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# Knowledge Integration in Models for Healthcare Decision Making

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## ABSTRACT

Typical healthcare organizations operate as adhocracies with multiple specialized departments. Therefore, effective healthcare decision-making relies on integrating knowledge from these multiple specialties. This study shows how knowledge integration practices can synthesize expertise in healthcare information systems models. Such models embedded in reports and dashboards can support medical decision making by various organizational stakeholders. Policy makers, regional hospital administrators and medical department chiefs rely on the models for resource allocation decisions. Clinicians use the models to make decisions on patient care. Using a field study of a large nationalized healthcare organization, our study posits that knowledge integration plays a significant role in both producing the models from healthcare data and using those models in decision making.

## Keywords

Decision support systems, Knowledge integration, Electronic medical records, Healthcare information systems

## INTRODUCTION

In the healthcare industry, organizations are relatively flat and operate as professional adhocracies that have only minimal formalized coordination mechanisms between medical specializations (Mintzberg, 1983). Since medical departments work largely in silos, sharing, synthesis and integration of specialized knowledge is limited. Information systems that provide this missing “holistic” view of activities across departments by integrating knowledge can facilitate better decision making at multiple levels in a healthcare organization. The timely integration of knowledge from multiple sources to build, refine and utilize models in decision making is key to many types of healthcare scenarios, such as monitoring and adjusting treatment regimens (Barrett, Mondick, Narayan, Vijayakumar and Vijayakumar, 2008), selecting treatment protocols and managing and reorganizing care facility resources (Maruster and Jorna, 2005). Likewise, a clinician can better assess the patient’s presentation and decide on the most appropriate treatment.

## Research Questions

In this study, we have the following research questions.

- Does knowledge integration significantly support the creation of quality decision models in a healthcare organization?
- Does knowledge integration significantly support decision making and subsequent patient care performance through the utilization of decision models in a healthcare organization?
- Do knowledge integrative practices facilitate knowledge integration in healthcare environments?

## HEALTHCARE DECISION MAKING

Healthcare organizations vary greatly by size, scope, geographic dispersion, patient mix and treatment policies for medications and procedures. Patient outcomes from the diagnosis and treatment of their condition determine the success or

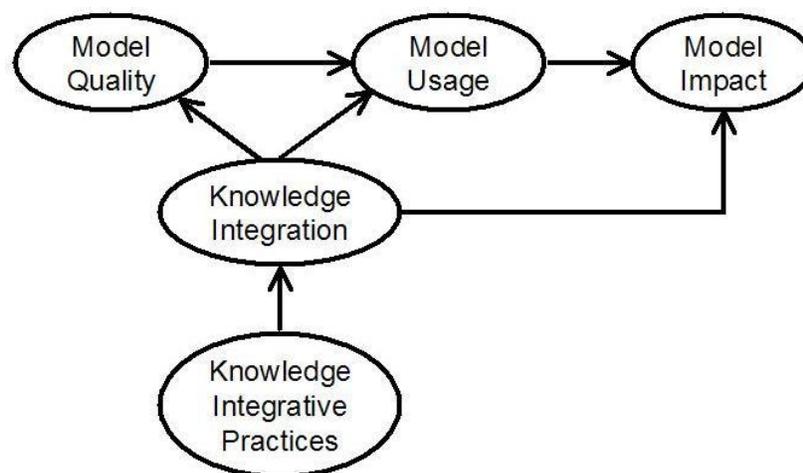
failure of a healthcare organization. The pathways of medical care – the processes and structures are important for the delivery of the care (Donabedian, 1966). A care process is a workflow or a set of activities around the delivery of patient care. These care processes are highly dependent on the structure or settings in which care takes place and the instrumentalities of which it is a product of. These structures include the administrative and related processes that support and direct the provision of care, the adequacy of the facilities and equipment, the nature of the medical staff, the access of the facilities to the patient and their quality and the operations of the programs in the institutions providing care. The outcomes of patient care are measured by the visible restoration, degradation or recovery, survival or death of the patient.

Typical decision making scenarios in the healthcare organization vary for different roles. For example, the clinician applies information from past patient outcomes to better decide on the diagnosis and assess the riskiness of a certain treatment for the current patient. Facility Administration uses outcome and utilization data on wait times, patient loads, prescription fill rates and geographic dispersion of the patient, to help form the basis for deciding suitable resources at a local or regional healthcare facility. At the policy level, comparing outcomes across facilities and regions, after adjusting for risks in the patient mix, enable such decisions as identifying facilities and surgical programs for site visits, auditing and necessary changes. This information is also used to determine (1) geographic distribution of patients based on their address distribution; (2) the need for additional community based support services; and (3) compliance with treatment regimens and medications. The Healthcare Executive uses the dashboard to (1) assess the outcomes of policy initiatives, such as patient wait times; (2) determine what resources are needed to meet new legal directives; and (3) develop medical protocols e.g., “Should a procedure ‘X’ be part of our medical care protocol?”

### Models Supporting Healthcare Decision Making

Models to support healthcare decision making rely on specialized knowledge from multiple departments (e.g. cardiac, orthopedics). Knowledge sources include various processes of care delivery (e.g. patient admission, preparation for surgery, recovery, discharge), the infrastructure supporting these care processes (e.g. medical record systems, clinical staff education and training, equipment capabilities) and their outcomes on patient care (e.g. complications, recover times, length of stay). A multi-modal decision support system is defined as a system that supports a wide range of decision making tasks at multiple organizational levels (Clark, Jones and Armstrong, 2007). In our case study, typical decision support models include (1) summary reports comparing patient outcomes over multiple periods, (2) dashboards to convey up to date status on utilization and outcomes and (3) and a calculator for clinicians to calculate the riskiness of patient conditions. The knowledge representation in these have multiple characteristics: information source, information time period, type of information, information processing/aggregation and information presentation.

The research framework is illustrated in Figure 1 and described in the subsequent sections.



**Figure 1. Research Framework (Adapted from Delone and McLean, 1991)**

### ROLE OF KNOWLEDGE INTEGRATION

The synthesis, delivery and use of the above models involve the integration of knowledge. Knowledge integration has been defined as the “synthesis” of individual team members’ information and expertise through “social interactions” (Robert et al.,

2008, Alavi and Tiwana, 2002). Knowledge integration is the outcome of group actions consisting of both the shared knowledge of individuals and the combined knowledge that emerges from their interactions (Okhuysen and Eisenhardt, 2002). Knowledge integration has also been defined as the establishment of shared syntax, semantics, and understanding so that specialized knowledge can be exchanged and combined (Carlile, 2004; Patnayakuni, Rai and Tiwana, 2007). Based on these definitions, we define knowledge integration in healthcare as the outcome of group actions consisting of both the shared specialized knowledge and expertise of individuals and the combined knowledge that emerges from their interactions during the establishment of shared syntax, semantics, and understanding. Three characteristics of knowledge integration are efficiency, scope and flexibility (Grant, 1996, page 380).

**KNOWLEDGE INTEGRATIVE PRACTICES**

Mechanisms for knowledge integration include directives from external regulations, such as JCAHO, HIPAA, organizational routines (workflows and rounds), and teams for patient care (Robert, Dennis and Ahuja, 2008). However, directives and organizational routines are inadequate in situations of uncertainty and complexity. Also, since teams are not always practical or formalized, an alternative group for knowledge integration is a community of practice (Wenger and Snyder, 1999). Three formal interventions include: managing time, questioning others and sharing knowledge within problem solving groups with specialized knowledge (Okhuysen and Eisenhardt, 2002).

On the other hand, constraints on transactive memory (e.g. electronic medical records), insufficient mutual understanding among clinical specialists, failure in sharing and retaining contextual knowledge, and inflexibility of organizational ties are identified as some of the common challenges faced in integrating knowledge (Mohan and Ramesh, 2007, Alavi and Tiwana, 2002, Mohan, Jain and Ramesh, 2007).

Table 1 lists the constructs in the research framework and their dimensions and content.

Construct	Content and Dimensions
Knowledge Integration Practices	Managerial, Organization and Technology supported knowledge integration enablers.
Knowledge Integration	Efficiency, Flexibility, Scope -The level of common knowledge, The frequency & variability Structure which economizes on communication, Span of knowledge integrated, Extending existing capabilities to encompass new knowledge, Reconfiguring existing knowledge within new patterns
Model Quality	Model quality consists of the following four categories– (1) Intrinsic, (2) Accessibility, (3) Contextual and (4) Representational
Model Usage	Proper and timely use of the model by multiple stakeholders in the healthcare network
Model Impacts	Impacts on healthcare provider, patient and healthcare organization and community

**Table 1. Research Constructs and Dimensions**

**RESEARCH IN PROGRESS**

This study will survey nurses, physicians and healthcare administrators to measure knowledge integrative practices, knowledge integration and perceived quality of the models embedded in dashboards used for decision making. The data collected will be analyzed to see if there is support for the research framework presented in Figure 2.

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