

## A Systems Development Life Cycle Approach to Patient Journey Modeling Projects

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### Abstract

*Patient Journey Modeling, a relatively recent innovation in healthcare quality improvement, models the patient's movement through a Health Care Organisation (HCO) by viewing it from a patient centric perspective. A Systems Development Life Cycle (SDLC) provides a standard project management framework that can improve the quality of information systems. The concept of following a consistent project management framework to boost quality outcomes can be applied equally to healthcare improvement. This paper describes a SDLC designed specifically for the health care domain and in particular patient journey modeling projects. It goes on to suggest that such a framework can be used to compliment the dominant healthcare improvement method, the Model for Improvement. The key contribution of this paper is the introduction of a project management framework in the form of an SDLC that can be used by non-professional computer developers (ie: health care staff), to improve the consistency and quality of outcomes for patient journey redesign projects. Experiences of applying the SDLC in a midwife-led primary-care maternity services environment are discussed. The project team found the steps logical and easy to follow and produced demonstrable improvement results along with ongoing goal-focused action plans.*

### Keywords:

medical informatics, SDLC, health care Improvement, patient journey modeling

### Introduction

Systems development life cycles (SDLC) were developed to provide a formal structure for the development of quality information systems. An overarching concept of a SDLC is the inclusion of a project management framework for planning, managing and controlling the people, development process and problem solution from the projects inception to the delivery of the required system [1, 2]. This theoretical construct can be applied in a similar manner in a variety of domains including health care improvement.

For a development project to be successful, the people involved in the project must have a detailed plan to follow. Attainment of the required goals depends heavily on hav-

ing a plan that includes an organized, methodical sequence of tasks and activities that culminate in the delivery of a system that meets the clients' needs for reliability and efficiency. This is a specific goal of a SDLC.

Such concepts can also be aligned to the goals of the dominant health care improvement method, the Model for Improvement (MFI) [3] and it is suggested that by integrating the two approaches, patient journey modeling projects can be conducted in a more consistent manner, delivering higher quality process improvements. In this paper we propose a SDLC approach to Patient Journey Modeling projects that compliments the Model for Improvement via the introduction of a project management framework. Key benefits of the proposed SDLC approach are the provision of a planning, monitoring and control structure that can be used by both IT and non-IT staff with little or no previous process improvement experience to improve the consistency and quality of outcomes for patient journey redesign initiatives.

The paper begins with a background on patient journey modeling and systems development life cycles. Methods and research motivations are then presented, followed by a discussion on the proposed SDLC for patient journey modeling. The paper finishes with highlights of the SDLCs application and a discussion on how the SDLC integrates with the Model for Improvement.

### Background

#### Patient journey modeling

Patient journey modeling is a patient-centric activity that details a patient's progress through a healthcare system for a given service [4, 5]. The goal of Patient Journey Modeling (PJM) is to improve health care quality by reducing variability in the care process. Specifically this includes evidence-based best practice, collecting required information only once, reducing the number of times a patient is moved, eliminating excessive activities, reducing duplicate communications and providing clear and concise information to the patient.

Several terms are used in the literature to refer to the concept of patient journey modeling (PJM) including: clinical pathways, patient flow redesign, clinical practice improvement and redesigning healthcare [6-8].

The most prominent method being used to reengineer health care processes, the ‘Model for Improvement’ (MFI), provides a framework for developing, testing and implementing changes that lead to improvement. As the method of choice for the Institute of Healthcare Improvement, it has been used extensively in the US [3] and by the NHS in England [4, 5].

**Systems development life cycle**

A Systems Development Life Cycle (SDLC) is a project management framework that organizes activities into phases [1]. If problem-solving activities are to be productive, the work conducted must be structured and goal-oriented. Computing professionals achieve these results by organizing the work into projects. A *project* is a planned activity (or set of activities) that has a definite beginning and end and that produces a desired result. *Project Management* deals with the planning, monitoring and control of all aspects of a project including the people involved, the problem solution and development process itself.

An SDLC was first introduced to the computing field in the 1960’s with the goal of providing guidelines to improve the quality of computer developments [1, 2].

Many systems being developed today follow a development path consisting of 3 core elements: *Analysis*, *Design* and *Implementation*. *Analysis* activities provide an understanding of the business information system requirements. *Design* activities define the technical architecture and structure of the new systems to satisfy the business requirements. *Implementation* is the actual construction, testing and installation of a functioning information system.

These 3 phases address the core activities required to develop an information system but two additional phases are also required when developing quality systems. A *Project Planning/Initiation* phase involves those activities required to initiate, plan and obtain approval for the project. Once the new system is completed and installed, the development team must perform activities to determine if the project satisfied the original business needs or whether the system needs amendment or enhancement. This is known as the *Post Implementation Review* or *Evaluation* phase.

**Current issues**

Present patient journey modeling approaches lack any type of project management structure for planning the improvement project or monitoring and controlling its progress. The MFI also lies at a level of abstraction above step-by-step procedures and does not adequately address the integration of technology to assist the change process. The introduction of a SDLC to patient journey modeling projects provides a mechanism for overcoming these issues and provides staff, both IT and non-IT, with a logical guide to achieving improvement results.

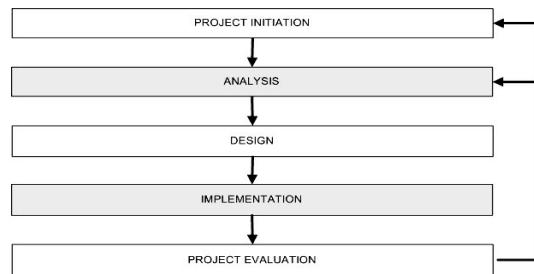
**Methods and research motivation**

The research described uses a constructive research process [9] enriched by aspects of a participatory action research environment [10]. This has involved patient journey modeling sessions with management and staff at Ryde Hospital’s Maternity department. Ryde provides midwife-led primary care maternity services for identified low-risk women through the public healthcare system [11, 12].

The work described in this paper originated as part of a Quality Review conducted at Ryde Hospital in 2006. Preliminary analysis of the areas under review indicated that although patient satisfaction was consistently high there were some significant patient assessment, information duplication and system administration issues. An SDLC was designed specifically for the PJM project. This included step-by-step activities and expected deliverables.

**A Systems Development Life Cycle for patient journey modeling projects**

The proposed Systems Development Life Cycle for patient journey modeling as shown in *figure 1*, follows the standard SDLC format.



*Figure 1 - A systems development life cycle for patient journey modeling*

There are 5 phases, namely: Project Initiation, Analysis, Design, Implementation and Project Evaluation. Outputs from the Project Evaluation phase are fed back into the Life Cycle and either trigger new process improvement projects or lead to further enhancements of the resulting patient journey. Figures 2-6 and their description, outline each of the phases in more detail.

Typically senior management will assign a process improvement team leader. In SDLC terms this person is known as the project manager. This role is responsible for reporting progress, leading the team and ensuring that goals and deadlines are met.

**Project initiation phase**

The primary purpose of the *Project Initiation* phase is to set the scope of the patient journey modeling project and to inform those who will be affected by the results what will occur during the project. *Figure 2* shows the 6 major activities that make up this phase with all outputs being stored in a Project Repository.

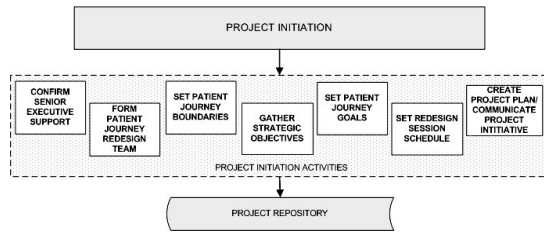


Figure 2 - Project initiation phase activities

The primary contributor to process improvement success is active, strong and visible executive sponsorship throughout the project [13, 14], thus the first activity must be to *secure a sponsor at senior executive level*. This will involve identifying a high-level project ‘champion’ who will ‘talk-up’ the project, is authorized to make resource decisions and can report project results to the executive team. Failure to secure a senior executive sponsor may see the project without required resources (both staff and physical) or lead to the project being cancelled if difficulties arise or budgets are tightened.

Once an executive sponsor is confirmed, the project manager sets about *staffing the project team*. In healthcare the inclusion of a representative from all areas affected by the results must be attempted. This includes clinicians, management, IT and administrative staff, and in the case of PJM projects, patient representatives as well. This helps to create a sense of ownership of resulting changes and promotes a culture of on-going process improvement. Ideally staff will be allocated to the project full-time but typically resources can only be released on a part-time basis.

Following formation of the project team the *scope of the patient journey modeling project* is discussed and agreed. The scope sets out what areas are to be included in the project analysis and what areas will be explicitly excluded. This information forms the basis for the first formal documentation created by the project team. It should be recorded in a retrievable medium and stored in the *project repository*. A *project repository* is a central storage area for all project information. Ideally this should be in electronic form as this allows future project teams to easily review past projects, identify successful attributes and reuse them where possible.

Following setting of the project boundaries, strategic objectives relating to the patient journey are gathered. *Strategic Objectives* are set by the Executive and are high level goals and measurements that drive the organisation’s overall direction. These may not be clearly defined in some organizations but must be clarified before the project can continue. Specific *patient journey redesign goals* are then defined based on the strategic objectives. Each goal should address a particular area of the problem domain and have expected measurements assigned. These measurements relate to the redesigned patient journey and will determine the degree of improvement attained, post implementation.

Once the team knows what it is trying to improve and how changes will be measured, a *schedule for the running of the redesign sessions* can be created. This aligns with the final activity in the Project Initiation phase, creating the Project Plan. The *Project Plan* lists all of the activities and tasks that will be carried out during the project, estimates their duration and assigns them to a project team member. This plan then guides the progress of the project determining what activities will be conducted, when they must be completed by and who is responsible for their completion. The project manager is responsible for monitoring and controlling the plan and identifying problems. Key information regarding the project initiation phase and the future plan should then be communicated to all areas. This can be done via internal news distributions or as part of in-service sessions. Areas that will be directly affected by resulting changes must be continually kept ‘in-the-loop’ so that they develop a sense of ownership and there are no surprises during implementation. All documentation created during the phase is added to the project repository for use in the next phase, *Analysis*.

**Analysis phase**

The *Analysis phase* focus’ on creating a graphical representation of the current situation and analyzing how this journey can be improved from the patient’s perspective (*Figure 3*).

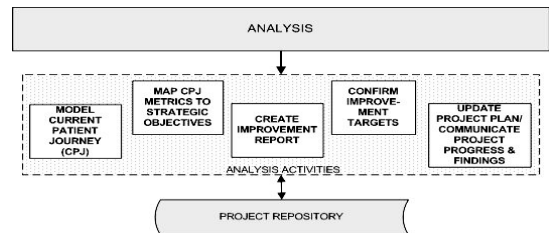


Figure 3 - Analysis phase activities

The first activity is to *create a model of the current patient journey*. This can be done using any process modeling technique including established techniques such as Lean Thinking or emerging techniques such as the ‘multi-layered patient flow’ communication tool [15, 16].

Existing *measurement criteria* should also be gathered during this exercise. The current patient journey model is created during facilitated group sessions. It is critical during this activity that key stakeholders are involved in the facilitation sessions including administrative, volunteers and patients as appropriate.

*Measurements* are then *mapped to the strategic objectives* documented in the project initiation phase. This is quite often an enlightening activity, as it will highlight where work is not adding value to the organization, staff or patients.

Following completion of both activities, a comprehensive *Improvement report* is created for management. This details what inefficiencies have been uncovered and what plans of action are possible to improve the current situation. This report should cover areas such as poor use of

human and physical resources, duplicated information collection and communications, unnecessary patient movements, excessive workflow activities and issues of confusion or lack of information for the patient. The report should also recommend priority action areas and activities. The report is submitted to management for discussion and approval.

Once approval is received the *target improvement areas and actions* should be reviewed and confirmed by the project team. It is now time to update the *project plan* based on any new information or scheduling issues and inform the rest of the organization on the outcomes of the analysis phase and what the next steps will be. All documentation created during *Analysis* is stored in the *project repository*.

**Design phase**

The *Design* phase (Figure 4) uses the outputs from the Analysis phase to redesign the patient journey aiming to improve the quality of care and reduce the level of variability for patients experiencing the same journey. It is in this phase that the team will start to work with existing technology constraints and systems and the requirement for new or integrated IT solutions.

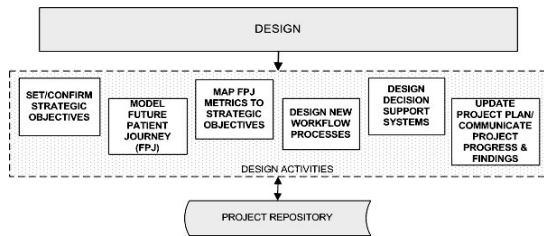


Figure 4 - Design phase activities

The first activity is to *confirm the strategic objectives* that the redesigned patient journey supports.

Once the direction is clear, facilitated group sessions are again used to create a visual representation of the *future patient journey*. This will include new or improved process flows, more efficient use of human and physical resources, streamlined information collection and dissemination, reduced patient movements, improved patient interactions and measurement criteria for all areas.

The *measurement* items are again mapped to the *strategic objectives* to ensure that the new journey is adding value to the organization and its future direction. Some adjustments may be necessary to the measurements defined in the previous activity and as with all other phase documentation these will be updated in the *project repository*.

The completion of the future patient journey and agreed metrics leads to the *design of new or enhanced workflows*. These may be automated or manual workflows. To enable the defined measurements to be captured and analysed, a *decision support system design* is required. This will identify what measurements must be captured and at what stage of the workflow enactment they are required. This is typically the domain of the IT section and will be derived

directly from the patient journey redesign work already conducted. The *project plan* is again updated and *project progress and findings* are communicated to the organization.

**Implementation phase**

The *Implementation* phase (Figure 5) is mainly concerned with the development and implementation of the designs output from the Design phase. This will primarily involve the IT section but will still require input from the project team. This will be in the form of *system testing of new/integrated workflows and the decision support system*.

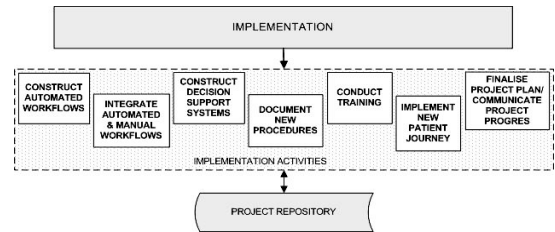


Figure 5 - Implementation phase activities

In parallel to this, the project team will update or *create documentation detailing the new patient journey* along with updated daily workflows. *Training* will need to be conducted on this material as well as any new systems that are to be implemented. The new patient journey goes ‘live’, with the *implementation of new/enhanced systems and workflows*. The project plan is finalised and details of the project’s implementation is communicated. Staff are also advised that following implementation, further improvement is encouraged and can be communicated to the project manager for inclusion in the Evaluation phase.

**Project evaluation phase**

The *Project Evaluation* phase (Figure 6) should be commenced within 3 months of implementation. The main goal of this phase is to revisit the new procedures and determine if they are delivering the expected benefits.

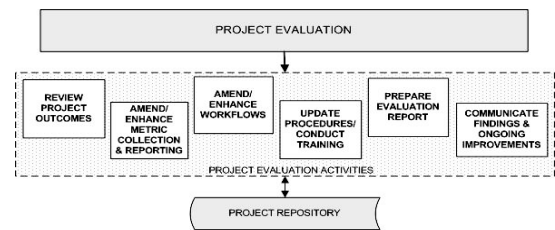


Figure 6 - Project evaluation phase activities

The first activity involves *reviewing the actual results* delivered by the new patient journey and measuring these against expectations. Decision Support System output should be analysed to determine if process metric collection and reporting is meeting set targets. *Amendments or enhancements* to the actual measurements and the way they are gathered and reported may be required. This may also lead to *refinement of the newly implemented workflows*.

Any changes to metric collection and reporting or workflows require updating of the documentation in the *project*

repository and possibly republication of updated patient journey procedures. Additional *training* may also be required.

An *evaluation report* is prepared for management outlining evaluation findings and actions taken to further improve the patient journey. Findings may lead to recommendations to revisit the *analysis phase* to conduct a major revision of the (now) current patient journey or may trigger recommendations of completely new patient journey modeling projects.

Results of the evaluation phase are again communicated to the organization including any new changes or projects.

## Results

The Ryde exercise has almost completed the first 3 phases of the proposed patient journey modeling SDLC. Work is still progressing, although some new workflows and procedures have already been tested. This includes the introduction of a new patient assessment form that can be completed and submitted online reducing the number of times a woman is required to attend the hospital prior to her first antenatal appointment. Patient permission paperwork has also been improved reducing the number of forms completed from 3 to 1. Explicit action plans are also in place to complete identified improvements. Health care staff found the SDLC easy to follow and confirmed that when integrated with the MFI, the SDLC had given them a solid direction and set of activities to complete. Specific mention was made of the fact that it could be followed by staff inexperienced in health care redesign projects and made the interactions with the IT section more seamless.

## Discussion

**Integrating the SDLC with the MFI.** This approach is seen as complementary to the Model for Improvement (MFI) not as a replacement. Specific activities within the SDLC align with MFI tasks (ie: set patient journey goals and setting aims) and others can be integrated as part of the MFI (storing gathered information in a project repository). The MFI also gives further information on some of the SDLC activities such as '*Forming the Team*', '*Setting Aims*' and '*Defining Measurements*'. An important point to note is how *Plan-Do-Study-Act* (PDSA) cycles are integrated into the SDLC. Once the Design phase is complete, specific areas of the future patient journey model can be selected for implementation on a trial group. Once this trial is complete, the improved procedures can be expanded until management and staff is confident that full-scale implementation should proceed. This means that the Implementation phase can be conducted in an iterative manner, with several iterations leading to implementation of the full future patient journey model over time. The SDLC approach also extends the MFI by including activities for the design and development of technology solutions to support process change. Most importantly the inclusion of a project management framework that supports the planning, management and control of improvement project work provides inexperienced project staff with a solid basis for delivering improvement results within required timeframes.

## Conclusion

The integration of a SDLC approach with the MFI for patient journey modeling is achievable and can be understood by all improvement team members, both IT and non-IT. The project team found the SDLC steps logical and easy to follow and produced demonstrable improvement results in the required timeframe, along with ongoing goal-focused action plans.

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