THE USE OF SMARTPHONES FOR ACCOUNTABLE CARE
AND EVIDENCE-BASED DECISION MAKING IN THE
MANAGEMENT OF GESTATIONAL DIABETES

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Abstract

Superior management of diabetes has become a global priority especially given the exponential increase
in the number of diabetes patients as well as the financial implications of treating this silent epidemic.
This research focuses on trying to address this issue with a minimum cost by examining the possibility of
using a mobile web-based reporting system that taps into existing widely available resources to monitor
and manage gestational diabetes. To test this solution we adopted a randomized control trial with two-
arm cross over applied to a private hospital in Victoria, Australia. We adopted an accountable care
system as the theoretical lens and developed a conceptual framework to bridge evidence-based
management with technologies. Theoretically, we unpacked McClellan, et al’s (2010) study with our
conceptual framework that consists of providers for information (evidence based management) and
technology (smartphone); enhanced Muhlestein, et al’s (2013) accountable care paradigm with the three
concepts (1) quality of life, (2) evidence-based management and (3) affordable care. From the perspective
of practice, we have uncovered far reaching implications for hospital management’s cost vs. quality care
to patients. In particular, it appears that the adoption of smartphones to support many aspects of care
and patient-clinician interactions is prudent.

Key words: Evidence-based decision making, Accountable care, Management of Gestational Diabetes
(GDM), Quasi-experimental approach.
1. INTRODUCTION

Diabetes is one of the leading chronic diseases affecting Australians with approximately 1 million Australians currently diagnosed with diabetes (Baker IDI, 2013). This alarming phenomenon triggers this research. In particular, we examine the aspects of accountable care and evidence-based decision making in the context of gestational diabetes management. Traditionally, healthcare delivery has been designed to treat patients at the point of care with less focus on being proactive in supporting preventative measures that keep people healthy and away from the hospital. This could be due to several reasons including the lack of suitable healthcare information systems to support the ideology of Accountable care.

Accountable care aims to improve quality and lower healthcare costs by proactively keeping people healthy and away from the hospital (Morse, 2013). This view of healthcare is one of the most popular discussions relating to US health reform and has supported the launch of pilot projects to test the concept, examine its sustainability, and explore how the model might look and be assessed for its potential (McClellan, et al. 2010). However, this concept is challenging especially when applied into solo and small-group practices primarily due to the cost of the required IT (information technology) investment and quality improvement training for staff (Shields, et al., 2011). In view of this critical challenge, this study examines the possibility of using a mobile web-based reporting system that taps into existing widely available resources (e.g. smartphones and cloud systems) and thus requires minimal IT cost and user training. Thus, we set out a unique research initiative that focuses on a specific issue to address a current dilemma, namely the support of gestational diabetes through improved accountable patient care.

Hence, the primary objective is to examine “how smartphones might keep Australian mums healthy” by preventing and/or reducing the impact of gestational diabetes (GDM). Specifically, the research question under consideration is “can using a smartphone solution to facilitate monitoring and management of Gestational Diabetes (GDM) support the accountable care paradigm?”

2. Literature Review

The relevant key bodies of literature include management of gestational diabetes and the accountable care system and are presented in turn below.

2.1 Management of Gestational Diabetes

Managing diabetes using information technologies is a relatively recent priority within the healthcare domain as diabetes has become one of the most prevalent and exponentially increasing diseases around the world. Further, the cost of managing patients with diabetes is also considerable. In Australia, it costs over $14.6 billion to treat a diabetes patient with complications running up to $9,645 per year (Diabetes Australia, 2013). Therefore, an effective management system for diabetes is an imperative.

As diabetes is a chronic disease there is by definition no cure. This makes the adoption of various management strategies paramount in the successful care of diabetic patients (Britt, 2007, AIHW, 2007, AIHW, 2008, Diabetes Australia, 2008). Moreover, the prudent adoption of these strategies can dramatically affect the cost of care without significantly impacting the quality of care. Typically, the management of diabetes is based on a mixture of self-management protocols linked with the support of a dedicated medical care team (Victorian Government, 2007). An essential element of self-management relies on regular testing of blood glucose, using a glucometer or blood glucose monitor.

Gestational Diabetes Mellitus (GDM) requires tight control of Blood Sugar levels, with a preferred range of readings between 4-6 mmol/L(Hoffman, et al, 1998; Siri and Thomas, 1999). The management of
GDM is conducted over a short period of time (that of the pregnancy) and thus a tighter management of sugar levels is required while the impact for both mother and baby of poor control can be far reaching and unpleasant. The need for such control draws into question the information that a diabetic may need when self-managing their condition.

2.2 Accountable Care System

An Accountable care system (ACS) refers to an entity that implements organized processes to improve and control the quality of care and cost, more importantly the providers will be held accountable for the results (Shortell and Casalino, 2008). Specifically, the term system refers to the care that must be established and delivered by healthcare providers (e.g. physicians, clinicians, nurses) and settings (e.g. hospital and nursing homes) over time with accountability to ensure quality care with reduction of cost (Shortell and Casalino, 2008; McClellan et al., 2010; Shields, et al. 2011).

An examination of the literature suggests that many studies look into the importance (Shortell and Casalino, 2008), application (Shields, et al., 2011), execution of the accountable care system (McClellan et al., 2010; Lewis et al., 2013) and its quality performance standard (Berwick, 2011). However, issues such as how quality of care is being defined and measured remain vast and unclear (Dentzer, 2013). More importantly, it is unsettling to be reminded that doctors’ decisions are not always evidence-based and in fact only 55% adhere to evidence based care (Asch, et al. 2006).

The pressure to provide evidence-based care has significantly impacted the medical sector over the past decade (Wickramasinghe and Schaffer, 2010). Since then much research was done to understand what it is, how it will impact medical practices, what its challenges are and how it could benefit people, organizations and society (Pfeffer and Sutton, 2006). Traditionally, evidence-based management is complimented with online services and technology (Jadad, et al., 2000). For that, very often quality of care and cost was being compromised. In this study, to overcome such an issue in achieving affordable care, we need a bridge between evidence-based care and technology that can then support the paradigm of accountable care. In view of this idea, we propose the following conceptual model (Figure 1) to explore the question “can using a smartphone solution to facilitate monitoring and management of Gestational Diabetes (GDM) support the accountable care paradigm?”

![Conceptual Model](image)

2.3 Conceptual Model

In this study, after assessing the characteristics of accountable care across levels (McClellan, et al. 2013), comparison of prospective attribution and performance to stimulate accountable care (Lewis, et al., 2013);
we found that the most reasonable framework that can serve as the foundation for our research in bringing out the core characteristics of accountability to ensure quality care (through Evidence-based management) with reduction of cost (use of smartphone) is the accountable care paradigm proposed by Muhlestein, et al, (2013).

The accountable care paradigm proposed by Muhlestein, et al (2013) defines the movement of terms of structural requirements, core processes and expected outcomes but it was lacking of emphasis on quality of care. To improve this accountable care paradigm, we believe that quality of care should include (1) quality of life, (2) evidence-based management and (3) affordable care.

The 1st level of the accountable care paradigm is about accountable care outcome measurements (Muhlestein, et al, 2013). It comprises of three criteria, they are (1) improving the individual experience of care, (2) improving the population health, (3) reducing the cost of health care for populations (Muhlestein, et al, 2013). With these criteria we believe that the improvement of quality of life can be further achieved if customers were to be provided with more emphasis on maximizing outcomes and control costs. Usually patients have little or no control over the cost of the care they consume and almost no information available to them regarding the cost or quality of care delivered by the providers or care giver (Bozic, 2013). For this reason, we believe that for some health issues, the ability to measure accountable care outcomes, requires the care providers and giver to avail patients with a few treatment options that are based on service receive and cost involved. This provides patients with options as to how they can live a quality life.

Process level care management is the 2nd level of the accountable care paradigm (Muhlestein, et al, 2013). This level consists of three criteria, which are (1) overseeing the provision of clinical care, (2) adopting an administrative infrastructure to coordinate the provision of care across the continuum of health services, (3) investing in and learning to use appropriate information technology to manage population health. To enhance the quality process level of care management, we suggest including the concept of evidence-based management. Especially with the empowerment from technologies, today many physicians are able to capitalize on the rich online information with internet connections to build experts communities for knowledge, best-quality evidence, and information sharing with care givers and patience directly. To better amalgamate evidence-based management into process level care management we incorporated Rousseau’s (2013) suggestion of the importance of managing users expectation, providing models of evidence-based practice, promote active use of evidence, building collaboration among all users. In this study, all users include physicians, nurses, and pregnant mothers.

The last level of accountable care paradigm is about aligning financial structures (Muhlestein, et al, 2013). It entails two criteria; (1) bearing financial risk for the measured health of a population, (2) aligning financial and professional incentives to encourage the production of high quality health outcomes. However, what is more important is to incorporate affordable care by providing choices in finding plans that are cost-effective and appropriate to consumer needs. For example, the use of a smartphone approach may be a cheap option for patients who require regular health monitoring to record and communicate with health practitioners. This may become evident if compared to other more dedicated or sophisticated technology that usually comes at a higher cost.

3. METHODOLOGY AND INITIAL FINDINGS

As part of our ongoing effort to understand changes occurring within the Australian healthcare system, we have been identifying and tracking healthcare organizations that appear to practice at least some aspects of accountable care from the Australian perspective. In our efforts of searching, we identified XYZ hospital as we believe that they showed unique characteristics of accountable care. In fact, many aspects of this concept were initiated and appreciated by their medical staff.
On selecting the specific hospital to evaluate we adopted a user-centred design approach to develop a unique mobile solution to support self-management of GDM. Specifically, we adapted the web-based mobile solution developed over several years by INET Intl. Inc (Goldberg, 2002, Wickramasinghe and Goldberg, 2008; Wickramasinghe, Troshani and Goldberg, 2010). In particular, the solution works as follows (figure 2): after the patient has taken their blood sugar reading using a glucometer, they enter the reading into a web-based form design for mobile phones. The submitted reading is then accessible to the designated clinician who can then review the readings in conjunction with all other relevant medical data and then provide immediate feedback and recommendation to the patient. Figure 2 includes an illustration of the charted record of patient readings that is accessible to the clinician. The chart displays the 4 readings normally taken for GDM patients for example before breakfast, 2 hours after breakfast, 2 hours after lunch and 2 hours after dinner. The mobile interface also allows patients to write messages about their food and exercise consumption and the clinician can review this information and provide additional feedback to the patient. All of this communication is managed through the mobile solution and provides a health model that can provides immediate support to patients remotely located from the hospital setting.

The solution was then trialed after all necessary ethics clearances were obtained using a two period cross-over clinical trial strategy (Rigby, 2003; Senn, 2002) over 10 week duration. Initial results are promising. Not only has proof of concept been established but we also demonstrated the benefits of a real time smart phone solution to facilitate the self-management and monitoring of GDM patients. Most notably all patients preferred the technology solution to the standard care and those patients who start with the technology solution found the change to the standard care disappointing. In addition, the clinical care team (obstetricians, diabetic educator and endocrinologist) preferred the technology solution over the standard care approach.

4. INITIAL FINDINGS

Based on the research method used, we mapped the collected results with the affordable care paradigm. We find that the smartphone solution supports the affordable care paradigm at multiple levels including; 1) at level 1 of the accountable care outcome measurements - since the solution enables improved individual experience of care; and improved population (all sufferers of GDM in this context) health and reductions in the cost of healthcare delivery (which were apparent from the data generated) and 2) at the process level care management - since the solution supports 1) overseeing the provision of clinical care
and 2) facilitating the adoption of an administrative infrastructure to better co-ordinate care. Finally, we note that given smartphones are a pervasive technology, there is essentially no learning curve so the solution is particularly beneficial and cost effective as no or minimal training and infrastructure costs are required.

From the perspective of measured outcomes of accountable care, it appears that the use of the smartphone as a health monitoring and communication channel, not only improved the patient experience of care but potentially provided a better quality of life to patients. That is, patients with pertinent information will be able to receive timely medical feedback, understand the result and take appropriate actions in controlling their blood sugar level. As a result, it improves the population health in a way that supports prevention and reduces the impact of the mother passing high levels of glucose to the baby inutero. Further, with such control there is evidence of a direct potential of smartphones to reduce health care costs at many levels.

5. CONCLUSION

Our initial research serves to contribute to theory and practice in several ways. This study strongly suggests that the use of smartphones to support GDM self-management not only facilitates superior monitoring and management Gestational Diabetes from an affordable way but it also supports the accountable care paradigm. Moreover, patients suffering from GDM can benefit by having a better quality of care and enjoying better health for themselves and their babies. From a theoretical standpoint, we unpacked McKeallan, et al’s (2010) study with our conceptual framework that consists of providers for information (evidence-based management) and technology (smartphone) who are jointly held accountable for a defined patients population in achieving measurable healthcare quality improvements with reductions of healthcare spending. Further, we have enhanced Muhlestein, et al’s (2013) accountable care paradigm with the three concepts (1) quality of life, (2) evidence-based management and (3) affordable care. Finally, in terms of managerial contributions, the study uncovers far reaching implications for hospital management as they currently wrestle with the orthogonal dilemmas of controlling costs and providing high quality and value to patients. In particular, it would appear that they should investigate the possibility of adopting smartphones to support many aspects of care and patient-clinician interactions.

In closing, we note that this was a small pilot study to investigate the potential of smartphones to support the affordable care paradigm in the context of management and monitoring GDM. Clearly more confirmatory research is required to generate statistically significant results and we plan to do such follow up studies.

6. REFERENCE


