

BEST PRACTICES IN ELECTRONIC MEDICAL RECORD IMPLEMENTATION: DEVELOPMENT OF A META-FRAMEWORK FOR EMR IMPLEMENTATION

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INTRODUCTION

In spite of over 3 decades of experience with Electronic Medical Record implementation, the penetration of the EMR is still less than 20% in the US and in Canada. The failure rates of EMR implementations are also consistently high at close to 50%.

The 'success factors' approach has been the most popular approach in the literature for describing implementation frameworks, but has not been fully explanatory and predictive of success or failure. Recently, we have seen a few new approaches (socio-technical model, risk-mitigation approach) to explain implementation success, but none are fully satisfactory.

The success of EMR implementation and utilization depends on the integration of the information technology into an often complex organizational setting. Existing EMR implementation frameworks are not comprehensive enough to explain all features experienced by implementers and have not helped to make EMR implementation any more successful. To provide more quantitative insight into EMR implementations, we attempt to integrate multiple conceptual frameworks in an overarching, yet pragmatic framework to explain factors which lead to successful EMR implementation.

METHODS

We followed the MOOSE guidelines for reporting meta-analyses of qualitative research studies. Our research question was, "What are the factors that promote success in EMR implementations with physicians as the primary subjects?"

Literature Search

We searched the Cochrane Database of Systematic Reviews to verify that no similar systematic reviews on EMR implementations have been published to date. A search of the English language articles in MEDLINE, EMBASE, DARE, Google Scholar and Web of Science was then conducted for the time period Jan 1990 to May 2006. Key terms used included: electronic medical records; primary health care; family practice; physicians; Text words used included: implement; adopt; deploy.

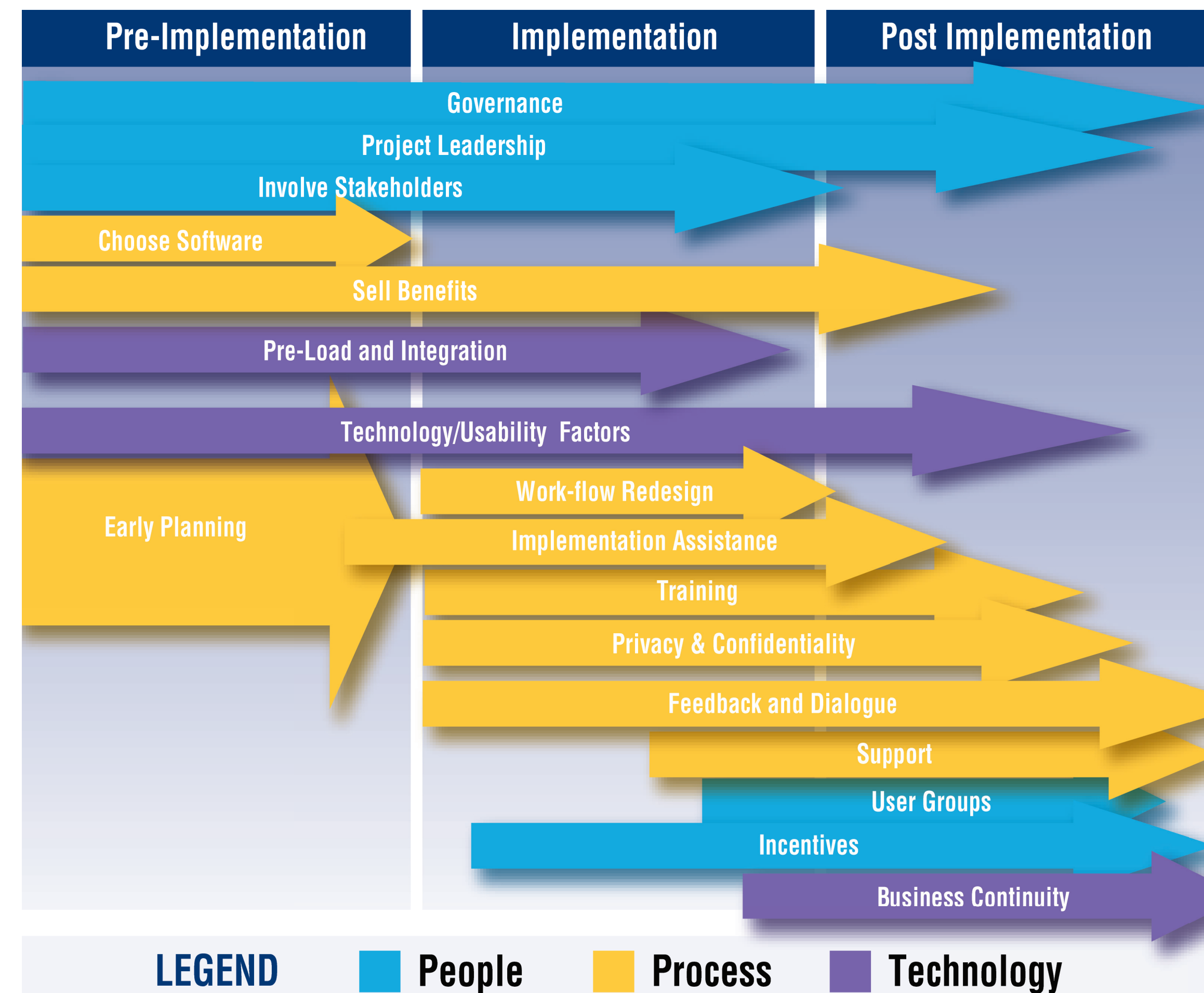
Inclusion and Exclusion Criteria

Inclusion criteria included implementations involving physicians in a primary health care setting, (including outpatient specialty clinics in internal medicine, pediatrics, obstetrics/gynecology), descriptions of real implementations, and articles that described implementations in progress. Articles on CPOE, CDSS were included only if they were described in the context of a broader implementation. Exclusion criteria were articles that did not involve physicians (eg nurses, pharmacists), technical descriptions, patient acceptance studies and descriptions, review articles, editorials and abstracts only articles.

Development of Implementation Framework

Each author independently reviewed at least 10 articles from the complement of retrieved full text articles to abstract best practice themes relevant to EMR implementation. In addition, a comprehensive reading of the EMR implementation literature was conducted, including relevant review articles that did not meet our inclusion criteria. We developed a proposed integrative framework of factors which lead to successful EMR implementations. The development of the framework and the operational definitions for the factors identified is described elsewhere. We report on the ability of independent reviewers to reliably detect these factors in the literature utilizing our operational definitions.

RESULTS



Inter-rater Reliability for Reviewer Detection of EMR Implementation Factors

Kappa Statistic, n=47

Factor	Exists	95% CI	Correct	95% CI
Choose software carefully (Process)	0.37	(0.09, 0.64)	0.45	(0.20, 0.69)
Involve multiple stakeholders (People)	0.58	(0.34, 0.82)	0.48	(0.25, 0.71)
Sell benefits, manage attitudes, assessment of preparedness and address barriers (Process)	0.38	(0.18, 0.58)	0.44	(0.23, 0.65)
Early Planning Strategies (Process)	0.29	(0.05, 0.54)	0.52	(0.29, 0.75)
Project Management Leadership (People)	0.62	(0.332, 0.91)	0.61	(0.36, 0.86)
Governance (People)	0.64	(0.36, 0.93)	0.56	(0.30, 0.83)
Technology Usability Factors (Technology)	-0.02	(-0.04, 0.01)	0.50	(0.19, 0.81)
Data Pre-load and Integration with other systems (Technology)	0.26	(-0.08, 0.60)	0.50	(0.25, 0.74)
Work flow & Redesign (Process)	0.50	(0.13, 0.87)	0.81	(0.61, 1.00)
Training (Process)	0.65	(0.36, 0.93)	0.60	(0.37, 0.82)
Implementation Assistance (Process)	0.37	(0.06, 0.68)	0.48	(0.22, 0.74)
Feedback and Dialogue (Process)	0.29	(0.02, 0.55)	0.42	(0.15, 0.69)
Privacy & Confidentiality (Process)	0.55	(0.30, 0.79)	0.52	(0.26, 0.78)
User Groups (People)	0.34	(0.07, 0.61)	0.34	(0.05, 0.63)
Support (Process)	0.47	(0.21, 0.72)	0.55	(0.30, 0.79)
Business continuity plan (Technology)	0.59	(0.32, 0.86)	0.64	(0.35, 0.92)
Incentives (People)	0.42	(0.12, 0.711)	0.49	(0.29, 0.68)
Outcome (Success/Failure on 5-point scale)	0.64	(0.46, 0.83)		

Impact of a factor on the overall outcome of the implementation was also assessed. In general, kappas for impact of a factor ranged from 0.41 to 0.77, with only one being lower than 0.41 at 0.27.

The table shows the inter-rater reliability for the various factors in the model. We accepted a kappa of 0.4 as showing moderate and acceptable correlation between reviewers. Most factors achieved an acceptable kappa for correct implementation and impact. Kappas for the existence of a factor were more variable and less reliable. Some are explained by our operational definition. For example, *choose software carefully* was not always reliably detected as many authors who were implementing in the late 1990's were developing their own software, not necessarily selecting one. *Early planning* activities were not always explicitly stated in the articles, yet it was sometimes clear from the description of the implementation that the implementers had spent considerable time planning for the implementation. Our reviewers did not have clear instructions on how to code for this. During consensus, pairs were instructed to code this as positive when the implementations demonstrated an orchestration of events that could not have been spontaneously planned and executed.

In general, many implementers did not mention the use of *User Groups*. This led to poor ability to discriminate this concept in the literature. Many authors did not mention *privacy and confidentiality or business continuity*, even though these are clearly important issues. The high kappas for these two concepts reflects the ability to reliably detect that those concepts were not mentioned –not that they were easily discriminated.

DISCUSSION

We have developed a comprehensive meta-framework for EMR implementation that includes multiple frameworks that have previously been described in the literature which are grounded in a variety of disciplines, including project management, organizational behaviour, technology implementation, behaviour theory and business.

We demonstrate that reviewers can reliably identify when implementers have executed a particular factor appropriately and whether it has had a positive or negative impact on the overall implementation. Reviewers are also reliable in assessing the overall success of implementations.

REFERENCES

- References available upon request. Requests may be sent to karim.keshavjee@sympatico.ca



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