Text4baby mHealth Program: Implementation and applicability within a homeless population of young mothers

Maureen Byrnes
DNP, RN, CNM, Clinical Assistant Professor
Seton Hall University-College of Nursing
maureen.byrnes@shu.edu

Abstract

The Text4baby mHealth program provided important health information to 18-21 year old homeless pregnant and new mothers residing within transitional housing at Covenant House. Enrollment rates and TEAM Text4baby rates were excellent and exemplify the mission and social capital within Covenant House-New Jersey. The Text4baby Process Policies developed for both clinical sites support sustainability of this innovative approach to improve maternal-infant healthcare outcomes, effecting this especially vulnerable population of homeless, young mothers and infants. To date, there are no published reports of implementing Text4baby, the largest mobile health program in the United States, within or among homeless young pregnant or new mothers. Yet, this group of young mothers faces the steepest odds in achieving optimal maternal-infant outcomes. Other implementation projects have all enrolled mothers by giving them the Text4baby tear-off enrollment instructions and later interviewed them via telephone survey regarding follow-thru on Text4baby enrollment completion. The importance of "on-site" enrollment support for this highly vulnerable, underserved population of young, pregnant or new mothers was an important finding of this implementation project of mHealth among homeless mothers. This project's findings provide important data demonstrating that despite substantial hardships, innovative "on-site" support facilitates enrollment rates in the Text4baby program, within a homeless transitional shelter for pregnant and new mothers with infants.

Key words: Text4baby, mHealth, Covenant House, homeless mothers

Introduction

Text4baby was launched in 2010 and is the first free national mHealth (mobile health) text messaging service in the United States. This innovative mHealth program sends free targeted text-messages to women who are pregnant or parenting an infant under the age of one. Its aim is to improve maternaland infant health outcomes (Gazmararian, Elon, Yang, Graham & Parker, 2013). Despite major medical advancements and years of public health promotion and education, more than 500,000 babies are born prematurely and an estimated 28,000 infants die before their first birthday annually (www.marchofdimes.com/peristats/Peristats.aspx).

The United States infant mortality rate of 6.6/1000 live births is higher than that of most other developed countries. The infant mortality rate for non-Hispanic African American women is 2.4 times the rate for non-Hispanic White women. Of the roughly 4.2 million babies born every year in the United States, 12.3% of all babies are born prematurely and 8.2% are born low birth weight. Additionally,1 in 28 infants are born to a mother receiving late or no prenatal care (www.marchofdimes.com/peristats).

Infant mortality rates, by state, range from a high of 10/1000 for Mississippi, 9.5/1000 for Alabama, and 9.1/1000 for Louisiana to a low of 3.9 for New Hampshire. The District of Columbia, which is not a state, has the distinction of having the highest infant mortality rate in the United States at 10.8/1000 live births. New Jersey's infant mortality rate of 5.6/1000 live births appears impressive when compared to the United States infant mortality rate of 6.6/1000 live births (www.kidscount.org/births). Yet, according to the Birth Certificate Database, Office of Vital Statistics and Registration, New Jersey Department of Health, the infant mortality rate, preterm birth rate, low birth weight rate by mother's race reveals a far greater risk for infants born to a mother who is African American (www.nj.gov/health/epht/outcome.shtml).

According to the New Jersey Department of Health, the infant mortality rate is a critical measure of a population's health and a worldwide indicator of health status and social well-being. Prematurity and low birth weight increases the risk for infant morbidity and mortality. Infants born preterm or low birth weight are at a greater risk of dying in the first month of life. They may also require intensive care at birth and are at higher risk

of developmental disabilities and chronic illnesses throughout life. They are more likely to require special education services. Health care costs and length of hospital stay are higher for both preterm and low birth weight infants (www.nj.gov/health/epht/outcome.shtml).

These statistics highlight the need for innovative approaches to improving maternal-infant health. Mobile phones may provide an appropriate means of addressing maternal-infant health challenges and reaching women from underserved communities.

In 2011, The World Health Organization completed a global observational report and estimated that there were over 5 billion cell phone subscribers, with commercial wireless signals covering over 85 percent of the global population, reaching far beyond the boundaries of the world's electrical grid (World Health Organization, 2011). Bennett (2012) observed that there are more iPhones sold than babies born throughout the world annually.

In the United States, recent research shows that 87% of African Americans and Hispanics and 80% of Whites own mobile phones. African Americans (79%) and Hispanic Americans (83%) are more likely than are whites (68%) to send text messages (Smith, 2010). According to Blumberg and Luke (2012), Americans living in or near poverty are more likely to live in a 'cell phone only' household (no fixed phone line) and those living in 'cell phone only' households are more likely to have experienced numerous barriers to healthcare.

Clinical sites

Covenant House, the largest charity of its kind in the Americas, provides shelter, stability, love and structure for homeless, runaway and trafficked youth (Ryan & Kelley, 2012). *Covenant House* New Jersey provides a wide range of services, residential and day services, to a population of 18-21 year old youth at *Covenant House Crisis Shelter*, Newark, while *Raphael's Life House* serves 18-21 year old homeless pregnant or new mothers with babies. *Covenant House* meets the immediate need for food, shelter and clothing, as well as a broad group of support services which include career development, medical care, educational and vocational services, counseling and behavioral health services, drug abuse treatment and prevention programs, addiction referrals, legal services, life skills, mother-child programs, pastoral care, transitional living programs, street outreach and after care. *Covenant House* is the largest provider in the state to homeless, runaway and at-risk youth between the ages of 18-21 years old. Currently, *Covenant House* serves 132 youth statewide, plus 19 babies each night. There are 45 beds at the *Newark Crisis Shelter* and 12 moms with their babies at *Raphael's Life House*, Elizabeth.

Raphael's Life House is Covenant House's designated longer-term transitional residence for 18-21 year old homeless women who are pregnant or parenting infants. They will find a warm welcome and the help they need to begin their new lives with their new babies. *Raphael's Life House* offers a continuum of services including classes on prenatal care and parenting, educational and vocational training, and life skills programs. Young mothers with health problems and other issues can receive treatment at the on-site medical clinic and participate in the other supportive services located at *Covenant House Crisis Shelter*, Newark. Since 1993, over 550 young homeless women have entered the doors of *Raphael's Life House* and their babies have started their lives there. Former residents often stay connected to the staff and fellow residents after moving on to independent living.

According to the *Covenant House* report on the "State of Street Kids in New Jersey" (www.covenanthouse-nj.org), 12% of New Jersey's 18-24 year olds live in poverty, 30% of the kids in their care have been in the foster care system and left with nowhere to turn on their 18th birthday and 70% have a history of physical or sexual abuse.

Each year, as many as two million 18-21 year old people in the United States face an episode of homelessness (Ryan & Kelley, 2012). More than half of homeless youth report their parents either told them to leave or didn't care if they left. Some youth never had a consistent home because they were foster children, never adopted, or aged-out of the foster system. Some youth are kicked out of their homes right after telling their parents they are gay or pregnant (Ryan & Kelley, 2012).

In a recent study of a representative national sample of shelter residents by The *Covenant House Institute*, it was reported that only 41% have a high school diploma, 40% had been living in foster care or another institutional setting, 38% experienced physical abuse, 40% of female youth reported a history of sexual abuse, 80% were unemployed, 63% lacked health insurance, greater than 25% had been hospitalized for depression, anxiety or other mental health issue, and more than 50% came from a family where someone used drugs regularly (Ryan & Kelley, 2012).

The *Text4baby* mHealth program could provide an acceptable platform to homeless pregnant 18-21 year old women for providing important health information, which could potentially change awareness of healthy behavior choices leading to optimal birth outcomes.

Description of the project

This project implemented a mobile health (mHealth) program, *Text4baby*, within a homeless population of 18-21 year old pregnant and new mothers

within *Covenant House Crisis Shelter*, Newark, New Jersey and *Raphael's Life House Transitional Housing for Homeless Mothers and Infants*, Elizabeth, New Jersey.

In 2010, The White House announced the launch of *Text4baby*, the nation's first free mHealth service, developed in partnership by the National Healthy Mothers Healthy Babies (HMHB) coalition, Voxiva, CTIA-The Wireless Foundation, the United States Department of Health and Human Services (HHS), and Johnson & Johnson, the founding sponsor. *Text4baby* has been implemented nationally through this unprecedented public-private partnership that has reached over 690,000 subscribers with critical health and safety information about pregnancy and baby's first year of life (www.text4baby.org).

Text4baby messages provide a variety of health and safety information that is important during pregnancy, postpartum, and during the baby's first year of life. Topics include safety, immunizations, nutrition, birth defects prevention, breastfeeding, developmental milestones, and more. Messages are sent approximately three times a week. Sometimes texts are sent more frequently to accommodate for urgent, time-sensitive information, such as flu vaccination and prevention, Pertussis outbreaks, and infant safety recalls.

The primary target audience for *Text4baby* is women who may be at higher risk for poor health outcomes and who may have problems accessing health information. *Text4baby* is specifically focused on reaching pregnant or new mothers who are younger than 25 years of age, low-incomewomen and women of color who identify as African-American or Hispanic/Latina (Remick & Kendrick, 2013). All of the 18-21 year old homeless pregnant or new mothers at *Covenant House* meet this criterion.

This implementation project seeks to determine if *Text4baby* is perceived as an acceptable platform for providing important health information to homeless young mothers, resulting in a change of homeless young mother's healthcare knowledge, which can then lead to improved health behavior choices. Making and keeping healthcare appointments, discussing health topics and concerns with healthcare providers and following evidence based practice health protocols are important benchmarks in demonstrating the value and impact of the *Text4baby* targeted mobile health program more broadly and specifically within a homeless population of young mothers.

To ensure that *Text4baby* is accessible to mothers of all income levels, *CTIA-The Wireless Foundation* worked with wireless phone companies to waive all text messaging fees associated with the program (www.Text4baby.org). Additionally, access to SafeLink Wireless service has been provided to all interested project participants. SafeLink Wireless is a provider of the United States Government's Lifeline Support Program. Lifeline is a federal government benefit for participants of specified public assistance programs or whose household income is at or below 150% of the Federal Poverty Guidelines (www.safelinkwireless.com). All of the 18-21 year old homeless pregnant or new mothers at *Covenant House* met this criterion.

Participation in this project and in the *Text4baby* program was voluntary. If interested, the homeless pregnant or new mother metwith me individually regarding the *Text4baby* mHealth program. Additionally, individual on-site support through the enrollment process was offered in this project. Mothers were free to not meet with me or to cancel their enrollment in the *Text4baby* program at any time. SafeLink Wireless Lifeline Assistance Program application assistance was alsoprovided to program eligible mothers, as needed.

Purpose and aims of the project

At the *Covenant House Crisis Shelter* in Newark, New Jersey, all candidates for enrollment were informed of the project by the *Covenant House Domestic Global Health Fellow.* The Domestic Global Health Fellow oversees all aspects of healthcare access and programs for all resident and day-service homeless youth. If interested, the homeless pregnant or new mother then met with me individually regarding the *Text4baby* mHealth program.

At *Covenant House Transitional Housing Shelter* specifically for pregnant or new mothers, *Raphael's Life House* in Elizabeth, New Jersey, the Resident Case Manager informed the homeless resident mother of the project and then informed me of the mothers interest in participation or not.

The immediate overall aim of this project was the enrollment in *Text4baby* by the homeless pregnant and parenting mothers accessing services or residing within the *Covenant House Crisis Shelter* in Newark, New Jerseyor residing at the *Covenant House Transitional Housing Shelter* for homeless pregnant or new mothers in Elizabeth, New Jersey. The longerterm expected results related to participation in this mHealth program was an increase in knowledge and awareness of maternal-infant health related content delivered via text messaging, with a resultant change in maternal-infant health related behaviors leading to optimal maternal-infant outcomes. The sustainability and replication of this mHealth project within other *Covenant House* shelters nationally, or other homeless shelters

that serve homeless pregnant or parenting mothers, also holds promise.

Risks and benefits

There are no known risks to participating in the *Text4baby* maternal-infant education and awareness mHealth platform. The benefits of participating in this project and the *Text4baby* mHealth program include increased maternal-infant health knowledge and behavior change; such as appointment attendance, improved communication with health providers and improved access to reliable health information and services. These findings have significant implications for understanding the feasibility and value of the *Text4baby* program and were evaluated at the close of the implementation project.

Significance of the project

Too many babies are being born prematurely, at low birth weight or dying before their first birthday in the United States of America. There are a disproportionate number of black infants within all three of the above infant morbidity and mortality categories. Other than Hawaii and the District of Columbia, unfortunately New Jersey has the largest disparity rates among white and black infant birth outcomes. The infant mortality rate for black infants is 3. 5 times higherthan the infant mortality rate for white infants in New Jersey (www.nj.gov/health/epht/outcome.shtml). Some causes for this are poverty, lack of access to health information and a lack of access to care.

Homeless young 18-21 year old pregnant or newly parenting mothers may benefit by receiving valuable maternal-infant health information delivered in a convenient, free and accessiblemanner. Yet, to date, there is no scholarly discussion of implementing the *Text4baby* mHealth program within homeless populations of young mothers.

This implementation project, if proven successful, would lend itself to replication throughout the *Covenant House Shelter System* nationally and within other homeless shelters, in general, who care for 18-21 year old pregnant and new mothers within the state and country.

Review of the literature

A literature review of Medline-PubMed, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Academic Search Premier, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Science Direct, Communication and Mass Media Complete, Health and Psychosocial Instruments, Health Source: Nursing/Academic Edition, Health Technology Assessments, PsychINFO, Social Sciences Full Text, Science Reference Center, ERIC and Google Scholar was completed using the search term of *Text4baby*, and MeSH subheadings of homeless, Covenant House, and New Jersey. Databases were searched without date restrictions, although this topic is more relevant within the last three years. A total of 10 articles were discovered. Due to of the newness of this maternal-infant mHealth program, research is ongoing.

Theoretical basis

Social Cognitive Theory and Health Belief Model, as discussed and described by Bandura (2004), provide the foundation for the development of a new preliminary theory model applied to *Text4baby* (Evans, Wallace & Sniders, 2012). Evans, Wallace and Sniders (2012) discuss how this proposed theoretical model has been used to guide the development of the *Text4baby* program and its potential in providing consistent evaluation across studies.

The mHealth model of behavior change for the *Text4baby* project is based upon traditional behavior theory, initially developed by Bandura (2004), as itaspires to build self-efficacy to successfully utilize healthcare, improve health knowledge and literacy and increase expectations for successful pregnancy and new motherhood (Evans, Wallace et al. , 2012). According to the authors, the proposed theoretical mHealth theory model builds knowledge and skills to manage health and prevent health risks. This new mHealth theory is also used to predict behavior change as it incorporates behavior theory with the unique features of the mobile channel.

A preliminary model of “mHealth conceptual model of behavior change for the *Text4baby* project” (Evans, Wallace et al., 2012) was used to guide the development of this implementation project.

Because of the newness of the *Text4baby* program, the Evans, Wallace et al. (2012) article documents the first randomized pilot evaluation study published. Text messaging has been demonstrated to be a potentially powerful tool in effecting behavior change. The Evans, Wallace et al. (2012) study attempts to assess the efficacy of the *Text4baby* text messaging campaign. The researchers involved in this study compared prenatal text messaging at two prenatal clinics, with a predominately Spanish speaking population. Two telephone surveys were given to enrollees. Overall, this pilot study found that mothers exposed to *Text4baby* were nearly three times more likely to believe that they were prepared to be new mothers, compared to those in the no exposure control group.

In another 2012 article, Evans, Abroms, Poropatich, Nielsen and Wallace discuss a case study wherein the authors explicitly discuss the incorporation of the Evans, Wallace et al. (2012) behavioral theory model within the *Text4baby* mHealth program. The authors review a case example of the evaluation of *Text4baby* at Madigan Army Medical Center, Tacoma, Washington. This evaluation again presents the proposed mHealth theoretical model of behavior change, informing interested promoters of mHealth as to how behavioral theory works within mobile health and encourages consistent application of the conceptual model across studies, thereby enabling meaningful comparisons.

Empirical literature

Development of and need for the *Text4baby* mHealth platform is a central concept of the program. *Text4baby* is the first free national mobile health service in the United States, recently launched in 2010. Through the provision of targeted, timely health information to pregnant women and new mothers, *Text4baby* aims to reduce barriers to accessing information and resources, increase knowledge around key health topics, improve positive health behaviors and build a mother's self-efficacy to engage in healthy behaviors (Remick & Kendrick, 2013).

Jordan, Ray, Johnson and Evans (2011) and Whittaker et al. (2012) present comprehensive overviews of the development and need for the *Text4baby* program. The U.S. Infant Mortality rate of 6.59/1000 is higher than most other developed countries and 50 percent higher than the *Healthy People 2010* target goal (Jordan et al., 2011). Infant mortality and premature birth rates are higher for African American infants. Low birth weight is another important health indicator that deserves attention. The cost saving potential of *Text4baby* as a powerful and relevant educational tool is compelling.

Partnership development is a central concept of the *Text4baby* program. The unique history and background of the *Text4baby* broad public-private partnership is covered in detail within both the Jordan et al. (2011) and Whittaker et al. (2012) scholarly articles. Government, corporations, academic institutions, professional institutions, tribal agencies and non-profit organizations all came together to support this first mHealth program focused on improving maternal-infant outcomes. The authors are experts in the evolution and intricacies of *Text4baby* partnership development because of their participation in it. The partners describe an unprecedented collaborative networking of powerful stakeholders who believed in the potential this program to accomplish its goals.

Content development and text messaging research processes are central concepts of the project and discussed by Remickand Kendrick (2013), Jordan et al. (2011) and Whittaker et al. (2012). Mobile formatting for health education was supported with data regarding the prevalence of cellular phones and texting habits nationally, as well as by gender, age, income level, educational background and race as variables by all of the authors. Message development is covered in great detail by Whittaker et al. (2012). Message development was overseen by key identified healthcare collaborators who then decided which topics would be targeted to coincide with the gestational age or the infant's age. Technical collaborators then developed the platform required for this to occur. The *Text4baby* Content Development Council (www.text4baby.org) is made up of leading national medical health organizations and federal partners who review and validate message content and message revisions, ensuring message content is current and accurate. Messages are based on evidence-informed guidance and most recently include enhancements to the text messages, including interactive features, mobile webpages, videos, and resource phone numbers. Well-baby visit and appointment reminders, as well as specific health related topics discussing prenatal care, vaccination, health insurance, and flu information are sent to support improved health behaviors. Partners that comprise the Content Development Council include the American Academy of Pediatrics, The American College of Obstetricians & Gynecologists, Centers for Disease Control and Prevention, March of Dimes, Society for Maternal-Fetal Medicine, American College of Nurse-Midwives, Association of Women's Health, Obstetric and Neonatal Nurses, Health Resources and Services Administration, National Association of Pediatric Nurse Practitioners and the U. S. Department of Health and Human Services.

Enrollment factors are central concepts of the project. J. A. Gazmararian led a team of Emory University researchers in the first two studies examining various components effecting enrollment in the *Text4baby* mHealth program. In 2012, Gazmararian, Yang, Elon, Graham and Parker provide the first research results of how literacy skills relate to successful self-enrollment in the *Text4baby* program. Health literacy is important to mHealth information and, as the authors point out, should be concise, clear and actionable while also aligning with the literacy skills of the intended users. Limited health literacy and its associated costs regarding maternal-infant outcomes are central to the success of this outcomes focused mHealth program. SMS (short message service), also referred to as a text message, development was addressed by the Healthy Mothers

Healthy Babies health literacy experts who validated message content was appropriate for all literacy levels.

This group of Emory University researchers then further studied whether low health literacy was associated with reduced enrollment success. The Gazmararian et al. (2012) findings suggest that the skill level needed to successfully navigate the enrollment process was most challenging for the women most in need of the health messages. Assisting women to enroll 'on-site' could prove beneficial in *Text4baby* enrollment success.

In 2013, the same group of Emory University researchers, (Gazmararian et al.) published the results of their prospective cohort study regarding factors related to the *Text4baby* enrollment process and reception among their study participants. Within this study's underserved, mainly African-American, English speaking, limited literacy population, about half of the women attempted self-enrollment. Promotion of *Text4baby* may be more successful if pregnant or new mothers are encouraged to enroll 'on-site'. This study provides much needed and valuable information regarding *Text4baby* program acceptability among African-American mothers.

Green, Dalrymple, Turner, Rogers, Williver-Farr and Zach (2013) discuss their research study of an 'enhanced' *Text4baby* program, which provided two additional weekly focused texts regarding the specific family health center where the research took place. The additional weekly texts in this research study discussed the family health center's specific philosophy of health and patient education classes. This 'enhanced' *Text4baby* research also utilized 'smartphones' capable of internet access. The embedded URL's (Uniform Research Locator) utilized within this research study was an additional enhancement offered to the mother in seeking additional health information independently, during the research study.

Parker, Dmitrieva, Frolow, and Gazmararian (2012) discuss the first mHealth international implementation of *Text4baby*, which is currently taking place in Russia. The additional variables of a social welfare platform, as well as a 1-day Health Communication Training for all doctors who provide care to pregnant women or infants was instituted within the Russian *Text4baby* program. The United States collaborators worked with the Russian team to create a model and evaluation strategy that mayprove useful within and across countries, ensuring monitoring and evaluation as an a priori component of the Russian *Text4baby* program.

In an editorial, vanVelthoven, Majeed and Car (2012) point out that exploratory trials and customary theory development processes were not followed regarding the *Text4baby* program. The authors note that of the research that has occurred to date, none is large scale. The authors believe the *Text4baby* intervention, which they describe as the largest mHealth intervention globally, could prove to be enduring, ineffective and even harmful.

External and internal evaluations of *Text4baby* are currently underway and will provide the necessary research regarding this innovative mHealth program. According to the*Text4baby* website (www.text4baby.org) current external evaluations include a mixed-method process and outcome evaluation of *Text4baby*, a randomized control trial measuring the changes in a number of knowledge and behavior outcomes and a small pilot evaluation assessing how*Text4baby* messages align with different health communication theories. Internal evaluations of *Text4baby* currently underway include a study to assess the impact of a text reminder intervention on adherence to a diabetes care regimen and glycemic control. Recruitment for the study is ongoing.

Methodology

The *Text4baby* program was launched in 2010 and is the first mobile information service designed to promote maternal and infant health through text messaging.

Targeted health information and safety tips are communicated through text messages at no cost to participants. *Text4baby* delivers the health information mothers and expectant women need, reaching them directly on cell phones that 89% of young women carry at all times (www.text4baby.org). This service was developed to address the high infant mortality rate and high prematurity rates in the United States.

Evaluations of the *Text4baby* program are demonstrating that *Text4baby* is increasing participants' health knowledge, facilitating interaction with health providers, and improving adherence to appointments and immunizations, which then serve to providea strengthened link to maternal-infant health services. Ongoing research is the earliest stages of evaluation. One recent study looks at self-enrollment (Gazmararian et al., 2013), with 51% of participants reporting that they attempted self-enrollment after being given the *Text4baby* program's "how to enroll" tear off sheet, which is utilized nationwide. Additionally, there are no *Text4baby* implementation projects which have considered implementation within a young homeless population of mothers.

Meghan Leigh, Associate Site Director of Covenant House, Newark, New Jersey, who oversees the Crisis Shelter Residential and Day Services Program-Newark, New Jersey, approved this project and

its objectives and *Raphael's Life House-Residential Program for pregnant or new mothers with infants* located in Elizabeth, New Jersey.

There are no known risks regarding enrollment in the *Text4baby* mHealth information program for pregnant women or mothers of infants. The benefits of receiving *Text4baby* mHealth information would be an increase in maternal-infant health knowledge, an increase in maternal-infant health care appointment attendance and facilitation of health provider interactions.

Phase I

The Infant Mortality Rate (death occurring during the first year of life/1000 live births) is declining in New Jersey, overall. In 2008, New Jersey's state infant mortality rate of5. 6 infant deaths per 1,000 births compared favorably regardingthe infant mortality national rate of 6.6 for the United States of America. During 2006-2008, New Jersey had the 7th lowest infant mortality rate in the nation. Yet, other than Hawaii and the District of Columbia, New Jersey had the largest disparity between infant mortality rates among white and black mothers during that same time period. Among infants born in New Jersey (2000-2008), the infant mortality rate was 12.7% for black infants and 3.7% for white infants, the preterm birth (born before 37 weeks) rate was 14% for black infants and 9% for white infants, the low-birth weight (less than 2500 grams) rate was 13% for black infants and 7% for white infants (www.nj. gov/health/epht/outcome. shtml).

The nationwide *Text4baby* mobile health text messaging service was developed to help address the public health crisis of poor maternal-infant health outcomes among minority women, especially those with lower socio economic status. Text messaging allows *Text4baby* to share health and safety information through a convenient and popular communication channel utilized by most 18-24 year old women while addressing maternal-infant health inequalities for low income, women of color. Enhancing the health, safety and well-being of young homeless pregnant, new mothers and their infants is of the highest importance, especially with regard to youngblack women.

Phase II

Ms. Meghan Leigh, as Associate Site Director of both *Covenant House,* Newark and *Raphael's Life House,* Elizabeth was instrumental in obtaining support at each site to maximize interdisciplinary collaboration on this project. Having a previous working relationship with the Resident Manager's at *Raphael's Life House*, Elizabeth, New Jersey provided a basis of support for the implementation of this project in a collaborative manner. The Global Health Corps Fellows (www.ghcorps.org), both Domestic and International, working at the *Covenant House Crisis Shelter*, Newark, New Jersey were important stakeholders who became enthusiastic partners in creating a team approach to the implementation of the *Text4baby* mHealth project with both the resident and day-program 18-21 year old pregnant or new mothers that they serve.

Phase III

At Covenant HouseCrisis Shelter, Newark, New Jersey the Global Health Fellow fills the role of health navigator and health counselor for all resident and day-services youth receiving services at this center. A thorough overview of the *Text4baby* program, maternal-newborn outcome disparities and this implementation project was provided as a part of the necessary staff education that must take place to ensure a collaborative approach. A notebook of *Text4baby* program materials was created and included samples of the *Text4baby* poster, *Text4baby* bilingual enrollment referral cards and *Text4baby* enrollment tear-off pads and was utilized at both clinical sites for educational purposes. The young women who are pregnant or new mothers were invited to speak with me regarding *Text4baby* by the Global Health Fellow at the completion of theirhealth counseling interaction with them. Speaking with me was on a voluntary basis, as was enrollment in the *Text4baby* program and weekly follow-up discussions. There was no exchange of any health information between medical services and this project. An office with computer access to the internet was provided for my use and was within close proximity to the Medical Services area of the shelter. Individual support was provided on-site at the Covenant House-Crisis Shelter to all young mothers who chose to self-enroll in the *Text4baby* program. Confidentiality and privacy were maintained during all DNP project visits.

A Resident Case Manager is always present at *Raphael's Life House*, Elizabeth, New Jersey, which is exclusively designated as transitional shelter housing for 18-21 year old pregnant or new mothers with babies. A thorough overview of the *Text4baby* program, maternal-newborn outcomes disparity and this implementation project was also provided to the Resident Case Manager as a necessary part of the staff education that must take place to ensure a collaborative approach. The Covering Resident Case Manager was provided with an overview of this implementation project, as needed. The resident young women who are pregnant or new mothers of *Raphael's Life House* were invited to speak with me regarding the *Text4baby* program by the case managers. A large private room with chairs and a table was provided for my use and was within close proximity

to the resident case manager, who provided internet access for project purposes, if needed. Speaking with me was on a voluntary basis, as was enrollment in the *Text4baby* program and weekly follow-up discussions. Confidentiality and privacy were maintained during all visits. A large binder with *Text4baby* program graphics and information was created and useful in explaining the *Text4baby* program. Additionally, all women were given one-on-one support in self-enrolling "on-site" in *Text4baby* at *Raphael's Life House*.

All *Text4baby* posters, tear-off pads and enrollment cards were free and acquired through the *Text4baby* program website (www.text4baby.org).

A listing of all participating *Text4baby* Mobile Operator Partners, as well as Federal "Lifeline" Assistance Program, "Safe Link Wireless" cell phone program applications for income eligible households in New Jersey were brought to the clinical sites and made available to mothers, as needed, at each visit.

Phase IV

Clinical site visits were conducted weekly. *Covenant House-Crisis Shelter* was visited each Monday and *Raphael's Life House* was visited each Thursday over the course of four months, May thru August 2013. All discussion encounters of *Text4baby* with young homeless mothers were noted, as well as enrollment on-site. Residents who declined discussion or enrollment in the *Text4baby* program are also noted. Follow-up discussions regarding *Text4baby* were available for all homeless mothers, at both sites, on a weekly basis. Weekly follow-up discussions focused on: reception of *Text4baby* messages; enrollment or technical concerns or difficulties; if texts were read or not; if texts were perceived as new healthcare knowledge, and if the mother reported any change in healthcare behavior.

The application process for a free federally funded wireless phone was researched so that all mothers could participate. The New Jersey Certification Form for the Lifeline Assistance Program was available at each of my clinical sites. Mothers were also offered assistance in this application for a free *Lifeline Assistance Program* cellphone, ensuring her ability to participate in this project, if she met eligibility criteria and chose to apply.

Date specific, project enrollmentand feedback data provided by homeless mothers residing at both homeless shelterswas collected regarding enrollment, refusal or inability to enroll, technical issues, perceived helpfulness of texts in gaining new health knowledge or changing maternal behaviorand sharing the *Text4baby* program with others.

Collaborative efforts and dissemination of the *Text4baby* program were notable at both *Covenant House Crisis Shelter* and *Raphael's Life House Transitional Housing Shelter* throughout the term of this project. The overriding and notable presence of social capital that exists within both of the project clinical sites further exemplifies and highlights The *Covenant House Mission of serving, protecting and safeguarding all, within the covenant community*. The network of social connections that exist between all *Covenant House* staff members and resident youth communicates their mission, shared values and norms of behavior, which enable and encourage mutually advantageous cooperation. Throughout the clinical site visits of this implementation project, all *Covenant House* staff members interacted and engaged with absolute respect and unconditional love toward all. In return, they ask all residents to treat everyone they meet the same way they would like to be treated.

Phase V

Project outcome data measurements of this mHealth implementation project were both quantitative and qualitative. Encounters with all 18-21 year old homeless, pregnant or new mothers were documented. Interest and other enrollment factors were collected.

The percentage of 18-21 year old homeless pregnant or new mothers given "on-site" support in enrollment in *Text4baby*, who then went on to enroll in the *Text4baby* program, thru this project was determined. Change in healthcare knowledge and behavior of mothers enrolled in *Text4baby*, in addition to sharing and referring *Text4baby* to others is also considered within this implementation project.

Outcomes of the project

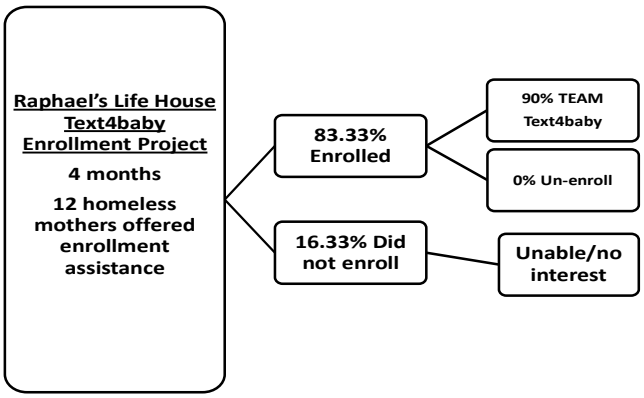
Sixteen mothers agreed to meet with me to discuss the *Text4baby* mHealth program. Four pregnant or new mothers were interacted with at Covenant House-Crisis Shelter and fourteen pregnant or new mothers were interacted with at *Raphael's Life House Transitional Housing* shelter. One pregnant mother at Covenant House-Crisis Shelter was not eligible to enroll during her sanctuary stay due to her young age. One new resident at *Raphael's Life House* was not eligible for this implementation project because she was not pregnant and her son was over 1 year of age. Both ineligible mothers were given information on the SafeLink wireless application process, the *Text4baby* mHealth program for their future, should they choose to apply. One *Raphael's Life House* new mother declined to discuss *Text4baby* because of disinterest in the program. This new mother 'transitioned' *from Raphael's Life House* two weeks later. One *Raphael's Life House* pregnant mother was unable to enroll because of overriding medical complications. Information on the

SafeLink application process, along with *Text4baby* program information was offered to this pregnant mother, should she decide to enroll at some time in the future.

One *Covenant House-Crisis Shelter* mother transferred residence into *Raphael's Life House Transitional* shelter; one mother participated in day-services at the Crisis Shelter; one mother had a short stay at the Crisis Shelter and was deciding her path regarding shelter, food, healthcare and community.

A fuller discussion of *Raphael's Life House Transitional Housing* project data offers important information regarding the implementation of the *Text4baby* mHealth program within a community of homeless young mothers. There were 12 homeless mothers eligible for *Text4baby* enrollment at *Raphael's Life House* and 10 of the homeless mothers moved forward with enrollment, revealing an 83.33% enrollment rate. 50% of the enrolled homeless mothers in this project were pregnant at the time of *Text4baby* enrollment and 50% of the homeless mothers were mothers of infants at the time of *Text4baby* enrollment. Of the 10 enrolled mothers, 9 mothers moved forward in joining as a TEAM *Text4baby*participant during the course of this project, revealing a 90% TEAM *Text4baby* participation in referring *Text4baby* to other mothers, providers and healthcare facilities over four months (See Figure 1).

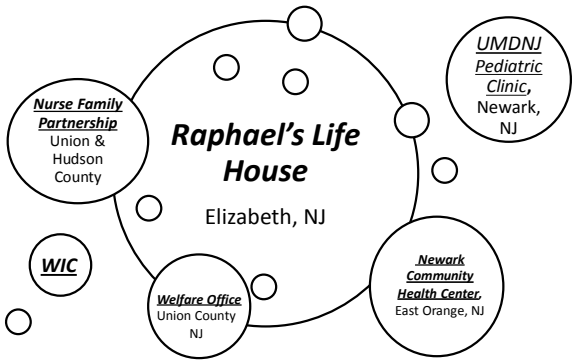
Figure 1 *Project Enrollment Data - Raphael's Life House*



(Byrnes, M., 2014)

This cohort of 10 homeless TEAM *Text4baby* mothers brought the *Text4baby* mHealth program to the University of Medicine and Dentistry of New Jersey-Pediatric Clinic, Newark, New Jersey; Newark Community Health Center (Federally Qualified Health Center), East Orange, New Jersey; WIC Supplemental Nutrition Program offices both in Newark and Elizabeth, New Jersey; the Union County Welfare Office, Union, New Jersey; The Nurse-Family Partnership of Union and Hudson County, New Jersey; and their cousins, friends, fathers of their babies, sisters and other family members (See Figure 2).

Figure 2 *TEAM Text4baby: Shares with health programs and providers*



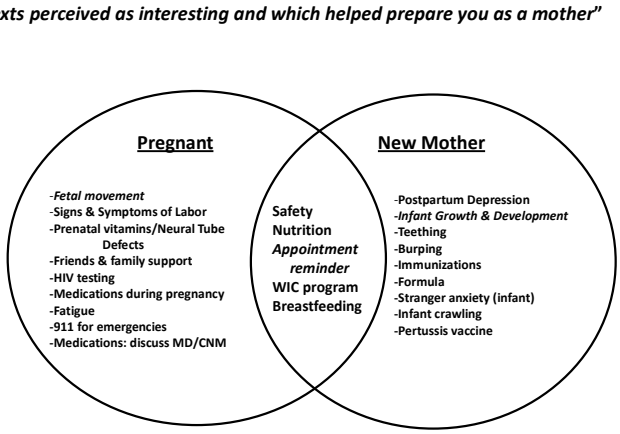
(Byrnes, M., 2014)

All mothers were provided with individualized, on-site enrollment assistance, spoke English as their primary language, self-identified as single/never married and of being between 18-21 years old and minority racial status. Within this cohort of enrolled homeless mothers, 87.5%of the mothers self-identified as African-American and 12.5% of mothers self-identified as Hispanic. All mothers self-reported as participating in the WIC program. It was noted, during weekly follow-up clinical site visits, that all homeless mothers in this project saved all *Text4baby* text messages received, although they were not asked or required to do so. Homeless enrolled mothers did not unenroll from the *Text4baby* program during this implementation project whatsoever, although they were sent regular prompts by the *Text4baby* program to reply STOP, should they no longer want to receive or un-enroll from the program. There were no technical difficulties experienced, or reported, within this implementation project with either enrolling or receiving *Text4baby* program text messages.

The enrolled homeless mothers were asked what texts they found interesting and helpful, containing new healthcare knowledge that helped them change their healthcare behavior as a mother. The pregnant homeless enrolled mothers most frequently mentioned the targeted text messages regarding fetal movement as being helpful. They reported following the guidance given to contact their healthcare provider if decreased fetal movement was experienced. Folic acid's link with neural tube defects was also chosen as a text message with new healthcare knowledge and which changed their behavior in taking their prenatal vitamin, containing folic acid, consistently. Friends and family support, signs and symptoms of labor, fatigue, calling 911-for emergencies and discussing over the counter, and all drug use with their healthcare provider were additionally chosen as being helpful. The homeless enrollednew mothers of infants most frequently chose the targeted text messages regarding infant growth and development as being most helpful. Postpartum Depression text messages were also noted as providing new, beneficial healthcare knowledge. Teething, crawling, immunizations, burping, formula use, stranger anxiety and pertussis parental vaccination were chosen as text messages that were valuable and which provided new healthcare information.

Safety, nutrition, the *Text4baby* appointment reminder feature, breast feeding and WIC information were chosen by both pregnant and mothers of infants as providing helpful and actionable healthcare information by this cohort of homeless young mothers (See Figure 3).

Figure 3 *Perception of texts received by homeless young mothers*



(Byrnes, M., 2014)

Because of the importance of supporting this new access to healthcare knowledge, additional reputable brochures were sought on infant growth and development and infant nutritionwere provided to each new mother who expressed an interest in these important areas of infant health.

Summary, conclusions and recommendations

To date, there are no published reports of implementing *Text4baby*, the largest mobile health program in the United States, within or among homeless young pregnant or new mothers. Yet, this group of young mothers faces the steepest odds in achieving optimal maternal-infant outcomes. Other implementation projects have all enrolled mothers by giving them the *Text4baby* tear-off enrollment instructions and later interviewing them via telephone survey regarding follow-thru on *Text4baby* enrollment completion. The importance of "on-site" enrollment support for this highly vulnerable, underserved population of young, pregnant or new mothers was an important finding of this implementation of mHealth among homeless mothers. This project's findings provide important data demonstrating that despite substantial hardships, innovative "on-site" support facilitates enrollment rates in the *Text4baby* program, within a homeless transitional shelter for pregnant and new mothers with infants.

Enrollment concerns or difficulties, as well as whether texts were read or not, were considered and discussed during follow-up visits. This level of continuity when implementing *Text4baby* provides a new paradigm for homeless maternal-infant shelters within Covenant HouseInternational and other homeless maternal-infant shelters, in general. New healthcare knowledge and changes in healthcare behavior are important predictors of maternal-infant outcomes.

Insight into the enrollment process for vulnerable populations of pregnant or new mothers, especially African American women, is called for by the research and was considered within this mHealth implementation project of the *Text4baby* program. Clear, concise and actionable healthcare information, provided via *Text4baby* is a unique mHealth platform, which proved to be an important contributor in improving maternal-infant healthcare knowledge among this young homeless mother population. Maternal driven discussions took place on a consistent basis and reflected a comfort level with sharing new healthcare information with providers at multiple health care program sites.

Stereotypical beliefs regarding homeless, young mothers have been challenged by documenting their exceptional level of generosity in sharing the *Text4baby* program with healthcare providers, family and friends. This finding provides fuel for further research that investigates how populations of underserved mothers actually share what they value.

Within this project, the enrolled mothers, although experiencing a paucity of economic currency,

were rich in social capital. The *Covenant House* setting may be unique in this regard and reflective of their missionon a broader scale.

Innovative mHealth projects implemented in New Jersey, especially among homeless mothers, has the potential to do the most good, in the state with the largest disparity in race based infant mortality and other poor infant outcome markers (prematurity and low birth weight) in the United States. If there is anything at all, that can be done to mitigate these disparate outcomes, it is a moral imperative.

It is evident, after completing this project, that implementation of the mHealth program, *Text4baby*, is an appropriate and sustainable platform to inform vulnerable, underserved, homeless pregnant and postpartum 18-21 year old mothers, residing within Covenant House-New Jersey, about evidence based, actionable maternal-infant health related information. Further research is needed regarding implementation and outcomes of the *Text4baby* mHealth program as it pertains to homeless populations of young mothers.

References

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior, 31*(2), 143-164.

Bennett, S. (2012). What's a Typical Day on the Internet? Retrieved on June 6, 2013, from http://www.mediabistro.com/alltwitter/internet-day_b19376

Blumberg, S. J. & Luke, J. V. (2012). Wireless substitution: Early release of estimates from theNational Health Interview Survey, July-December 2012. Retrieved on June 21, 2013, from http://www.cdc. gov/nchs/nhis. htm

Byrnes, M. (2014). *Implementation of a mHealth program within a homeless population of young mothers* (DNP Final Project). Retrieved from http://scholarship.shu.edu/final-projects/1

Evans, W. D. , Abroms, L. C. , Poropatich, R. , Nielsen, P. E. , & Wallace, J. L. (2012). Mobile health evaluation methods: The Text4baby case study. *Journal of Health Communication, 17,* Suppl 1, 22-29.

Evans, W. D., Wallace, J. L., & Snider, J. (2012). Pilot evaluation of the text4baby mobile health program. *BMC Public Health, 12*, 1031.

Gazmararian, J. A., Elon, L., Yang, B., Graham, M., & Parker, R. (2013). Text4baby program: An opportunity to reach underserved pregnant and postpartum women? *Maternal and Child Health Journal, 18*(1), 223-232.

Gazmararian, J. A., Yang, B., Elon, L., Graham, M., & Parker, R. (2012). Successful enrollment in text4baby more likely with higher literacy. *Journal of Health Communication: International Perspectives, 17,* Suppl 3, 303-311.

Green, M. K., Dalrymple, P. W., Turner, K. H., Rogers, M. L., Williver-Farr, H. & Zach, L. (2013). An enhanced text4baby program: Capturing teachable moments throughout pregnancy. *Journal of Pediatric Nursing, 28*(1), 92-94.

Jordan, E. T., Ray, E. M., Johnson, P., & Evans, W. D. (2011). Text4baby: Using text messaging to improve maternal and newborn health. *Nursing for Women's Health, 15*(3), 206-212.

Parker, R. M., Dmitrieva, E., Frolov, S., & Gazmararian, J. A. (2012). Text4baby in the United States and Russia: An opportunity for understanding how mHealth affects maternal and child health. *Journal of Health Communications, 17*, Suppl 1*,* 30-36.

Remick, A. P., & Kendrick, J. S. (2013). Breaking new ground: The text4baby program. *American Journal of Health Promotion, 27*(3), s4-6.

Ryan, K., & Kelley, T. (2012). *Almost home: Helping kids move from homelessness to hope.* Hoboken, NJ: John Wiley & Sons, Inc.

Smith, A. (2010). Pew Internet & American Life Project: Mobile Access 2010. Retrieved on July 2, 2013, from http://www.pewinternet. org/Reports/2010/Mobile-Access-2010. aspx

Van Velthoven, M. H., Majeed, A., & Car, J. (2012). Text4baby – national scale up of an mHealthprogramme. Who benefits? *Journal of the Royal Society of Medicine, 105*(11), 452-453.

Whittaker, R., Matoff-Stepp, S. , Meehan, J. , Kendrick, J., Jordan, E., Stange, P., Cash, A., Meyer, P., Batty, J., Johnson, P., Ratzan, S., & Rhee, K. (2012). Text4baby: Development and implementation of a national text messaging health information service. *American Journal of Public Health, 102*(12), 2207-2213.

World Health Organization. (2011). mHealth: New horizons for health through mobile technologies. Retrieved on July 1, 2013 from http://www.who. int/goe/publications/goe_mhealth_web. pdf.