

Development and implementation of a clinical pathway programme in an acute care general hospital in Singapore

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Abstract

A clinical or clinical pathway defines the optimal care process, sequencing and timing of interventions by doctors, nurses and other health care professionals for a particular diagnosis or procedure. Clinical pathways are developed through collaborative efforts of clinicians, case managers, nurses, pharmacists, physiotherapists and other allied health care professionals with the aim of improving the quality of patient care, while minimizing cost to the patient.

The use of clinical pathways has increased over the past decade in the USA, the UK, Australia, and many other developed countries. However, its use in the developing nations and Asia has been sporadic. To the author's knowledge, there is to date, no published literature on the use and impact of clinical pathways on the quality and cost of patient care in the Asian health care setting. This paper provides a qualitative account of the development and implementation of a clinical pathway programme (using the example of patients with uncomplicated acute myocardial infarction) in an acute care general hospital in Singapore. The paper concludes that clinical pathways, when implemented in the context of an acute care hospital, can result in improvements in the care delivery process.

Keywords: care processes, cost-effectiveness, quality of care, variances

The struggle between the cost and quality of health care has led providers to look for new and innovative ways of delivering cost-effective care in an efficient manner. Total quality management philosophy teaches that the most effective way to improve quality is to reduce variation in the process of providing a service. In the field of health care delivery, clinician-directed diagnostic and therapeutic plans, called clinical pathways, provide such an approach in the hospital setting by reducing variation in clinical processes, and improving the quality of care while keeping hospital length of stay to an acceptable minimum. It is a relatively new clinical process improvement tool that has been gaining popularity across hospitals and various health care organizations in the USA, Australia, the UK and Singapore.

A clinical pathway is essentially a multidisciplinary plan of care that outlines the main clinical interventions that are carried out in the hospital by a group of professionals responsible for the care of the patient. It is used as a guide to plan, co-ordinate, deliver, monitor, review, and document care concurrently. Pathways embody clinical practice guidelines, while at the same time allowing variations in provider activity and patient response. However, unlike clinical practice guidelines, pathways are commonly developed by a group of

doctors, nurses and other health care professionals for local use within an organization. Pathways are continuously reviewed and evaluated in the light of clinical evidence so that they become a method for evaluating the care provided and form an important component of continuous quality improvement in clinical practice. Pathways also define expected or anticipated outcomes of care, and are therefore used as tools for process and outcome audits. Hospital managers have also used pathways to minimize average length of stay without compromising the quality of care provided. This is especially important in a case-mix funding environment, whereby reimbursement for hospital care is on a per Diagnosis Related Group (DRG) episode basis. In this manner, clinical pathways have a direct and tangible impact on patient care processes and outcomes. The approach and objectives of clinical pathways are consistent with those of total quality management and continuous clinical quality improvement and are essentially the application of these principles at the patient's bedside.

Despite the growing popularity of pathways, their impact on clinical outcomes and their clinical effectiveness remains largely untested and unproven through rigorous clinical trials. Much of the research has focused on changes in the process

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of care delivery rather than on outcomes [1–7]. There have been fewer published studies that have evaluated the outcomes of using clinical pathways. Most of these uncontrolled studies have shown a reduction in hospital length of stay and decreased costs without any adverse clinical outcomes [8–13]. A more detailed discussion is provided at the end of this paper.

Objectives of clinical pathways

The often stated goals of implementing clinical pathways usually include the following:

- (i) Selecting a ‘best practice’ when practice styles are known to differ significantly and unnecessarily.
- (ii) Defining standards for the expected duration of hospitalization and for the utilization of clinical tests and procedures.
- (iii) Examining the interrelationships among the different steps and stages in the care process and to engineer strategies to co-ordinate or decrease the time spent in the rate limiting steps.
- (iv) Giving all involved staff common goals and helping them to understand their roles in the entire care process.
- (v) Providing a framework for collecting and analysing data on the care process so that providers can understand how often and why patients do not follow an expected course during their hospitalization.
- (vi) Decreasing clinical documentation burdens.
- (vii) Improving patient satisfaction through improved patient education – e.g. better care giver-to-patient communication on the plan of care.

Variances

Flexibility is the key in using clinical pathways. They are guidelines and maps, not inflexible dictates for care or treatment. Because clinical pathways reflect the care needed by most, but not all patients within a defined population, situations arise in which there are differences from the anticipated plan of care. A well designed clinical pathway should capture 60–80% of patients within a defined population. This is because a clinical pathway can only be designed for the ‘usual’ patient. Some patients will fall off the pathway during the course of their hospitalization. Some patients will encounter problems in the course of their hospitalization, causing variation in the interventions and outcomes. Variances are the unexpected events that occur during patient care – events that are different from what is predicted on the clinical pathway. Despite the intent to define the essential components of care, there still is variation in how care will be delivered and how patients will respond. Variances can be positive or negative. Positive variance occurs when the patient progresses

towards projected outcomes earlier than expected, when pre-selected interventions such as pain medication administration are unnecessary, or when interventions such as patient education can successfully begin at an earlier stage. Negative variance occurs when either the patient fails to meet projected outcomes, there is a delay in meeting the outcomes, or there is a need for additional interventions previously unplanned.

An essential part of the use of clinical pathways is the collection and analysis of information obtained when patients deviate from the pathway. Analysis of variation provides useful and accurate information on the frequency and causes of variations in patient care. The analysis encourages members of the multidisciplinary health care team to adhere to the guidelines and standards set in the pathway, or justify the reasons for variations. In this way, clinical pathways compel doctors and health care providers to evaluate critically and understand the basis of clinical decisions. Several authors have shown that using clinical pathways and clinical practice guidelines can improve clinical outcomes and the quality of patient care by reducing avoidable variation in the clinical process [14–16]. Analysis of variance is also a powerful clinical audit tool as all aspects of patient care are constantly reviewed and revised. Improvements in the quality of care are achieved through continuously redefining the pathways to reflect current best practice. This is the essence of continuous quality improvement incorporated into clinical practice. Variance data are used most effectively as a means of educating clinicians and enabling them to make considered changes to their practice based on emerging trends and the results of that care. The clinicians and the clinical pathway development team are intimately involved as they determine whether the variance data indicate that changes are needed in the clinical pathway itself or whether other system changes are required. This is the essence of evidence-based medicine in practice, i.e. using clinical data and evidence to plan the best possible treatment for the patient.

The recording, collection and analysis of variances provides continuous audit data on the care being delivered. Such audit information is specific to each case-type on the pathway being analysed. This regular analysis of the care processes, practices and outcomes through the analysis of variances and the feedback of the team is a vital component of the entire clinical pathway programme. Analysis can highlight deficiencies in the care process due to problems arising from the hospital system, such as reasons for delayed discharges, inavailability of sufficient operating theatre time, etc. Clinical pathways are also an ideal tool for outcome audit analysis because the documents can be retrieved and studied to ascertain whether or not the interventions resulted in the desired clinical outcomes as stated on the pathway.

The development and use of clinical pathways in Singapore

One of the main driving forces for the escalating use of clinical pathways in the USA has been the rising costs

of hospital care and the resultant pressures by insurance companies and health maintenance organizations on providers to control the cost of clinical care. In Singapore, health care is generally provided on a fee-for-service basis. Health care provided at public hospitals is subsidized at varying levels by the government, depending on the type of ward (categorized in terms of comfort and privacy). Health expenditure is about 3.1% of the Gross Domestic Product (compared with about 13% in the USA). The health care environment in the USA is generally fragmented with a great variety and heterogeneity of providers. In Singapore, there is greater vertical and horizontal integration within the health care system. With such a vastly different health care system from the USA, are clinical pathways useful in the Singapore setting? The author is of the opinion that as pathways provide a vehicle for ensuring quality care for patients, they can be used and applied in any health care setting. The prime objective of a clinical pathway should be to use current evidence and incorporate it into clinical practice in a manner that allows a holistic and cost-effective care plan to be delivered to the patient. Pathways are therefore applicable in any health care setting regardless of the system of care delivery or financing.

With the current financial crisis affecting the Asian economies, there will be greater pressures on health care organizations to provide only cost-effective care and use technology in an appropriate manner. Pathways could therefore be very useful for health care organizations by providing them with a rational basis for the use of limited resources without compromising the quality of care. Furthermore, with the impending implementation of a case-mix or DRG-like system of reimbursement for hospital care, there are now good reasons for hospitals to start using clinical pathways as a means to provide the most cost-effective care within the shortest possible length of stay.

Many models on how clinical pathways could be implemented have been developed. There is no one correct method or means of implementation. The organization must determine what is the most suitable approach. Coffey *et al.* [17] described a generic approach for establishing and using clinical pathways. It consists of selecting the diagnosis and procedures for clinical pathways, appointing a team to develop the pathways, selecting the appropriate methods for designing the pathway forms, documenting current processes, studying internal and external practices, implementing the pathways, defining key measures of pathway outcomes, developing data collection tools, educating all staff involved, analysing variances and results, and improving the clinical pathways as required.

Development of the AMI clinical pathway: a systems approach

Cardiovascular diseases account for about one-quarter of all deaths in Singapore, second only to cancer as a cause of mortality. Acute myocardial infarction (AMI) is a common disorder, and is characterized by an acute occlusion of the

coronary arteries by a thrombus, built on an atheromatous plaque. AMI is both a high volume and high cost diagnosis, with significant long-term impact on health care services and financing. It is therefore an ideal case type for a clinical pathway.

This study was performed at the Changi General Hospital, the first purpose-built regional hospital in Singapore, serving an estimated 800 000 people living in the eastern and north-eastern sector of the country; it is an 800 bed acute care general hospital providing a comprehensive range of clinical and para-clinical services. More than 80% of the beds in the hospital are subsidized by the government, i.e. from eight bed to four bed rooms. The target population is the middle to lower income groups living in the sector. The main clinical services centre on the disciplines of general medicine, general surgery and orthopaedics. The average length of stay for patients in the hospital is between 4.8 and 5.5 days. The majority of beds are used for acute care.

In July 1996, the Changi General Hospital's Medical Board decided to pilot a clinical pathway programme. The objectives of such a programme have been outlined above. A systematic approach to planning the clinical pathway programme was adopted in the hospital to ensure that a comprehensive and rational method of development evolved through rigorous research and evaluation. The pathway programme evolved through five phases in chronological order as detailed below.

Phase I Assessment and situational analysis

This phase began as the result of a strategic planning process initiated by the hospital in an effort to respond to pressures brought by outside sources such as the community and the government. The main objectives were:

- (i) To provide infrastructure, resources and direction for the programme.
- (ii) To provide a framework for future evaluation of the programme.

Appointment of a steering committee

In July 1996, the need for a clinical pathway programme was decided by the Medical Board and supported by top management, which included clinical chiefs and the nursing division. The idea for such a programme was first mooted by a group of hospital staff who visited some reputable hospitals in the USA to learn about best practices and to acquire knowledge on recent developments in the field of health services provision and management. This benchmarking exercise resulted in the hospital adopting two important new philosophical cornerstones – the practice of evidence-based medicine and the use of clinical pathways. This was a crucial first step in introducing this new clinical process improvement tool as support from top management and clinical leaders is critical to the success of any new programme involving change within an organization. Thereafter, the formulation, implementation and evaluation of clinical pathways was overseen by the Case Management Steering Committee (CMSC) composed of the clinical quality

manager (chairperson), case managers, senior nursing personnel and representatives from the clinical and para-clinical departments. Such broad based participation was deemed crucial to the success and acceptance of this new programme. It fostered ownership of the process through bottom-up planning with top-down support.

Defining administrative support

The CMSC commenced the planning process by first defining the types and amount of support that could be provided to the programme. Resources included all inputs such as human resources, financing and materials (equipment). At this stage, it was agreed that a full-time project manager (the author) would be crucial to the overall success of the programme.

Definition of roles, purpose and responsibilities, accountabilities and goals

The CMSC's next task was to define clearly the roles, responsibilities, purpose, accountabilities and goals of each person and department participating in the programme. This minimized duplication of activities and resulted in clear lines of action among the participants. At this stage, it was necessary to ensure that the goals and objectives of the clinical pathway programme were consistent and reflective of the hospital's overall mission and strategic planning initiatives.

Literature review and background information

A situational analysis was a necessary early step in planning. Identifying current problems, issues or concerns helped to shape programme goals. Historical information such as hospital mortality and morbidity, average length of stay for each case type, financial data and patient satisfaction surveys were important for comparison during evaluation and provided a rational and systematic basis for selecting and developing new clinical pathways.

The steering committee first analysed the main disease epidemiology affecting the population in the eastern sector to determine the common reasons for hospital admission. Thereafter, a literature review of existing pathways from other hospitals (mostly from the USA and Australia) was conducted to determine the common types of pathways developed and their prescribed length of stay. This was compared with the current existing average length of stay for various diagnoses in the hospital. An audit of current clinical practice was also carried out to identify problem areas that could be resolved by the clinical pathway process.

Situational analysis

Implementing a new programme that involved significant organizational change requires sensitivity and correct timing of the change process. A systematic organizational analysis provided an opportunity for the steering committee to determine at an early stage, the organization's strengths, weaknesses, opportunities and threats – a SWOT analysis. In SWOT analysis, a list of the strengths and weaknesses within the hospital or department, and the external opportunities and threats to the implementation plans are written down and discussed. In this case, the steering committee discussed

these issues at a meeting. Through brainstorming, a SWOT analysis revealed the following main points:

(i) Strengths

- presence of committed and supportive top management
- committed case managers and project co-ordinator
- support from the Medical Board
- apparent willingness of key managers and leaders to change
- a commitment of the hospital's top management to quality improvement
- patient-centred nursing system in practice on the wards

(ii) Weaknesses

- lack of full-time project co-ordinator and case managers
- insufficient resources
- shortage of adequate numbers of nurses in the wards
- lack of a clinician champion for the pathway programme

(iii) Opportunities

- higher educated patients who desire more information about their illness
- monopoly of hospital care provision in the eastern sector – the only other competitor is a comparatively small private hospital which does not have a clinical pathway programme
- no other hospital in Singapore has yet to fully implement a clinical pathway programme – there was therefore an opportunity to be an industry leader in this field of clinical process and quality improvement, which could improve the reputation and recognition status of the hospital
- case management and clinical pathways could open up new markets for the hospital and additional revenue through providing consultations and educational packages to other hospitals and organizations interested in developing similar programmes
- the use of pathways could potentially improve the quality of care through the practice of evidence-based medicine

(iv) Threats

- staff morale and motivation may not be optimal for such a radical change
- inadequate financing and resources to meet future needs
- frequent change of junior doctors, requiring repeated briefings and potential documentation problems and poor compliance

- resistance to change among clinicians and nurses

SWOT analysis provided the hospital and the steering committee with the opportunity to identify key situations and people to facilitate successful implementation of the programme and at the same time, highlighting potential difficulties and obstacles that can be avoided through careful planning.

Assessment of current practices

During this phase, the rationale for current work practices were questioned. Documenting the current care delivery process was a good place to start. However, improving practice would only occur in response to serious questioning of what, when, who, where, how and why things are done the way they are. What criteria are really necessary for the patient to be discharged? What care can be provided at home or on an outpatient basis? What intermediate patient care objectives or outcomes are really necessary in order to accomplish the desired outcomes? What activities contribute and what activities are unnecessary to the attainment of desired outcomes? Why are certain practices being done? Do different practices really result in different outcomes? Through this gradual process of self-appraisal, new ideas were generated and improvements made which matter to patient outcomes.

Setting clear and measurable goals and objectives

Setting clear and measurable goals and objectives was extremely important to the success of the programme. Well-defined goals gave the programme direction and facilitated evaluation. The goals of the clinical pathway programme at Changi General Hospital have been stated above.

Education and clarification

During this stage, all members of the steering committee were provided with the relevant literature. Building consensus about the pathway programme was the educational goal at this phase, as well as attaining a consistent understanding of the project's basic concepts. Experiences from other institutions was also very helpful.

Phase 2 Design

The design phase had four main objectives:

- (i) Identification of the case types or patient populations for the pilot pathways.
- (ii) Development of the content of the pathways.
- (iii) Design of documents and forms that support the programme goals.
- (iv) Development of education and evaluation plans for use in programme implementation.

Selection of case types for pilot phase

Criteria for selection of case types for the pilot phase that were adopted included high volume/high cost diagnoses, predictable pattern of care, clinician interest and support, availability of motivated and committed staff and possibility of multidisciplinary involvement and participation. Through

this exercise, it was decided that the first three clinical pathways to be developed would be: uncomplicated AMI, elective laparoscopic cholecystectomy and hip fractures. This paper focuses on the pathway for AMI.

Clinical pathway development and design teams

The AMI pathway was developed by a team of professionals composed of a cardiologist (clinician-leader), an intensive care nurse, a case manager (who was the clinical pathway coordinator), a dietitian, a pharmacist, a physiotherapist and a social worker. Through the development process, the team had to identify and solve organizational problems, both current and potential, that could form obstacles to the smooth implementation of the pilot AMI pathway. This was felt to be one of the most positive benefits of the pathway development process – dealing with system issues and increasing communication and understanding among the multidisciplinary team. In addition, they also undertook a critical review and analysis of the current practice patterns among various clinical staff in the hospital. A thorough literature review was undertaken to ensure that the guidelines written in the pathways reflect the current best practice based on evidence and available resources.

Development and design of the clinical pathway document and variance management system

Careful thought and consideration needed to be given to the design of the clinical pathway documents and forms. Important factors included simplicity and clarity with reduction of duplication or unnecessary documentation. This ultimately facilitated and promoted acceptance of its usage among the hospital staff. As a tool for multidisciplinary clinical documentation, the pathway should support the needs of all care givers concerned. At this stage, streamlining of documentation was crucial.

Variance management issues were many and complex. Some of the important issues considered were:

- Who would record the variance?
- Who would collect and aggregate the data?
- How would the data be stored?
- Who would analyse the data?
- What kind of information might be collated and analysed?
- How often would variances be reported to clinicians and management?

The method of recording and collating variances was determined at this stage. The design of the variance collection sheet was simple and easy to complete and did not add unnecessary duplication of documentation. In this case, the variance collection form was designed by the case managers and a team of nurses. This was important because it fostered a sense of ownership among the nurses who would ultimately be using the form.

The system of variance tracking and analysis was semi-automated, using manual collection forms and data entry into

a database using Microsoft Excel. Variances were collated by the case managers during their daily ward rounds and entered directly into the database. Variances were classified into three categories: patient or family, caregiver and system.

Developing an education plan

A plan was developed to educate all clinical staff about the clinical pathway programme. A basic package of educational material was produced for the staff for them to read and assimilate. The educational material included an overview of basic terms and concepts, objectives of the pathway, scope and content, an outline of the benefits of clinical pathways and variance management, and the system of implementation in the hospital. Education for staff also included methods for helping them cope with change. Clinicians, nurses and allied health professionals each attended 6 hours of intensive training that provided them with the knowledge of the basic principles of clinical pathways, their benefits and the objectives of the hospital's programme. There was also the need to familiarize the doctors and nurses with the new pathway documents. Guidelines on the use and documentation of the clinical pathways were written, distributed and explained to all relevant staff.

The training curriculum was phased so as not to create information overload. This was achieved through an introductory series of 'road-shows' to create general awareness among all staff. Thereafter, the workshop sessions followed with ample opportunity given to the participants to voice their uncertainties and apprehension towards clinical pathways and variance documentation. Case scenarios and studies were developed to enable the nurses to deal with potential problem cases. Finally, a series of refresher courses were conducted to keep all staff updated on new developments and as a means to obtain continuous feedback regarding the utility of the pathways.

Phase 3 Pilot implementation

The pilot phase had two specific objectives:

- (i) To find ways of improving the pathway documents and forms with a view towards ensuring maximal usage and acceptance.
- (ii) To ascertain that the variance data recorded and collected were meaningful.

Pilot implementation

During this time, close monitoring of staff and the use of the pathways was carried out by the case managers and the project manager. Regular and frequent ward rounds were carried out to examine the quality of documentation and to correct any errors or omissions.

After the first 50 completed cases or so, an initial evaluation of the utility of the clinical pathway documents was carried out with a view towards improving the layout and design. The pathway design team also analysed the variance data to determine if the desired information had been obtained. Every effort was made to ensure that variance information recorded was meaningful and relevant.

During this phase, the factor crucial to success was the easy accessibility of ward staff to the project manager and the case managers. Many of the initial problems tended to revolve around how terms and goals were defined, and how information was communicated from shift to shift and department to department. No problem was considered trivial at this stage, and the steering committee was at hand to provide all the necessary support and encouragement. One desired outcome at this phase was that staff felt themselves to be an integral part of the process of solving problems they identified. Their perception that suggestions were acted upon rapidly and resulted in real improvements to the pathways encouraged further participation and acceptance.

Phase 4 Full implementation

This was perhaps the most difficult part of the entire process because it involved extensive monitoring and education. For larger hospitals, a phased implementation from one unit to another might be preferable. This could be achieved over a period of months or years. Success would be gradual and incremental. This phase had two main objectives:

- (i) To provide clinicians with a pathway to co-ordinate patient care and engage in collaborative practice while utilizing limited resources efficiently.
- (ii) To collect useful and meaningful clinical information to guide the care and concurrently to determine trends and patterns that could be addressed through quality improvement processes e.g. clinical audits.

Implementation, monitoring and problem solving

During this phase, the case managers were the most important people in the process. They conducted daily ward rounds to ensure that all suitable patients admitted were put on the pathway. They enforced compliance with the guidelines for the use of the pathways. They served as the link between the steering committee, pathway development teams and the ward staff using the pathways.

As the project progressed to this stage, additional education was organized in response to specific needs identified by staff and management. Reinforcement and encouragement continued, and everyone was updated on the project's progress. Success was widely publicized.

Phase 5 Evaluation and integration

The final phase involved evaluating the project to determine the achievement of predetermined goals and objectives. The ultimate aim of the evaluative process was to improve the implementation process at all levels. Once clinical pathways became part of the hospital's system of care delivery, the steering committee could then focus on designing new pathways.

Evaluation focused on process and outcomes. Process evaluations document the extent to which the programme was implemented as designed and serving the target population. Outcome evaluations focus on the extent to which anticipated

health and non-clinical outcomes are achieved for the population served. Efficiency evaluations examine the cost and resource issues associated with the clinical pathway.

Evaluation was both qualitative and quantitative. Qualitative or process evaluation involved determining the reasons and root causes of problems identified or of successes achieved. This was carried out through focus group interviews of selected staff, nominal group techniques and surveys of staff satisfaction or attitudes towards the pathway. Another important qualitative evaluation was the amount of resources utilized to develop the pathway programme.

Quantitative evaluation involved the use of data to determine if the objectives had been met. Targets were set early in the programme development and then measured to assess the degree to which the objectives had been met. At Changi General Hospital, quantitative evaluation was favoured over qualitative techniques in view of its more objective means of arriving at conclusions. However, there should be a balance between the two forms of evaluation. The variables that were measured for evaluation included average length of stay, bill sizes, mortality, morbidity as a result of hospital procedures and primary disease, and patient satisfaction scores.

One important limitation of pathway programme evaluation is that rigorous inferences about the effects of pathways themselves may not be possible. There are many other factors associated with a clinical pathway programme and many other extraneous variables affecting the outcomes of care delivery and hospitalization. The outcome of clinical care is subject to a complex interplay of factors that has yet to be fully understood. It would therefore be too simplistic to attribute the observed effects solely to the influence of clinical pathways unless a well controlled study is done. This is often not possible in an operational setting.

Obstacles to project implementation

Published studies and surveys on difficulties encountered in implementation of clinical pathways are rare. Little and Whipple [18] surveyed 14 hospitals to determine what were the common problems encountered in the implementation phase of a pathway programme. This section discusses some of the more significant problems and obstacles encountered by the researcher and the case managers at Changi General Hospital.

Lack of clinician support and acceptance

This is a common and recurrent problem. Most clinicians are generally supportive of the use of clinical practice guidelines. However, it has been shown that there is a gap between knowledge, attitude and actual practice in using the guidelines. The researcher used a top-down approach through the hospital Medical Board to obtain support from the senior clinicians. Thereafter, selecting suitable clinician champions to steer the development of pathways fostered a bottom-up approach. This facilitated greater ownership of the process and minimized resistance to change. Another crucial strategy was to ensure that consensus among the relevant clinicians

was obtained on the draft pathway before full implementation. This was done by using the Delphi technique. All comments and criticisms of the draft pathway need to be considered carefully and necessary amendments made. The researcher also encouraged the clinician leader of the pathway development team to present the final draft to her colleagues through an open forum. As the hospital is a public teaching institution, one persistent problem is the periodic rotation of junior doctors in and out of each clinical department. This meant that case managers and the clinician leaders had to conduct briefings and teaching sessions on the pathway programme every 6 months.

Anxiety and scepticism among the nursing and paramedical staff

As clinical documentation on the pathway involved the nurses, it was expected that the main bulk of anxiety and uncertainty would be expressed by them. The main strategies to tackle this obstacle were education, reassurance and streamlining of documentation. Constant and regular face-to-face contact with the nurses was carried out to ensure that the nurses were given close guidance on the new documentation tool and variance recording. The workshops, lectures and case studies all helped to foster confidence in the nurses and paramedical staff. Through the educational and teaching sessions, feedback was obtained and acted upon.

Legal issues

In this instance, briefing sessions with the doctors and nurses helped to erase some of the more worrisome features of using clinical practice guidelines and pathways. In addition, putting down a legal disclaimer on the clinical pathway document and advising that interventions could be changed according to the patient's clinical condition made the use of such forms more acceptable to the clinicians.

Documentation problems

There was a concern that clinical documentation would need to be duplicated and there would be unnecessary wastage of paper. This concern was addressed through streamlining of clinical documentation and minimizing the need for nurses to write long shift reports by focus charting or charting by exception. This enabled the nurses to perform their clinical duties and focus on important clinical issues affecting the patient during their shifts. In general, the feedback from nurses has been favourable and the actual amount of clinical documentation has decreased.

Lack of information systems support

A variance management system should preferably be automated to facilitate variance collection and analysis. At the beginning of implementation, the amount of variance data was manageable through manual collection and analysis. At Changi General Hospital, we used the Microsoft Excel database with some in-house modifications for data storage. However, with increasing numbers of patients completing

the pathway and greater complexity of data analysis requirements (e.g. use of multivariate and regression analysis), it was decided that a software should be developed locally or acquired for data storage and analysis. This should be linked with the hospital's patient information systems so that there would be no necessity for duplication of data entry of patients' biodata and disease codes and relevant information on patient outcomes.

Discussion: cost-effectiveness of clinical pathways: a growing concern

There is considerable uncertainty whether pathways improve or influence clinical practice. Few evaluations have been carried out using randomized controlled trials. The first published randomized controlled study on a clinical pathway was carried out by Falconer *et al.* [19]; it was found that a pathway for congestive heart failure had no significant impact on the duration of hospital stay or on patient outcomes. However, two early studies demonstrated the utility of pathways in well designed, but uncontrolled studies. Bailey *et al.* [20] showed that an asthma clinical pathway did not significantly reduce the length of stay, but was associated with an increase in the use of metered-dose inhalers which resulted in estimated cost savings of US\$288 000 per year for the institution. Nichol *et al.* [21] developed a clinical pathway for patients with acute chest pain that is based on published literature, research and expert opinion to improve quality and efficiency of care for patients at low risk for complications of ischaemic heart disease. Retrospective analysis showed that the pathway was able to reduce substantially resource use and costs of care. Recently, other studies have also provided some evidence of the cost-effectiveness of clinical pathway implementation, particularly in the surgical disciplines [22–25]. While there is some evidence of the effectiveness of pathways, other studies have also shown otherwise. Holmboe *et al.* [26] showed recently that hospitals that instituted clinical pathways did not have increased use of proven medical therapies, shorter lengths of stay, or reductions in mortality compared with other hospitals that commonly used alternative approaches to quality improvement among Medicare patients with AMI.

It is very difficult to conduct randomized controlled trials on the effectiveness of clinical pathways because of operational and ethical constraints. As such, most published studies involve an uncontrolled and non-randomized before and after type of analysis. To date, there has been no published study on the impact of clinical pathways in the Singapore context. Despite the uncertainties regarding the effectiveness of clinical pathways, the current competitive environment will not allow health care organizations to wait for the results of rigorous trials before starting to use them. In addition, performing controlled trials may prove to be problematic because of 'contamination' of control groups who may have knowledge of the intervention. Studies in which patients or doctors are assigned randomly to either a pathway or

conventional management are therefore unlikely to be undertaken. The question of ethical considerations in conducting such randomized trials is also another issue that needs to be addressed before proceeding further.

To measure the cost-effectiveness of pathways, one must measure the total costs for the entire episode of care, including the post-hospital phase of management. Pathways that reduce hospital costs through reduction in length of stay may be merely shifting the rest of the costs to the community and outpatient setting. In such instances, it would be a fallacy to conclude that pathways are cost-effective and decrease resource utilization. Finally, even if valid data on resource use, patient satisfaction and clinical outcomes can be obtained, the effectiveness of pathways at an institution may remain a value judgement. For instance, in the study by Nichol *et al.* [21] on the management of patients with acute chest pain at the emergency department, the authors showed that a clinical pathway could reduce resource use. However, the authors did not examine the longer term outcomes such as re-admission rates, unplanned returns to the emergency department for recurrent chest pain and patient satisfaction. If these outcomes were observed, would the hospital have revised the pathway? In reality, the cost, quality and patient satisfaction vectors may not always point in the same direction. What values are placed on these different outcomes is an issue each organization needs to consider carefully with clinicians and managers as active participants in all such decision making.

Conclusion

Current trends clearly show that clinical pathway programmes are being launched throughout the world. As a potential tool for quality improvement, pathways have tremendous appeal because of their multidisciplinary methods, their focus on process and outcomes of care, and on reducing unnecessary variation in treatment. Clinical pathways have much to offer the health care organization and the individual practising clinician. They provide a proactive, locally owned facility by which the multidisciplinary team can critically review and improve their processes and practices of care delivery towards the achievement of agreed clinical outcomes through the provision of best possible practice within the available resources. Pathways are also a means towards efficient resource management, provision of more information to patients and a clinical audit tool.

However, there are still serious concerns regarding their effectiveness and questions remain about the development, implementation and costs of clinical pathways. Methods to develop pathways remain unstudied and are still evolving with wide variations seen among institutions in their approach to topic selection, team composition, documentation on the pathway and variance management systems. Considerable research is needed to explore which methods of pathway development and implementation are most likely to provide benefits. As the technology of clinical pathways and their application expands, an important challenge for researchers

will be to develop rigorous methods of evaluation techniques to assess their impact.

In view of the current paucity of evidence concerning the effectiveness of clinical pathways, hospitals and health care organizations should be encouraged to publish their evaluations of pathways. National and professional associations should also be encouraged to establish standardized criteria for evaluations of clinical pathways. Comparisons of the results of evaluations may be difficult because of differences in case-mix and practice environments. However, this should not detract clinicians and health service researchers from evaluating the local impact of pathways because ultimately, such evaluations form part of the practice of evidence-based medicine.

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Appendix: AMI clinical pathway, Changi General Hospital

Emergency room	Day 1 intensive care	Day 2 intensive care	Day 3 intensive care → ward	Day 4	Day 5–6	Day 7
Inform cardiologist, relatives of patient's DIL status To intensive care unit	Inform cardiologist Review patient status Inform relatives of patient's DIL status if not yet done Refer patient to CRP	Assess for complications Refer to CRP if not yet done Inform patient, relatives of possible discharge to home by Day 7 if no major complications	Assess for complications Refer to CRP if not yet done Refer to medical social worker if needed Transfer to general ward with telemetry	Assess for complications Refer to CRP if not yet done Review DIL status Educate patient, relatives on disease process and long-term medication	Assess for complications Prepare patient for home by Day 7 Review DIL status if not yet done Educate on lifestyle changes and coping skills	Assess for complications before discharge Reinforce patient education and ensure thorough knowledge of continuing care and lifestyle adjustment
ECG stat. ECG 1 st hour post thrombolytics CXR(P), Set i.v. plug FBC, U/E/Cr PT/PTT, CK/CKMB × 1 st specimen, GXM	ECG (P) FBC U/E/Cr GXM if not yet done CK, CKMB × 2 ECG 4 th hour post thrombolytics Fasting lipids next day	ECG Fasting lipid profile	ECG/telemetry 2-D echo for Day 6 or Day 7	Off i.v. plug 2-D echo for Day 6/Day 7 if not yet ordered	2-D echo for Day 6/Day 7 if not yet ordered	2-D echo Appointment as outpatient if not already done
Obtain consent to i.v. thrombolytics (refer protocol) i.n. oxygen 4l/min S/L GTN	i.v. thrombolytics (refer protocol) i.v. heparin if > 12 hours post infarct	Off i.v. lignocaine after 48 hrs if no VT Off i.v. heparin after 48 hours if no chest pain		Off telemetry if fit Off 6-hourly blood pressure monitoring	Off telemetry if fit	Discharge if fit Out-patient follow-up in 5–6 weeks (after exercise stress test) 2-D echo appointment as out-patient if not yet done Out-patient exercise stress test in 4 weeks time
Nitrodisc i.v. morphine if not in shock	i.v. lignocaine if in VT i.v. morphine for pain relief					
Hourly vital signs Continuous ECG monitoring	Hourly vital signs Continuous ECG monitoring	Hourly vital signs Continuous ECG monitoring	ECG/telemetry 4–6-hourly vital signs			

CK/CKMB, Cardiac enzymes; CRP, cardiac rehabilitation programme; CXR(P), chest X-ray (portable); DIL, dangerously ill; ECG, electrocardiogram; ECG(P), electrocardiogram (portable); echo, echocardiogram; FBC, full blood count; GTN, glyceryl trinitrate; GXM, group and cross match; i.n., intranasal; i.v., intravenous; PT/PTT, blood clotting profile; S/L GTN, sublingual glyceryl trinitrate; Stat., immediate; U/E/Cr, urea/electrolytes/creatinine; VT, ventricular tachycardia;

Author's note: This chart should not be used by readers as a guideline for the care of patients with AMI. Readers should consult the actual clinical pathway and guidelines. These are available from the author upon request.