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# Mobile application as a prenatal education and engagement tool: A randomized controlled pilot☆

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ABSTRACT

*Objectives:* Research has shown that mobile applications provide a powerful alternative to traditional paper diaries; however, little data exists in comparing apps to the traditional mode of paper as a patient education and engagement tool in the clinical setting. This study was designed to compare the effectiveness of a mobile app versus a spiral-notebook guide throughout prenatal care.
*Methods:* This randomized ($n = 173$) controlled pilot was conducted at an East Coast community hospital. Chi-square and repeated-measures analysis of variance was used to test intervention effects in the sample of 127 pregnant mothers who completed their prenatal care in the healthcare system.
*Results:* Patients who were distributed the mobile application used the tool to record information about pregnancy more frequently ($p = .04$) and developed greater patient activation ($p = .02$) than patients who were distributed notebooks. No difference was detected on interpersonal clinical communication.
*Conclusion:* A mobile application successfully activated a patient population in which self-management is a critical factor.
*Practice implications:* This study shows that mobile apps can prompt greater use and result in more activated patients. Findings may be translated to other patient populations who receive recurring care for chronic disease.

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## 1. Introduction

Mobile health (mHealth) applications shift mobile telephone technology from the lean function of text messaging [1–4] to a potentially dynamic interactive and social environment that can include verbal, vocal, and visual messages [5]. Mobile apps enable patients to record health information collected at each appointment and to track their health. As patients interact with this information, they may become more engaged in their care. Activated patients believe their roles as patients are important, that they have the confidence and knowledge necessary to take action, and that they can enact behaviors to maintain and improve their health [6–8]. These patients take action, ask questions of the provider, and participate in decisions about treatment [9–11]. They are collaborative partners with the provider in their health care [6].

Patient activation is just one factor that affects prenatal interpersonal processes of care. Interpersonal processes of care conceptually and operationally capture three dimensions of clinical care: communication, patient-centered decision making, and interpersonal style [12,13]. In the prenatal setting, evidence has demonstrated a limited association between interpersonal processes of care and risk of Caesarean delivery [13].

Specifically in the context of clinic communication, physicians communicate differently with patients who they perceive to be more active in clinic interactions [14]. Interventions, including educational programs [15], care coaching [16], and motivational interviewing [17], have attempted to increase physician perception of active patients with varied success. Patient activation can be increased with strategic methods [11,18–20].

Compared to a written recording of children's health information, mothers find e-diaries easier to use, less bothersome, and more efficient [21]. Although pregnant mothers are increasingly using mobile applications throughout their pregnancy [22,23], data on the extent to which the use of apps improve care are

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limited [24]. Research has shown that mobile apps provide a powerful alternative to traditional paper diaries in weight loss promotion [25]; however, little data exists in comparing apps to the traditional mode of paper as a patient education and engagement tool in the clinical setting. In a randomized study of a mobile application regarding long-acting reversible contraception, patient use of a mobile app was found to be most effective in complementing interpersonal healthcare rather than replacing provider counseling [26].

The following randomized controlled study was designed to test the effectiveness of a mobile application as an alternative to a spiral-notebook guide throughout prenatal care. Three hypotheses are tested.

H1: Patients who are distributed a mobile application will use the education and engagement tool more than patients who are distributed notebooks.

H2: Patients who are distributed a mobile application will develop greater patient activation than patients who are distributed notebooks.

H3: Patients who are distributed a mobile application will report better prenatal interpersonal processes of care from their prenatal provider than patients who are distributed notebooks.

## 2. Methods

The study was conducted at a community hospital in both the women's health and family medicine departments. In this hospital system, women are distributed a spiral notebook at their obstetric care intake appointment, which generally is scheduled for 8–10 weeks gestation. The spiral notebook is designed for two purposes: (1) patient education of what happens throughout pregnancy, and (2) patient record keeping of the patient's own pregnancy experience, including space for recording weight, blood pressure, and journaling about what they experience between prenatal appointments. The mobile app used in this study was designed for the same two purposes and contained identical content, through a mobile design interface (available on both Android and iOS platforms). This randomized controlled study had one intervention (mobile application) and one control (standard of care–spiral notebook) group. The study was approved by the first author's Institutional Review Board.

In each department, the obstetrics intake nurse serially screened all new obstetrics patients for inclusion criteria from October 2013 to January 2014. If patients met inclusion criteria, the nurse invited the patient to talk to a research assistant about the study (see Fig. 1). Exclusion criteria included conditions that would elevate the patient's care to complicated obstetrics care (e.g., cardiovascular disease, diabetes mellitus, renal disorder, etc.). This was intended to capture a low-risk obstetrics patient population that would follow a standard pathway of care, in which patients attend a prenatal appointment once every four weeks during pregnancy.

At consent, patients were asked if they owned a device which would support a mobile application. If patients did not own a device, the study team issued them a spiral notebook. These patients ($n = 2$) were kept in the study for measurement, but were not included in data analysis. The study used pre-assigned block randomization (each block $n = 40$) to balance the conditions throughout recruitment. Following consent and baseline measures, participants were randomized to the two conditions. Providers were blinded to patient participation in the study.

Surveys were completed at each prenatal appointment, which occur approximately every four weeks. This accounted for five data collection points, from 10 to 12 weeks gestation to 32 weeks gestation. All data collection was conducted with paper-and-pencil surveys in the clinic, immediately before and following each

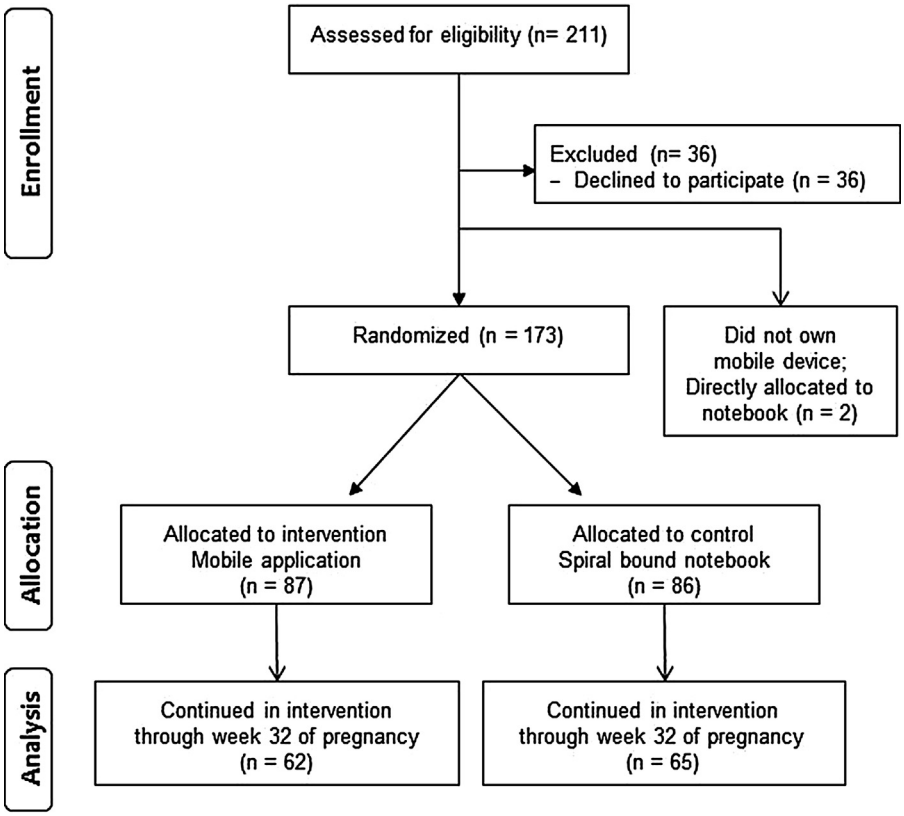


**Fig. 1.** CONSORT flow diagram.
Figure illustrates recruitment, allocation, and follow up for each condition.