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Methodological Review

Innovative use of the integrative review to evaluate evidence of technology transformation in healthcare

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ABSTRACT

Healthcare is in a period significant transformational activity through the accelerated adoption of healthcare technologies, new reimbursement systems that emphasize shared savings and care coordination, and the common place use of mobile technologies by patients, providers, and others. The complexity of healthcare creates barriers to transformational activity and has the potential to inhibit the desired paths toward change envisioned by policymakers. Methods for understanding how change is occurring within this complex environment are important to the evaluation of delivery system reform and the role of technology in healthcare transformation. This study examines the use on an integrative review methodology to evaluate the healthcare literature for evidence of technology transformation in healthcare. The methodology integrates the evaluation of a broad set of literature with an established evaluative framework to develop a more complete understanding of a particular topic. We applied this methodology and the framework of punctuated equilibrium (PEq) to the analysis of the healthcare literature from 2004 to 2012 for evidence of technology transformation, a time during which technology was at the forefront of healthcare policy. The analysis demonstrated that the established PEq framework applied to the literature showed considerable potential for evaluating the progress of policies that encourage healthcare transformation. Significant inhibitors to change were identified through the integrative review and categorized into ten themes that describe the resistant structure of healthcare delivery: variations in the environment; market complexity; regulations; flawed risks and rewards; change theories; barriers; ethical considerations; competition and sustainability; environmental elements, and internal elements. We hypothesize that the resistant nature of the healthcare system described by this study creates barriers to the direct consumer involvement and engagement necessary for transformational change. Future policies should be directed at removing these barriers by demanding and emphasizing open technologies and unrestricted access to data versus as currently prescribed by technology vendors, practitioners, and policies that perpetuate market equilibrium.

1. Introduction

The United States receives a poor return on its healthcare dollars. Costs remain higher than any other industrialized country while low measures of patient care quality and care efficiencies persist [1–3]. There is a clear need both to improve quality and to reduce healthcare costs. Recent legislative efforts to address these issues all contain a significant emphasis on improving the use of health information technology (HIT) and enhancing value in healthcare. Since 2009, over $30 billion dollars has been spent to address these identified deficiencies through the incentivized adoption and use of HIT and new payment models [4–6]. Health reform legislation, has mandated and propelled new health care delivery models that are highly dependent on HIT, including accountable care organizations, medical homes, bundled payments, and other value based payment structures [7]. Market transformation from these policies is expected to occur through incremental acceptance of new technologies and growing adoption of new care delivery models [8,9].

Healthcare's multiple payer–provider relationships, multiple delivery models, the significant knowledge gap between patients and providers, and the intricacies of health behaviors and medicine itself converge to create a highly complex system. Complexity science describes complex systems as *adaptive*, with change

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emerging from the many goals and priorities of the individual *agents* within the system and environment itself [10–13]. These many interactions make outcomes and behavior hard to predict and traditional linear models cannot take into account the multiple relationships contributing to change within the system [14]. As a result the more complex the system becomes, the more resistant it is to change and transformation [15]. Since no individual agent has the ability to change the system, the system experiences slow incremental change until a clear superior alternative emerges [14]. To overcome this resistance, transformation may demand radical changes in the underlying structure or environment of the system and does not generally occur incrementally over time [15–17]. These periods of short radical change are the foundation of Gersick's theory of punctuated equilibrium (PEq) [18,19]. Punctuated equilibrium represents a pattern of transformational change that has been demonstrated in biological, organizational, and complex market settings. In each case long periods of incremental change are separated by short radical transformational periods.

Given the complexity of the healthcare system and a desire to encourage transformation, there is a need to understand how change is occurring within this complex environment. Understanding the role of government, health information technologies, health systems and patients is important to the evaluation of delivery system reform and the goal of healthcare transformation. This study describes the use on an integrative review methodology combined with the validated transformational framework of PEq to develop a more complete understanding of the potential barriers and challenges necessary to transform healthcare given its complex nonlinear behavior. Complexity science describes the need to identify patterns of change when evaluating complex systems [20]. PEq was selected as it describes an identifiable pattern of change observable within complex environments. Our proposed method described here attempts to look for this observable pattern using the literature as evidence. We hope to demonstrate that the conclusions reached through such a method are uniquely beneficial to future policy discussions and as a measure of transformational change within the healthcare market.

2. Methods

2.1. Integrative review

The integrative review methodology outlined by Whittemore and Knafl adopted for this study encompasses the following activities: literature search, data evaluation/reduction, data comparison/synthesis, and presentation [21]. The integrative review draws strength from evaluating an extensive set of primary sources emphasizing inclusion and diversity over consistency of study design. By increasing the breadth and number of data sources a more comprehensive understanding of the topic is achieved. The method is further enhanced the by use of an evaluative or theoretical framework to interpret the broad set of data identified within the review. In this case, the application of PEq theory provides the structure to evaluate the progress of healthcare transformation.

2.2. Theoretical framework

The theory of PEq defines three distinct components of market transformation guided by PEq, periods of deep structure, equilibrium, and revolution (Fig. 1). *Deep structure* describes the existing market environment that includes the markets core values and beliefs; strategies; allocation of resources; structure; and controls. These periods are stable in that the choices and patterns exhibited often reinforce themselves as part of "mutual feedback loops" [19].

Equilibrium describes the influences of investments, processes, and structure that reinforce the underlying deep structure, allowing for only gradual and incremental change over time. During periods of equilibrium, complex systems make incremental adjustments based on the existing environment maintaining a level of *inertia* that is resistant to major change. This inertia often occurs due to blindness to new ideas that do not fit within an organization's or system's existing paradigm or a basic fear of change that could result in a loss of market dominance [19].

Revolutionary periods represent radical changes in the deep structure of the environment or system that results from disruptions in the relationships, values, and controls defining deep structure. Revolutionary changes in deep structure result from two basic causes; (1) internal changes that challenge the alignment of relationships, values and/or controls that define the existing environment; and/or (2) environmental changes that limit the ability of the system to maintain its current structure. Changes in political climate, new consumer demands, and/or new technological innovations are often characteristic of these periods of revolution [22].

Tushman and Romenelli describe periods of deep structure in the context of the political and economic environment, proposing five elements that impact deep structure; core values and beliefs, strategy, power distribution, structure, and control systems [23]. Gersick refers to these elements collectively as the "design of the playing field and the rules of the game" [19]. These descriptive elements were used in this review as part of the evaluative framework for deep structure within the healthcare system.

2.3. Literature search

Multiple search strategies were applied to obtain sources for review. Five electronic databases were searched: MEDLINE/PubMed, Business Source Complete, Social Science Research Network, Web of Knowledge, and Factiva. The Web of Knowledge data base was used for an ancestry search on three foundational articles: Gersick's 1991 synthesis of change models into the PEq model; Anderson and Tushman's 1990 review and development of the *Technology Cycle* of transformation; and Tushman and Romenelli's paper on organizational evolution and *inertia* in

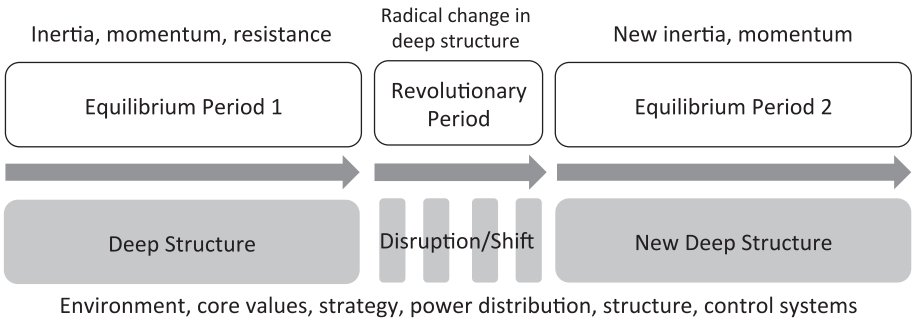

Fig. 1. Representation of three components of Gersick's theory of punctuated equilibrium – *deep structure, equilibrium period and revolutionary period.*