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A Description and Evaluation of Improved Organisational Performance Through the Use of a Continuous Improvement Process by Queensland Ambulance Service

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ABSTRACT

The impact of a specific Continuous Quality Improvement (CQI) methodology on organisational performance and patient care outcomes in the pre-hospital care environment is examined in a study that focuses on use of the Australian Business Excellence Framework by Queensland Ambulance Service (QAS).

A literature review indicates an expanding field of publications relevant to CQI and performance measures in this field. Most is about improvements in highly specific episodes of medical care in permanent healthcare facilities. The great majority of this material is of limited value to ambulance where the conditions for patient care are fundamentally different, and the nature of care more immediate and delivered under frequently trying, and sometimes dangerous, conditions.

The public health literature is starting to address CQI in patient care, and some relates to the ambulance environment, stimulated in part by the ambulance industry itself and bodies from which a growing amount of safety and quality in health care regulations is emanating as social awareness and consumer demand increase. Most literature addresses overseas systems, with little reference to Australian ambulance services.

This qualitative research involves three sequential, inter-relating projects based on CQI in patient care as applied by QAS since 1997, and is work in progress. The enquiry posits that the use of a deliberate CQI approach using the ABEF in the ambulance environment is more likely to make a positive difference to patient outcomes than an approach that does not.

KEY WORDS

Ambulance, Quality, Continuous Improvement, Patient Care

1 INTRODUCTION

Continuous Quality Improvement (CQI) in health care is a process still in its relative infancy compared to the application of quality management processes in other fields. Ambulance services play a substantial role in the continuum of patient care, and work commenced in 1997 with the application of such an approach to ambulance operations by QAS. QAS plays a prominent role in this trend using a conceptual model known as the Australian Business Excellence Framework (ABEF), and has now engaged in significant improvements sufficient to receive three Australian Business Excellence Awards, an international standard of recognition. The ABEF, shown at Figure 1 below, is regarded as a world class model for developing Business Excellence by enabling a user to engage in self assessment, identify strengths and opportunities for improvement, and then engage in improvement plans to address the latter.

This paper reports on a study that forms the basis of the research component of a Doctor of Health Science started in 2003. The study provides an opportunity to examine the research question in an ambulance service that has been using a CQI approach, thereby informing future practice better through evidence-based findings. Investigation examines work in progress in QAS where the ABEF is being used as a deliberate intervention strategy to drive CQI, seeking improved patient care outcomes in the environment addressed primarily by ambulance services.

Figure1: The ABEF

2 AIMS

The research aims to:

- Determine if a systematic approach to CQI in patient care delivery by an ambulance service can lead to improved patient outcomes.
- Compare the performance of an ambulance service which uses such an approach with one that does not.
- Inform ambulance practice in the selection and application of a continuous improvement model.

3 BACKGROUND

The research resides in the domains of both health management and CQI. The impact of the use of a CQI methodology on organizational performance and therefore, patient care outcomes in the pre-hospital emergency care (ambulance) environment, is examined. The research is primarily from a qualitative methodological approach based significantly on an ethnographic basis. Previous research comprises industry-based work associated with the conduct of a CQI program across QAS. Extensive data are held, with work ongoing in the field of real organizational performance management. Patient care and related stakeholder interaction for the period 1997 to 2006 feature in the data.

The concepts of quality assurance, total quality management and the broader and more recent enhancement of the general field of quality, CQI, are now well known. The rate and width of adoption is still far from complete across society generally, and even less so than in the area of pre-hospital emergency care, particularly that provided by ambulance services. Numerous works have been produced (Delavigne and Robertson, 1994 and Ishikawa, 1989), since the essential genesis of the modern quality movement out of the work of Deming. An entire industry has grown about such theory to operationalise it, with Batten (1992), Morgan and Murgatroyd (1999) and Ryall and Kruithof (2001) being representative of the plethora of practical guides now available.

Terms such as Total Quality Management, Quality Assurance, Quality Improvement, Continuous Quality Improvement are frequently used interchangeably, a practice that has helped to confuse many practitioners and decision makers alike. For the purpose of this study, the term *Continuous Quality Improvement (CQI)* is used to provide the context for the research, with reference to the other phrases being made only when necessary to clarify what has actually occurred in QAS during the timeframe examined.

The proposed study therefore focuses on the application of a leading model of CQI – the Australian Business Excellence Framework (AQC, 2002 and SAI-G, 2004) by QAS in the quest for CQI, and by extension, patient care as a result. Both quantitative and qualitative methods have been applied in this work through a variety of data gathering analysis and research tools. In-service publications containing both data and its analysis are being used to inform the ongoing management (and improvement) of a $310M operation in FY 05/06.

4 LITERATURE REVIEW

An initial review of the literature indicates a large and expanding field of publications relevant to CQI Improvement and performance measures in the healthcare field. However, the great majority of that literature deals with hospital-based patient care, with the more clinically focused articles dealing with measures that have limited application to the environment of pre-hospital emergency and non-emergency care faced by ambulance (Bizovi *et al*, 2002, Duggan 1999, COA, 1999 and Ricard-Hibon *et al*, 1999).

The most immediate and obvious gap is that much of the literature is about improvements in highly specific episodes of medical care, occurring in hospital or healthcare facilities (Cobelas *et al*, 2001 and McCracken *et al*, 2001). The majority of this technical material is of limited direct and practical value to ambulance where both the environmental conditions for patient care, and especially the duration of the patient care episode, are normally fundamentally different to the controlled environment of an operating theatre or nursing ward (Balazs and Thompson, 1996, Davis and Downie, 1997, Francis and Mazany, 1997, Isouard, 1999, Judge, 1998 and QAS, 2001).

This distinct gap is evidenced by the relative paucity of literature pertaining to quality improvement specifically to the ambulance, or pre-hospital, environment. This is an observation found to be remarkable given the ongoing application of ambulance care for over a hundred years in Australia, and since 1892 in Queensland (QAS, 2001). This observation is also generally reflected in both local and overseas literature (ASNSW, 2002, and TASA, 1999).

Ambulance services generally have a role (or mission) similar to that of QAS, namely the minimisation of pain or suffering through the rapid and effective treatment and transport of the sick and injured to a place of definitive care (QAS, 2002). In FY 01/02, 566 499 cases (DES, 2002) were handled in Queensland alone out of a population of 3.8 million. By FY 04/05, this had risen to almost 700 000 (DES, 2005). Similar percentages of state populations requiring ambulance care annually are reflected across all Australian ambulance services (APC, 2002). This suggests that the ambulance function is quite significant in the continuum of patient care and therefore deserving of rigorous analysis. Further, relatively little discussion occurs in academic publications about

continuous improvement and the potential impact on patient outcomes that might emanate from a wider view of “whole of organization” performance, regarded by some as just as important as patient-centric care measures (Bowers and Kiefe, 2002, Francis and Mazany, 1997, Moore, 1999, and Thomson, 2003).

From a pre-hospital emergency (and non-emergency) patient care and transport industry perspective, there is a growing volume of literature - examples being Australian (CAA, 1999 to 2004) and British efforts in publishing benchmark data. There is a robust range of EMS-based articles, predominantly from North America, but the great majority concentrate on clinical matters and only occasionally addressing quality assurance or CQI e.g. Cady and Lindberg (2001). Similarly, the federal government has collated and published data on a range of services provided by both the federal (and state) governments. This development is the consequence of an intent to inform debate and encourage improved productivity. Notable in its fifth edition (APC, 2002), the Report on Government Services allocates 275 pages in three chapters devoted to Health, but only 12 pages to Ambulance which is grouped and discussed in a chapter on Emergency (not Health) Services. Clearly these might be due to the lack of relative research such as that proposed in this Study.

This fact highlights a further difficulty in analyzing the research literature with regard to the question – whether ambulance is the *emergency arm* of health services, or the *health arm* of emergency services. The literature on this issue is scant, and the consequent absence of debate in the literature and the consequential difficulty in sourcing a ready supply of quality articles is reflected in some key Australian publications. For example, the premier source of general data on national output, the Australian Bureau of Statistics, makes no mention at all of *ambulance*, and uses the word *paramedic* only once in 41 pages on health (ABS, 2002). Similarly, a major Queensland study in 2001 (QH, 2002) refers once to the word *ambulance* in 142 pages, and then only in the Index. These observations suggest a significant gap in literature coverage of what is clearly a major component of the continuum of patient care, at least in official Australian data gathering and reporting regimes driven by government.

The situation is improved in the international literature, but even then most data on ambulance, commonly referred to as EMS (Emergency Medical Services) in North America and in Europe – ambulance in Britain – appear in EMS or fire journals. This industry-specific material is growing as the ambulance industry applies more sophisticated measurement and more systematically applies CQI. However, such developments are still in their infancy, and the bulk of the articles in such journals are case-specific (Munk, 2000, Cobelas *et al*, 2001, Chase and Perina, 2001, Francis and Mazony, 1997 and Taigman, 2000). This area of the literature, however, does provide a basis upon which to advance this study.

Fortunately a growing body of CQI literature is evident in a range of other fields, notably business and manufacturing, where that movement started. CQI is becoming increasingly applied in the health sector and this is starting to be reflected in the literature. Writers indicate a growing interest in its application to healthcare. Cobelas *et a*l (2001), Moore (1999) and Easton and Jarrell (1998) are indicative of this group as they outline the great potential for improved outcomes in patient care through this process. They also suggest that the limitation to further improvements is the procedural implementation of quality measures rather than the process itself, additional to swinging away from quality assurance.

Other writers have addressed the impact of CQI in ambulance services. Fischer *et al* (2000) indicate the need for more advanced analysis of organizational improvements in an ambulance environment where they examine a large range of Key Performance Measures (KPI) from a quantitative analysis perspective and go on to advocate greater use of measurement to aid the continuous improvement of ambulance services. Similarly, McCoy (1996), Law and Boyce (2003) and CAA (2001) address performance measurement in the context of Australian health care and advocate the use of common

performance indicators where such can be found and used to practical effect in the continuum of patient care.

There are few empirical papers on CQI projects that have been transformed into research projects. Study design can affect the degree of validity of such research, especially when evaluating interventions aimed at improving the quality of care. Bizovic *et al* (2002) suggest possible solutions to the potential problems associated with such studies, a most useful paper from which to draw benefit at this stage of the project. Descriptive research generally strives to define the frequency of quality care, or the frequency of failure to deliver quality care. However it is not easy to define good-bad, or error, in the quality of care. Valid tests are needed to determine what is an error in care before such a line of enquiry might be pursued. This helps inform a range of ambulance measures (Fischer *et al,* 2000, and Shuster and Shannon, 1994).

Fortunately, a range of writers regards CQI as having two clear approaches. The first of these is a retrospective approach that seeks to find errors in patient care and then change practice in a safe and sensible manner in the future from a “learn but lay no blame” approach. The second is best described as a prospective view that seeks to improve service delivery generally as a result of a systematic and co-operative approach to continuous improvement (Pelowitz, 2003, Shaw, 2002 and Bowers and Kiefe, 2002). Borrowing from other fields of endeavour to learn processes such as improved organizational and work design (Law and Boyce, 2003), statistical process control and work process control are but a few of the consequences of the general quality movement emanating from the work of stalwarts including Duran and Deming (Delavigne and Robertson,1994). In summary, the literature reveals a focus on CQI in the hospital sector and healthcare generally but most is not directly applicable to ambulance. There is a growing body of literature that is addressing patient-specific care in the ambulance environment, mostly overseas. This appears to have been stimulated by the ambulance industry itself and regulatory bodies.

5 RESEARCH METHOD

The study started in 2003. It is a natural experiment using a qualitative research (ethnography) approach, utilising a range of data collected since 1997 in a large scale planned organizational intervention to achieve CQI through the deliberate application of the ABEF. Some quantitative data helps inform the research, as those data reflect most of the outcomes of organizational performance as measured and reported using QAS’ KPIs. They also constitute an element of Organisational Self Assessments (OSA) and other survey methodologies used by QAS over the period of the study.

Qualitative data has been primarily used to further measure the degree of change resulting from decisions taken to improve organizational performance overall, and within it, the core business of maximising positive patient outcomes. Quantitative data are used together with the qualitative data to illustrate and further inform the data gathering that included staff, patients and other stakeholders who either directly benefited from QAS patient care, or stood to be potential beneficiaries of that care. Discourse analysis of informant interviews is also being used to examine responses to pre-determined questions that have been developed in conjunction with supervising faculty from the Queensland University of Technology and cleared by the QUT Research Ethics Committee.

The research method involves the conduct of three sequential and inter-relating projects, using literature reflective of a strong emphasis on CQI in health care. Because the initial literature review indicated a relative paucity of pre-hospital/ambulance-specific discussion of the research proposal topic, industry sources pertaining to the pre-hospital ambulance environment were used as well. A theoretical model of the key determinants of patient outcomes, based on the ABEF, and forming the conceptual underpinnings of a CQI approach to improving those outcomes, is under development and subject to ongoing refinement (adapted from the ABEF as published by SAI-G, 2004).

The three projects are based on CQI in organizational performance, and with it, the core business of patient care as it has been applied by QAS since 1997. Occasional necessary references to applications of the same concept in international and interstate settings will be made to give greater meaning to the events experienced and actions taken in the Australian (QAS) setting. This is considered necessary to contextualize areas for examination and treatment, as benchmarking and other comparative methods have featured significantly in the QAS Quality "Journey", and form an essential plank in the QAS CQI structure. This view is supported in much of the literature, both inside and outside, of structured hospital environments. Projects constituting this research are:

5.1 Project 1 - Policy Analysis. Project 1 entails a **descriptive policy analysis** of the pre-1997 period in QAS. It examines key areas of inquiry pertaining to the quality of patient care in the pre-hospital environment:

- What constituted "the quality movement" in QAS prior to the intervention.
- How patient outcomes were assessed in QAS.
- What the QAS KPIs were and how they were derived.
- To what extent did patient care standards line up with those of contemporary healthcare organisations.
- Why was it considered necessary to "improve" upon the quality of patient care/outcomes.
- How QAS service delivery occurred/was managed and delivered at jurisdictional level.

5.2 Project 2 - Process Evaluation. Project 2 entails a **descriptive evaluation** of the processes followed by QAS and what occurred in the period 1997-2006 to examine:

- What constitutes "Quality" in QAS now.
- What CQI methodologies were used by QAS and why they were selected.
- What the KPIs are now.
- How does QAS performance data in this period compare with the pre - 1997 era.
- To what extent do the data reflect improvements in patient care outcomes.
- How does QAS compare with another Australian and/or an overseas service.

5.3 Project 3 - Synthesis of Outcome Measures and Results. Project 3 entails the **synthesis of outcome measures, processes and results** and constitutes the most important experimental research component by examining the following key questions:

- Has the use of a CQI approach in QAS worked.
- To what degree are existing performance measures valid in determining patient outcomes.
- What are now considered to be Best Practice in patient care outcomes.
- To what degree do the current KPIs enable the determination of improved patient care.
- What is considered to be the most effective CQI model for ambulance services.
- Have the outcomes in patient care justified the investment.
- Should CQI be a planned intervention at all.
- What, if any, changes might be made to how an Ambulance Service uses CQI to improve patient care outcomes.

6 PROGRESS TO DATE

The principal strengths of this research lie in the length of time over which the work in question has been in progress, and the magnitude of the study. Additionally the potential for future application of findings to other ambulance services in particular are high, given that little work of this nature is known to have been conducted. All of the performance data gathered were obtained either from official reports or serving/ex- ambulance personnel, thereby giving a rich texture to and basis for qualitative research from an ethnographic perspective. This material complements, in excellent perspective, the quantitative performance data gathered to inform the QAS decision-making process

and to meet Queensland and Australian government and industry body reporting obligations and undertakings.

Some supporting research used to inform KPIs and other uses was carried out on a randomised control basis eg the Householder Survey (OESR, 2002) while other, eg the pre-hospital cardiac arrest data, was based on 100% sample. Similarly, much of the remaining data required of QAS reporting regimes is absolute, eg the total number of cases responded to, by category, and cost per case. These data provide a significant amount of descriptive as opposed to inferential, statistics for analysis, and permits a high degree of constancy between years and months, being the unit of time for comparison of the use of such data, facts and knowledge to inform decision making, and by extension, contribute to overall (potential) improvements in patient care.

Aside from the primary literature review, which is updated weekly with ongoing release of fresh material, QAS performance data gathering has been ongoing for some years within QAS. These data fall into three areas:

- Quantitative data from the full range of KPIs upon which QAS reports to a range of authorities, and which is used to inform decision making as well as meet statutory reporting regimes.

- Quantitative and qualitative data derived from Organisational Self Assessments as a direct consequence of the application of the ABEF across QAS since 1997. These data helped inform comprehensive Improvement Plans across a range of activities, and produced significant improvements, only some of which are readily identifiable in the KPIs published by QAS, a selection of which are shown in Figures 2 to 6 below.

- Quantitative and qualitative data from targeted evaluation instruments used by QAS eg patient satisfaction, staff satisfaction, Local Ambulance Committee satisfaction, QAS Organisational Self Assessments and other measures.

As the study is industry-based, access to the data needed was secured from QAS along with full industry support and approval from QAS. The Australian Centre for Pre-Hospital Research, based in Central Office QAS as a joint University of Queensland-QAS venture, also provided support. QUT Research Ethics Committee clearance was gained and an interview list, questions, clearances and information sheets/guidelines were approved prior to the field research which commenced in 2005.

7 PRELIMINARY QUALITATIVE FINDINGS

Interviews with key informants are now under way with respondents being grouped for research comparison into four groups: Retired QAS staff, Serving with QAS-only experience, Serving with Other Ambulance Service AND QAS experience, and Non-QAS expert witnesses. Results of this element of the research is yet to be written up, and will constitute the qualitative/experience-based element of the discussion chapters. This anecdotal-based source of data is expected to provide rich ethnographic support to the quantitative data.

8 PRELIMINARY QUANTITATIVE FINDINGS

Although some of the data presented below are in the form of patient cases (a case is defined as one patient), all data collected as part of the QAS Performance Management and Reporting process has already been blinded in the data collation, analysis and reporting processes. This also applies to all data from Organisational Self Assessments, Staff Satisfaction and Patient Satisfaction Surveys.

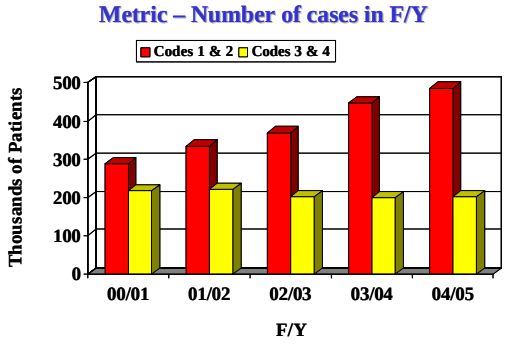

Figure 2: All Cases – 1 & 2 (Urgent) 3 & 4 (Non-urgent)

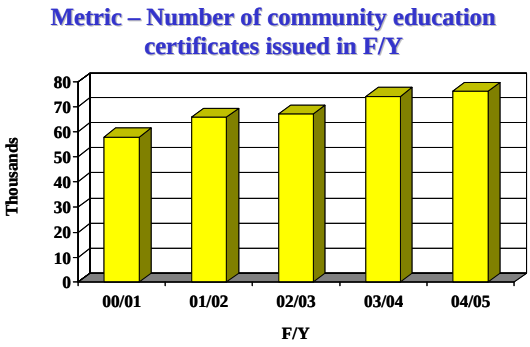

Figure 3: Community Education

Figure 2 is an output measure which demonstrates the constantly growing response demand profile. It shows the magnitude of demand and the relative proportion of Urgent and Non-Urgent cases that QAS is actually handling. Matching assets, including trained paramedics and communications officers to this demand profile puts other KPIs into perspective.

Figure 3 refers to the proactive output of people trained in first aid, and each year adds to the number of the community having been trained before. Outcomes of such activity is impossible to measure, but it is safe to assume that patients who benefit from first aid prior to arrival of QAS outcomes are more likely to experience lower morbidity and mortality.

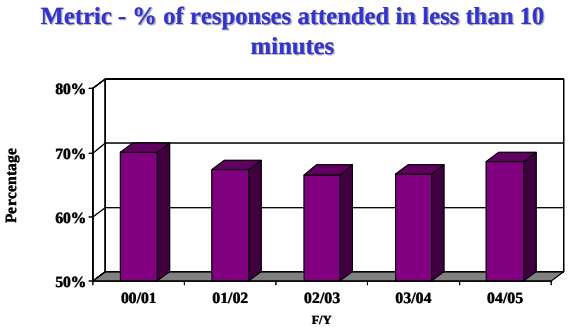

Figure 4: Response Times (Urgent)

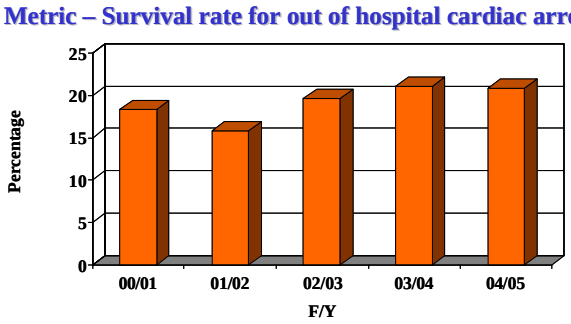

Figure 5: Out of Hospital Cardiac Arrest Survival Rates

Response times in Figure 4 can be seen to have dropped during intense demand in FY 01/02 and FY 02/03 but then improve. Current data reported monthly show the last 14 consecutive months be reflect consistent improvement, suggesting the deliberate actions taken in a range of areas have combined to generate this result. Figure 5 demonstrates the changing results in the percentage of patients who are resuscitated and handed over to hospitals alive.

To what degree these KPIs data are directly attributable to use of the ABEF and its self-assessment capability is not possible to measure precisely. It is this area that qualitative evidence from the study's informants and comparisons with interstate Ambulance Services data over the same time that do NOT use a CQI approach plays an important part in the study's findings, as there are complex variables that cannot be isolated and controlled in the ambulance emergency environment.

Figure 6 (below) reflects the steadily improving degree of patient satisfaction with the quality of care by QAS. For the last three years, Ambulance personnel have been rated the most admired profession followed by Firefighters. Again, it is not possible to determine what portion of this steady increase is attributable to use of the ABEF, but the application of Category 5 (Customer and Market Focus) features prominently in QAS thinking, measuring and subsequent actions.

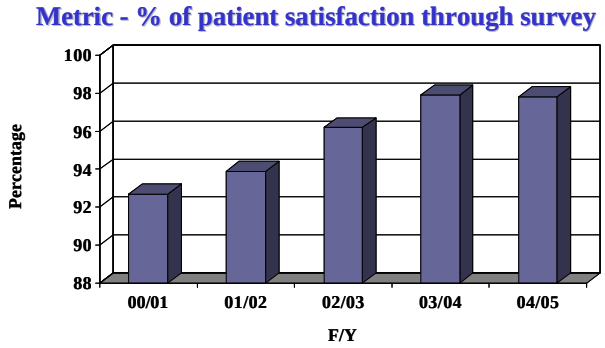

Figure 6: Level of Patient Satisfaction

9 LIMITATIONS

Limitations of the study include the potential for generalisation as a result of the qualitative approach taken. With regard to the OSAs carried out, convenience sampling was used in all five annual surveys (1998 to 2005), in that respondents to questionnaires were allowed to self-select participation. Interviewees were deliberately targeted on the basis of the function they performed, giving credibility to their testimony in the role of key informants. Some of the OSA qualitative data were gathered on an observational and recording basis during actual ambulance emergency responses, and all of the remaining data in ambulance workplaces from which operational crews sometimes had to respond during such research. Such is the reality of ambulance operations, and the attenuating limitations on research. Regarding quantitative performance data obtained from normal operational data recording processes, the reliability of data cleansing ranges from very high quality in the case of pre-hospital cardiac arrest data to "unknown" in the case of the huge number of data points in the gathering of response times (almost 700 000 in FY 04-05).

10 CONCLUSIONS

This study is scheduled for completion in late 2006, so definitive conclusions may not yet be drawn. However, the trend data from major KPIs provided in this paper, supported by qualitative data (work in progress), suggests that the use of a CQI model – in this case the ABEF – does make an important difference to patient care outcomes in the ambulance environment.

A variant of the ABEF, modified to the context of the ambulance service delivery environment, is under development and is shown in Figure 7 below. A possible outcome of the study, as listed in the Aims stated earlier in this paper, is the application of such a model to other Ambulance Services, and possibly to allied health care organizations.

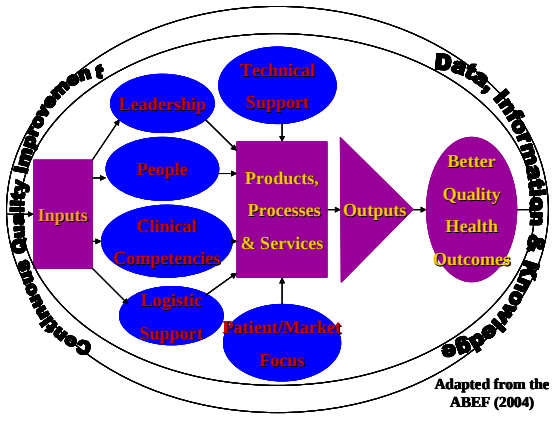

Figure 7 : A CQI Model

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