, S., Hartling, L., Gokiert, R., Cappelli, M., Hnatko, G. and Newton, A. S. (2010), 'A systematic review of crisis interventions used in the emergency department: recommendations for pediatric care and research', *Pediatric Emergency Care*, Vol. 26 No. 12, pp. 952-62.

Hemaya, S. A., and Locker, T. E. (2012), 'How accurate are predicted waiting times, determined upon a patient's arrival in the Emergency Department?', *Emergency Medicine Journal*, Vol. 29 No.4, pp. 316-318.

Institute of Medicine. (2001), *Crossing the Quality Chasm: A New Health System for the 21st Century*, The National Academy Press, Washington, DC.

Institute of Medicine. (2006), *Emergency Medical Services at a Crossroads,* The National Academies Press, Washington, DC.

Jarman, B., Aylin, P. and Bottle, A. (2010), 'Hospital mortality ratios. A plea for reason', *British Medical Journal*, Vol. 340 No.7757, pp.c2744-c2744.

Jayaprakash, N., O'Sullivan, R., Bey, T., Ahmed, S. S. and Lotfipour, S. (2009), 'Crowding and delivery of healthcare in emergency departments: the European perspective', *Western Journal of Emergency Medicine*, Vol. 10 No.4, pp. 233-239.

Lorenzo, S. Mira, J., Olarte, M. and Guerrero, J. (2004), 'Analysis matricial de la voz de cliente: QFD aplicado a la gestion sanitaria, SciELO Espana, <http://scielo.isciii.es/scielo.php?pid=S0213-91112004000800008&script=sci_arttext&tlng=en>, accessed August 2012)

Mazur, G. H.; Gibson, J. and Harries, B. (1995), 'QFD applications in health care and quality of work life', paper presented at the First International Symposium on QFD, March 23-24, Tokyo, <http://www.mazur.net/works/health_care_qfd_quality_of_work_life_qfd.pdf>, accessed October 2012.

O'Connor, R. E., Slovis, C. M., Hunt, R. C., Pirrallo, R. G. and Sayre, M. R. (2002), 'Eliminating errors in emergency medical services: realities and recommendations', *Prehospital Emergency Care*, Vol. 6 No. 1, pp. 107-13.

Oberklaid, F., Barnett, P., Jarman, F. and Sewell, J. (1991), 'Quality assurance in the emergency room', *Archives of Disease in Childhood*, Vol. 66 No. 9, pp. 1093-1098.

Philipp, M. O., Kubin, K., Hormann, M. and Metz, V. M. (2003), 'Radiological emergency room management with emphasis on multidetector-row CT', *European Journal of Radiology*, Vol. 48 No. 1, pp. 2-4.

Practical Concepts Incorporated. (1979), *The Logical Framework. A Manager's Guide to a Scientific Approach to Design & Evaluation*, Practical Concepts Inc., Washington, DC.

Rahman, Z. and Qureshi, M. N. (2008), 'Developing new services using fuzzy QFD: a LIFENET case study', *International Journal of Health Care Quality Assurance*, Vol. 21 No.7, pp. 638-658.

Ruchholtz, S., Waydhas, C. and Lewan U. (2002), 'A multidisciplinary quality management system for the early treatment of severely injured patients: Implementation and results in two trauma centers', *Intensive Care Medicine*, Vol. 28 No. 10, pp. 1395–1404.

Schmidt, T. (2009), *Strategic Project Management Made Simple: Practical Tools for Leaders and Teams*, John Wiley & Sons Inc., New Jersey.

Shah, M. N. (2006), 'The formation of the emergency medical services system', *American Journal of Public Health*, Vol. 96 No. 3, pp. 414-423.

Steele, R. and Kiss, A. (2008), 'EMDOC (Emergency Department overcrowding) Internet-based safety net research', *The Journal of Emergency Medicine*, Vol. 35 No.1, pp. 101-107.

Talib, F., Rahman, Z. and Azam, M. (2011), 'Best practices of total quality management implementation in health care settings', *Health Marketing Quarterly,* Vol. 28 No.3, pp. 232-252.

The Times of Malta, Editorial, Wednesday 22 August. (2012), 'Emergency services demand urgent attention', <http://www.timesofmalta.com/articles/view/20120822/editorial/Emergency-services-demand-urgent-attention.433863>, accessed October 2012.

Travaglia, J. F., Deborah, Spigelman, A. D. and Braithwaite, J. (2011), 'Clinical governance: a review of key concepts in the literature', *Clinical Governance: An International Journal,* Vol. 16 No. 1, pp. 62-77.

Trzeciak, S. and Rivers, E. P. (2003), 'Emergency department overcrowding in the United States: an emerging threat to patient safety and public health', *Emergency Medicine Journal*, Vol. 20 No. 5, pp. 402-405.

UK NHS Trust. (2012), 'Imperial College Health Care, St Mary's Hospital A&E quality indicators' <http://www.imperial.nhs.uk/patients/ourstandards/emergency-care-quality-indicators/st-Marys-Hospital-performance/june-2012/index.htm>, accessed October 2012.

United Nations Development Program. (2000), 'Capacity Building Workshop for Dryland Management', Beirut, Lebanon. May 3-5, 2000, <http://www.who.int/ncd/vision2020_actionplan/documents/LFAUNDP.pdf> accessed October 2012).

Van Dillen, J., Mesman, J. A., Zwart, J. J., Bloemenkamp, K. W. and van Roosmalen, J. (2010), 'Introducing maternal morbidity audit in the Netherlands', *An International Journal of Obstetrics and Gynaecology*, Vol. 117 No. 4, pp. 416-421.

Velianoff, G. D. (2002), 'Overcrowding and diversion in the emergency department: the health care safety net unravels', *The Nursing Clinics of North America*, Vol. 37 No. 1, pp. 59-66.

Zimmermann, P. G. (2001), 'The case for a universal, valid, reliable 5-tier triage acuity scale for US emergency departments', *Journal of Emergency Nursing*, Vol. 27 No.3, pp. 246-254.

Figure 1: The proposed integrated QFD and LFA framework for A&E unit quality

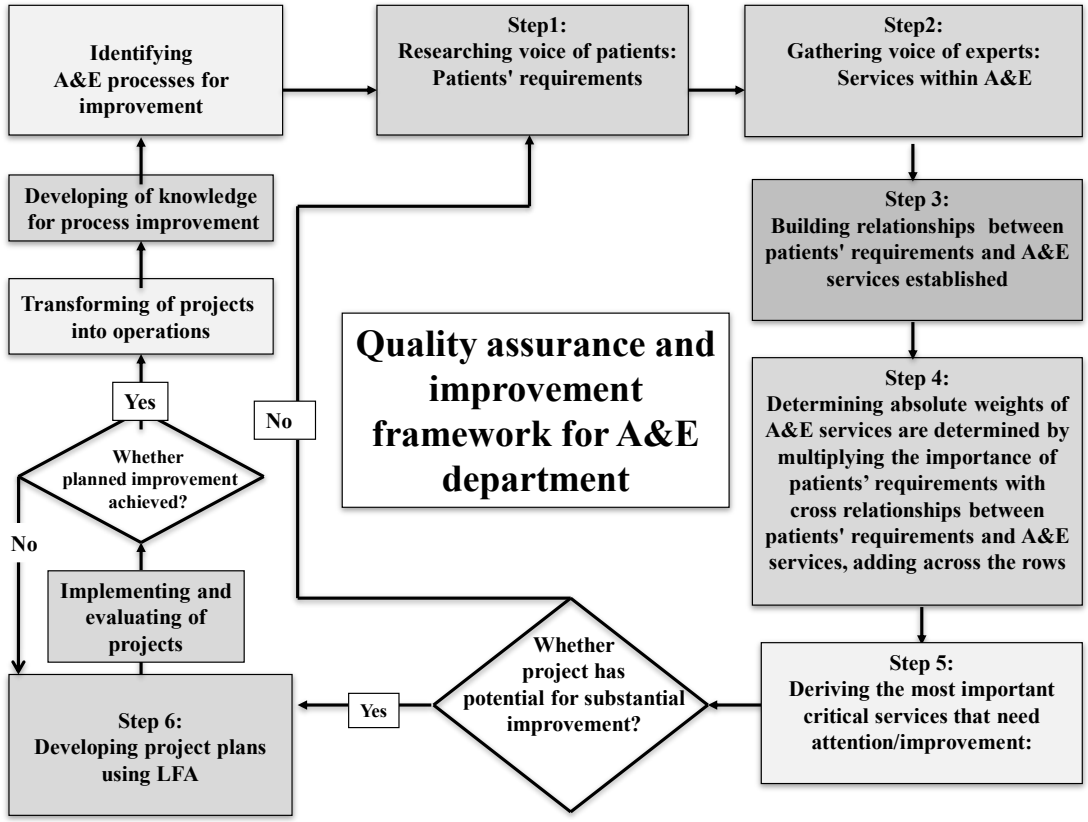

Figure 2: Cross-relationships between patients' requirements and experts' service requirements at A&E

9 : Very Strong Relationship 3: Strong Relationship 1 Weak Relationship	Voice of Professionals (A&E Services) / Voice of Patients	1.Consultant-based Cover	2. First Significant medical Encounter	3. Recruitment of Doctors And Nurses	4. Specialization/training	5. Expert triage	6. Guidelines and Protocols	7. Information by And to referring Doctor	8. Inter- and Intra-Departmental Communication	9. Communication With patients/ Relatives	10. Infection Control	11. Good Bed Management	12. Integrated ICT Framework	13. Maintenance
Resources Availability	1. 24 hour availability of experienced and competent emergency doctors/staff	9	9	9	9	3		3		3	1	1	3	
	2. Clean/comfortable environment										9	1		9
	3. State of the art and well-maintained facilities/equipment		1		3								3	9
	4. Availability of beds in hospital	3	3				1		3		3	9	3	
Services Availability	5. Faster patient flow	9	9	1	3	9	9	9	1	1		9	3	
	6. Expert filter of emergency from non-emergency cases	9	3	1	9	9	9	3		1				
	7. Reduced waiting time at A&E	9	9	9	3	3	3	3	3				3	
	8. Prompt services	3	9	9	3	3	3	3	3			3	1	
	9. Timely medical and procedural information	3	3	3	3		3		1	9	1		1	
	10. Responsive doctors and staff	9	3	9	3	3	3	9	3	9	3		3	1
	11. Friendly and courteous doctors/staff	9	3	3	3	3	1	3	1	9	1			
	12. Comfortable stay		1	1		1	1	1	1	3	3	9		3
	13. Discharge letter from A&E to GP for those not admitted	3	3	3	3		3	9	3	3			3	
	14. Faster admission to hospital	3	3	3	3	1	9	1	9			9	3	

Figure 3: A&E department House of Quality

House of Quality

Importance: 1 to 10 scale, with 10 being most important
Target values: 5 point scale (where 1 is no change, 3 is improve the service, 5 is make product better than the private sector)
Service point: Scale of 1 or 2, with 2 meaning high service effect and 1 being low effect on service
Absolute weight = customer importance X target value X sales point

Voice of Patients	Voice of Professionals	1. Consultant-based emergency cover	2. First significant medical encounter	3. Recruitment of doctors/nurses	4. Specialization/training	5. Expert triage	6. Guidelines/protocols	7. Information by and to referring doctor	8. Inter- & intra-Departmental communication	9. Communication with patients/relatives	10. Infection control	11. Bed management	12. Integrated ICT	13. Maintenance	Importance	Target value	Service point	Absolute weight
1. Experienced & competent emergency doctors /staff		9	9	9	9	3		3		3	1	1	3		10	5	2	100
2. Clean and comfortable environment											9	1		9	7	1	1	7
3. State of the art & maintained facilities/equipment			1		3								3	9	6	1	1	6
4. Availability of beds in hospital		3	3				1		3		3	9	3		9	5	2	90
5. Faster patient flow		9	9	1	3	9	9	9	9	1		9	3		9	3	2	54
6. Expert filter of emergency cases		9	3	1	9	9	9	3		1					8	3	2	48
7. Reduced waiting time at A&E		9	9	9	3	3	3	3	3				3		7	3	2	42
8. Prompt services		3	9	9	3	3	3	3	3			3	1		6	3	1	18
9. Timely medical and procedural information		3	9	3	3		3		1	9	1		1		5	5	2	50
10. Responsive doctors and staff		9		9	3	3	9	9	3	9	3		3	1	7	3	2	42
11. Friendly and courteous doctors/staff		9	3	3	3	3	1	3	1	9					6	1	2	12
12. Comfortable stay			1	1		1	1	1	1	3	3	9		3	6	1	1	6
13. Discharge letter from A&E to GP		3	3	3	3	1	3	9	3	3			3		5	3	2	30
14. Faster admission to hospital		3	3	3	3	1	9	1	9			9	3		7	5	2	70
Absolute Weights	3867	501	431	343	330	272	363	362	256	239	141	305	185	139				
Absolute factors		0.13	0.11	0.09	0.09	0.07	0.09	0.09	0.07	0.06	0.04	0.08	0.05	0.04				
Relative weights	24941	3456	3402	2400	2292	1654	2454	1870	1850	1446	629	2141	1170	177				
Relative factors		0.14	0.14	0.09	0.07	0.07	0.10	0.08	0.08	0.06	0.03	0.09	0.05	0.05				

Figure 4: A&E department objectives tree

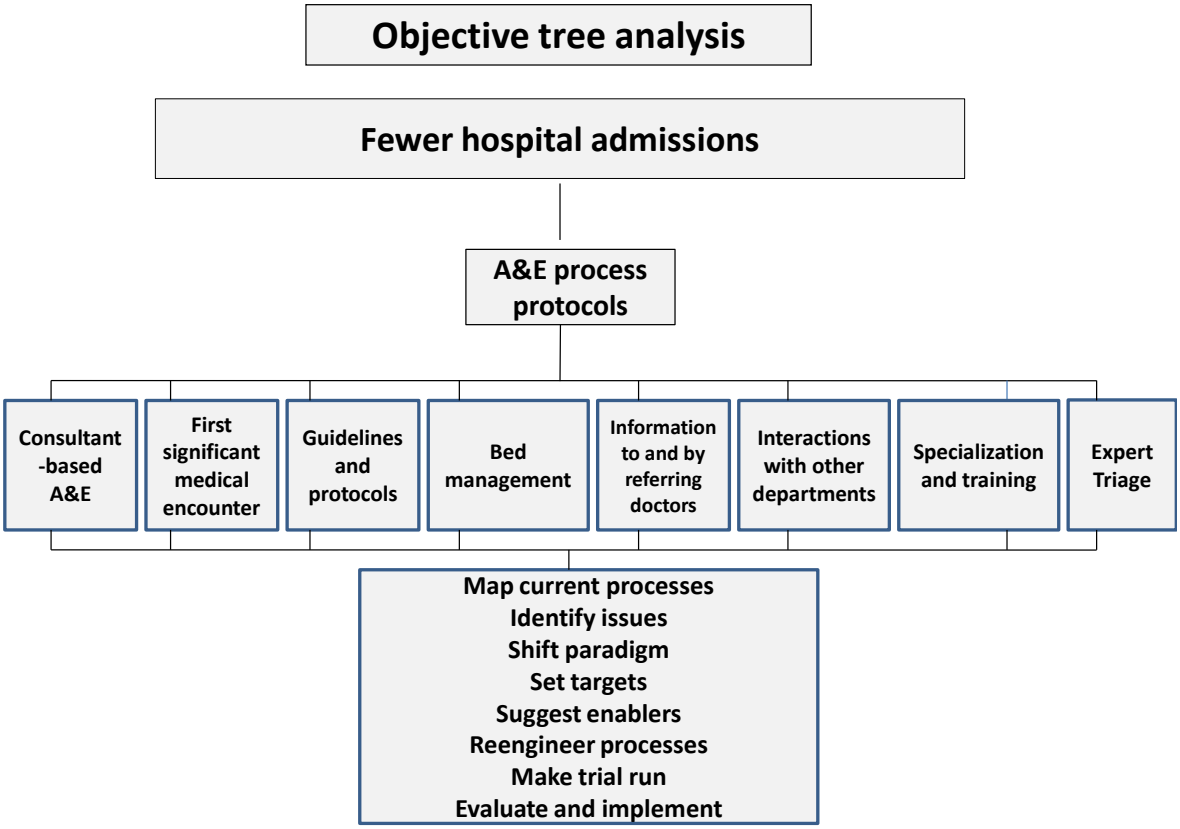

Figure 5: Logical framework analysis for implementing standardized A&E process protocols

	Indicators	Means of verification	Assumptions
Purpose Fewer hospital admissions	Hospital admissions decreased from_ to _after 12 months	Hospital activity analysis reports	Patients are satisfied with overall service and adequately managed at A&E
Goal Standardized A&E process protocols	Patient turnaround time at A&E is reduced from _to _	A&E audit reports	
Outputs •Consultant-based A&E •First significant medical encounter •Guidelines and protocols •Bed management •Information to/by referring doctors •Interaction with other departments •Specialization and training •Triage	•No. of consultants increased •Time to be seen by senior A&E officer improved •No. of guidelines/protocols •Bed availability improved •No. of customer service complaints decreased •No. of complaints from clinical hospital departments •Specialization/training •Triage time improved	•Admission & discharge reports •A &E performance reports •Hospital performance reports •Bed management reports •Customer service reports •Triage register	Doctors and staff are appropriately trained to operate the new processes
Activities •Map current processes •Identify issues •Shift paradigm •Set targets •Suggest enablers •Reengineer processes •Make trial run •Evaluate and implement	Schedule and budget	Budget document	•Management commitment •Employee involvement •Agreement with unions