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Impact of Pre-Conception Health Care: Evaluation of a Social Determinants Focused Intervention

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Abstract The purpose of this study was to evaluate the outcomes of the social determinants component of a multiple determinants model of pre- and inter-conception care. Health department vital statistics and infectious disease data on birth and factors influencing birth outcomes were analyzed for participants in a program designed to mitigate the effects of social class and stress in contrast to a matched comparison group and other relevant populations. The program showed promising results related to reducing infant mortality and reducing other high-risk factors for poor birth outcomes, including low birth weight and sexually transmitted disease. Social determinant interventions, designed to mitigate the impact of social class and stress, should be considered with efforts to reduce infant mortality, particularly the disparities associated with infant mortality. Additional research should be conducted to refine replicable social determinant focused interventions and confirm and generalize these results.

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Introduction

The problem of infant mortality in the U.S. is illustrated by its declining rank compared to other countries. The U.S. world rank for infant mortality has dropped from being tied for the 12th lowest rate in 1960 to being tied for 29th in 2004, with poorer European countries such as Greece, Portugal and the Czech Republic having reduced their infant mortality to the extent that they now have lower rates than the U.S. [1]. While other countries continue to improve, infant mortality in the U.S. has remained relatively stable, particularly in the last decade. The problem in the U.S. is exacerbated by even worse rankings for high rates of preterm birth and low birth weight, both major causes of infant mortality [2], and very large disparities between racial/ethnic minorities and white populations [3, 4].

Interventions focusing on increased access to health care and public health interventions addressing high-risk behaviors have had little success in improving infant mortality in the United States. Improvements in early and continuous prenatal care and reductions in behaviors linked to poor birth outcomes, such as smoking during pregnancy and teenage childbearing [5–13], have not decreased infant mortality. Korenbrot and Moss [14] conclude that birth outcomes in the United States act less as indicators of poor healthcare and health behaviors, and more as indicators of deeper disparities among women of different social classes and ethnicities [15–18].

The growing recognition that increasing access to prenatal care and targeting high-risk behaviors during

pregnancy does not adequately address the continued problem of poor birth outcomes in the U.S. has led to new paradigms with an emphasis on the health of women before they become pregnant. The pre-conception/inter-conception, life course and multiple determinants approaches to the problem are supported by substantial theory, practice and epidemiological evidence. In particular, these approaches address the growing evidence that social class [19–25] and stress [26–29] are the major predictors of poor birth outcomes [30–37]. Other evidence supporting these approaches includes socio-economic status (SES), including education, occupation and income [38], and pre-conception experiences (various social and behavioral factors beginning at the mother's birth) that have been linked to pregnancy outcomes [39].

Evidence also suggests that pre-pregnancy interventions, which target behaviors such as tobacco use, alcohol use, and consumption of adequate folic acid through multivitamins or diet prior to pregnancy care, can be successful in improving birth outcomes [40–42]. Liu et al., [41] demonstrated that such pre-conception interventions have significant impacts on early prenatal care utilization. Other promising results have also been shown with studies on pre-/inter-conception clinical and community based interventions [43–47].

Although models for the pre-conception care [4, 6, 40–43, 48, 49], life course [7, 8, 33, 46, 50–53] and multiple determinants approaches [37, 54–59] are well described in the literature, more outcomes-based research and evaluation are needed to demonstrate their effectiveness in achieving the intended outcomes, particularly interventions targeting social determinants such as socio-economic status and stress as major causes of poor birth outcomes. This article reports on the methods and results of an evaluation of the Magnolia Project, a pre-conception care approach, previously described by Biermann et al. [43] that provides early evidence of the effectiveness of social determinants focused interventions with a primary purpose of mitigating the effects of racism and class, prior to a subsequent pregnancy.

The Magnolia Project is intended to reduce the risk of poor birth outcomes through social and behavioral interventions tailored for high-risk women. The initiative focuses on women who are currently not pregnant, but are at risk of becoming pregnant in the near future. These include women who have had a previous poor birth outcome (fetal or infant loss, low birth weight baby); who had a child as a young teenager (<15 years old); who are of childbearing age (15–44) and do not have a regular source of healthcare; who are substance-abusers; who have a history of mental health or psychosocial problems (partner or child abuse, depression, anxiety); who have a history of causal, high-risk or unprotected sexual relationships; and who have been identified and/or referred as high-risk by child protective services or other health and social service agencies. The Magnolia Project includes the following intervention strategies:

1. Providing outreach, education and support to women in need of well-woman care, prenatal care and other services;
2. Increasing the availability of case management and care coordination to at-risk women who are either pregnant or ineligible for existing services because they are not pregnant;
3. Providing health education directed at specific risk factors identified through Fetal and Infant Mortality Review (FIMR) and other community studies;
4. Increasing the accessibility and availability of well-women health care and prenatal care.

Building resilience to negative social determinants through social and behavioral case management distinguishes Magnolia case management from the broader Healthy Start program, within which the Magnolia Project is located. The focus on building resilience to negative social forces through peer mentor-based case management complements but differs from nursing models of case management, which also have reported a positive impact [60]. Many of the Healthy Start clients not participating in Magnolia case management received services from the Magnolia clinic, the same clinic serving the case management clients.

Methods

The evaluation study was conducted for an intervention utilizing a unique multiple determinants model with components that address health disparity issues that are substantially linked to stress and lower social standing. The Magnolia Project is heavily reliant on case management interventions that address life issues influenced by stress and social class. The intervention includes a "*Participant care and goal plan*," which is tailored to the needs and preferences of each participant. The written plan is developed through a collaborative process involving the participant and the case manager, addresses both health and social risks, and outlines specific steps the participant must follow to improve her health and well-being and to meet her goals for social, economic, and personal development. Various qualitative research efforts that were implemented during this evaluation with case managers, program leaders and participants confirmed that the case management approach including goal setting for the broad range of social issues was a major part of the intervention.

Design

A secondary data analysis design was used to assess the impact of the Magnolia Project's pre- and inter-conception case management on birth outcomes and related health factors. A quasi-experimental design was used to retrospectively assess statistically significant differences in birth outcomes and factors influencing birth outcomes before and after case management between the intervention group and a closely matched comparison group of Medicaid-eligible clients.

Birth outcomes data and data influencing birth outcomes (1995–2005) for the study were obtained from five data sources: (1) the Florida Department of Health's Bureau of Vital Statistics, (2) the Florida Department of Health's Sexually Transmitted Disease Bureau, (3) the Florida Department of Health's Health Management System database (HMS), (4) the Magnolia client database, and (5) census data systems or various surveillance systems accessible through the Duval County Health Department's (DCHD's) Center for Health Statistics.

A second component was developed to explore the use of survey measurement tools to examine factors related to stress and social status as intermediate outcomes. The instruments are still in development, as the samples were not large enough to allow reporting of the results.

Sampling

In effect, purposeful sampling was used to identify the intervention group which consisted of all Magnolia clients who received case management services for at least 90 days during the past 6 years (2000–2005) and whose cases were subsequently closed ($n = 222$). Clients were admitted to the program if they met three or more of the following risk factors: a previous poor birth outcome (fetal or infant loss, low birth weight baby); giving birth as a young teenager (<15 years old); being of childbearing age (15–44) and not having a regular source of health care; substance-abuse; a history of mental health or psychosocial problems (partner or child abuse, depression, anxiety); a history of casual, high-risk or unprotected sexual relationships; and identification or referral as at-risk by child protective services or other health and social service agencies.

A similar risk-factor comparison group was randomly selected from Department of Health (DOH) clients in a high-risk area in Jacksonville using the DOH data and the Health Management System (HMS) clinical service records, then matched against Magnolia's risk-assessment criteria [race, matched case's age difference, risk factors, and event (fetal death, infant death, STD, gave birth to child, etc.) time difference equal to or less than 3 years]. The similar risk-factor comparison group was obtained from the eligible population by simple random selection without replacement using the SAS procedure, SURVEYSELECT. Multiple matching criteria were established at a 1:2 ratio to increase statistical power and reduce sampling error and Type I error. Two additional reference populations, Magnolia clients using clinical services only and non-Magnolia clients within the Magnolia Project target zip codes, were also used to infer impact of the Magnolia case management intervention on birth outcomes through comparisons of outcomes for time frames similar to before and after case management. Consequently, the Magnolia case management clients were compared to a random sample of clients with similar risk factors from communities in close proximity, to clients who received Magnolia clinical services without case management, and to residents living in the high-risk, predominantly African American community who do not receive Magnolia services.

Variables

The dependent variables (outcomes that would be influenced by the intervention) were low birth weight, infant death, inter-conception period and selected behaviors that may contribute to birth outcomes (such as high-risk sexual behavior). The independent variables were participation in the Magnolia case management intervention as measured by group membership (intervention group and comparison group), time (before case management, after case management) and the interaction of group membership and time. Potential mediating variables were socio-economic status (SES) data such as education, occupation, income and residence; demographic data such as age and other health conditions; and service utilization data (referrals and other services accessed in the Magnolia Project).

Outcome variables were defined as follows:

1. The infant mortality rate was calculated using the Florida Department of Health Office of Vital Statistics' formula and the infant deaths and live births Vital Statistics data sets.
2. Birth weights that were less than 2500 g were designated as low birth weight, another indicator of poor birth outcomes.
3. Inter-conception periods were grouped into three categories of successful birth spacing according to the project's goals of achieving a 2-year minimum between births as follows:
   (a) *Success*—last birth before or less than 1 year after enrollment, followed by a birth greater than or equal to 24 months
   (b) *Failure*—last birth before or less than 1 year after enrollment, followed by the next birth less than 24 months

(c) *Not Applicable (NA)*—some clients had not given birth during the study period or had a first pregnancy within 2 years before the study was concluded

4. Reports of sexually transmitted diseases were categorized as before-case-management and after-case-management as follows:

(a) *Before case management*—client had a STD before enrolling in case management or within 6 months after enrolling in case management
(b) *After case management*—client had STDs reported 6 months or more after enrolling in case management

Analysis

Statistical software programs (SAS, SPSS, and Excel) were utilized to test the primary hypotheses of group membership's impact on low birth weight, infant mortality, inter-conception periods, and repeated STDs for study participants. Datasets were linked and then stripped of personal identifiers for confidentiality during analysis using SAS programming. The following statistical tests were used to test for statistically significant differences at the .05 and .10 levels (marginal significance). Chi square or Fisher Exact tests were used to test for significance between the intervention group and similar risk-factor comparison group before case management, then after case management and among all four groups (intervention, similar risk-factor comparison group, Magnolia clinic services only clients, and non-Magnolia clients within the project's zip codes) for birth outcomes (low birth weight, normal birth weight, and infant mortality) and repeated STDs. A Generalized Estimating Equation (GEE) was used to examine the differences in the pre- and post-case management gain scores of the intervention and similar risk-factor comparison groups for birth outcomes and repeated STDs. A relative risk analysis was applied to analyze the proportional difference of infant mortality rates and low birth weights among the following groups: intervention group, similar risk-factor comparison group, Magnolia clinic services only clients and non-Magnolia clients within the project's zip codes.

Results

The Magnolia case management clients were predominantly single and black, with less than a high school education. Clients with less than 90 days enrollment were excluded from the study because of insufficient exposure to the intervention. Most of the clients in the study were enrolled in Magnolia case management for more than half of a year. Table 1 presents the socio-demographic characteristics of Magnolia clients who were enrolled in the case management program. Prior to case management, Magnolia case management clients had a low birth weight percentage of 27.6% in comparison to the similar risk-factor comparison group (13.1%) and the two population-based reference populations, Magnolia clinic services only clients and non-Magnolia clients (15.9% and 13.6%, respectively). Among Magnolia case management clients, low birth weight decreased 11% (see Table 2) after case management, while the similar risk-factor comparison group increased 3%. The 11% decrease in low birth weight for Magnolia case management clients had marginal statistical significance ($P = 0.066$). Moreover, following case management, the similar risk-factor comparison group's increase in low birth weight from 13.1% to 16.3% was not statistically significant ($P = 0.245$). A Generalized

Table 1 Demographics of Magnolia case management clients (2000–2005)

Client	Frequency	Percent
Client enrollment status		
Case management and clinical services	159	71.62
Case management only	63	28.38
Days in Magnolia program		
91–180	54	24.32
181–365	64	28.83
>365	104	46.85
Marital status		
Single	180	81.82
Married	15	6.82
Separated	9	4.09
Divorced	6	2.73
Unknown	8	3.64
Race		
White	10	4.57
Black	203	92.69
Other	1	0.46
Unknown	5	2.28
Education		
Less than high school	112	50.91
High school/GED/technical degree	80	36.36
Some college	17	7.73
Undergraduate degree	3	1.36
Graduate degree	2	0.91
Unknown	6	2.73

$n = 222$

Source: Magnolia Project Clinic Service Records

Table 2 Comparison of birth weight: Magnolia case management clients (CM) to non-participants, 1995–2005

Birthweight status	Magnolia case management Clients		Magnolia case management % change (*P* value)	Similar risk factor group		Similar risk factor group % change (*P* value)	Magnolia clinic only clients	Non-Magnolia clients in Magnolia zip codes
	Before CM (%)	After CM (%)		Before CM (%)	After CM (%)			
Low birthweight	34 (27.6)	14 (16.7)	−10.9[a] (.066[a])	53 (13.1)	52 (16.3)	3.2[b] (.245[b])	269 (15.9)	2407 (13.6)
Normal birthweight	89 (72.4)	70 (83.3)		351 (86.9)	266 (83.8)		1419 (84.1)	15301 (86.4)

[a] Magnolia before CM versus after CM

[b] Similar risk factor comparison group before CM versus after CM

Source: Duval County Health Department-Health Management Systems (HMS)

Table 3 Comparison of Infant Mortality Rates*: Magnolia case management clients (CM) and non participants, 1995–2005

Birth outcomes	Magnolia case management clients ($n = 206$)		Similar risk factor group ($n = 412$)		Magnolia clinic only clients	Non-Magnolia clients in Magnolia zip codes
	Before CM	After CM	Before CM	After CM		
Infant death	10	3	11	12	55	247
Live birth	123	84	404	320	1688	17715
Infant mortality rate	81.3	35.7	27.2	37.5	32.6	13.9

Source: Duval County Health Department-Health Management Systems (HMS)

* Rate = per 1,000 live births

Table 4 Comparison of inter-conception periods: Magnolia case management (CM) clients and non participants, 1995–2005

Inter-conception management*	Magnolia case management clients ($n = 217$)		Similar risk factor group ($n = 412$)	
	Frequency	Percentage	Frequency	Percentage
Success	72	33.2	129	31.5
Fail	28	12.9	56	13.7
Not applicable	117	53.9	224	54.8

* $P = .88$

Source: Duval County Health Department-Health Management Systems (HMS)

Estimating Equation model procedure to compare the within group rates of change between the Magnolia case management (−10.9) and similar risk-factor comparison groups (3.2), showed a marginally significant ($P = 0.067$) impact on low birth weights.

The infant mortality rate dropped from 81.3 to 35.7 for Magnolia case management clients following case management, while the similar risk-factor comparison group experienced an increase in infant mortality from 27.2 to 37.5 following a similar period of case management (see Table 3). The decrease in the Magnolia case management clients' infant mortality rate (−45.6%) compared to the similar risk-factor comparison group's increase (+10.3%) was substantial, but the within group changes were not statistically significant between the groups due to the number of live births and deaths in the two samples. Magnolia case management clients had a slightly higher percentage of successes (33.2%) and a lower percentage of failures (12.9%) in achieving the desired inter-conception periods in comparison to the similar risk-factor comparison groups (31.5% and 13.7%, respectively). Chi square analyses of the frequency and percentage of successful and failed inter-conception periods for the Magnolia case management clients and similar risk-factor group clients did not show statistically significant differences (see Table 4).

Magnolia case management clients had lower repeat STD rates (10.8%) than did the similar risk-factor comparison group clients (12.9%). Following the case management period, Magnolia case management clients who did have STDs since 1995 also reported lower STD rates than did the similar risk-factor group during a comparable time frame (see Table 5). The total incidence of post-intervention STDs (10.4%) for case management was

Table 5 Comparison of sexually transmitted diseases: Magnolia case management (CM) clients and non participants, 1995–2005

STD status	Magnolia case management clients ($n = 222$)		Similar risk factor group ($n = 412$)	
	Frequency	Percent	Frequency	Percent
Repeat STDs	24	10.8	53	12.9
After case management only	23	10.4	69	16.7
No post STDs	175*	78.8	290	70.4

* $P = .02$

Source: Florida Department of Health of Sexually Transmitted Disease Bureau

significantly lower ($P = .022$) than the incidence of STDs for the similar risk-factor comparison group (16.7%) at simulated post-intervention (see Table 5).

Discussion

This study shows promising results of an innovative program conducted in Jacksonville, Duval County, Florida [43], demonstrating the potential impact of pre- and inter-conception care case management on birth outcomes and factors influencing birth outcomes. The study focused on the impact of the case management component of the program aimed at mitigating the effects of social class and stressors, and was implemented in conjunction with culturally responsive clinical services. Previously reported studies have been restricted by a narrow focus on limited risk factors and behavior interventions for pre-conception care with limited generalizable data [43, 44, 46, 48, 58, 60, 61]. The study is important because of the limited evidence supporting pre- and inter-conception healthcare, particularly multiple determinant interventions with an emphasis on social stressors.

This study was promising but not conclusive due to limitations. Infant mortality is very difficult to measure as an outcome due to the relatively large cohort needed to detect change. Dealing with less than 1% (1% is 10 per 1,000) of deaths in live births and only a small percentage of women in a program who become pregnant creates the need for a very large cohort. The problem is compounded by the need for an even larger number of births to demonstrate statistical significance when the program is successfully trying to delay pregnancies. This study illustrated the problem by achieving profoundly meaningful but not statistically significant changes in infant mortality. Another limitation of the study was the exceptionally high-risk population of Magnolia case management clients, the intervention group. Although this was a testimony to the program's success in recruiting exceptionally high-risk women, it also presented challenges for comparing the intervention group to a similar high-risk group. While the comparison group had similar numbers and types of risks factors, the outcome data showed much lower rates of poor outcomes for the comparison group versus the Magnolia case management group. These poor birth outcome rates actually increased for the comparison group, indicating that there were no naturally occurring improvements toward the characteristics of larger populations in that community and certainly nothing towards the larger population of the county has a whole. However, it is also possible that the Magnolia case management clients may have had such extremely poor birth outcomes that natural improvements (regression towards the mean) would have occurred even if there were no naturally occurring improvements in the remainder of the populations.

This study was important because of its unique contributions to the evidence supporting pre- and inter-conception healthcare related to birth outcomes. Many promising approaches to reductions in infant mortality have been described in the Centers for Disease Control and Prevention's (CDC) "Recommendations to Improve Pre-conception Health and Health Care—United States" [39, 40, 49, 58]. The select panel grouped pre-conception indicators into two broad categories: (1) behaviors and experiences (tobacco use, alcohol use, multivitamin use, nonuse of contraception among those women who were not trying to become pregnant, dental visit, health counseling, physical abuse, and stress) and (2) health conditions (being underweight, overweight, or obese; having diabetes, asthma, hypertension, a heart problem, or anemia; or having a previous low birth weight or preterm delivery) as focused indicators that should be addressed in a life-long continuum from pre-conception care to prenatal care to address adverse birth outcomes, mainly attributed to adverse behavior. The results of this evaluation study go beyond the CDC recommendations to include factors that influence the social determinants of health.

While the CDC recommendations and the growing supporting evidence address many medical and public health related determinants of health, the recommendations do not substantially address social determinants, particularly stress and social status. There is also a paucity of evidence that addresses the social determinants that are reflected in the growing consensus about underlying causes of disparities, including infant mortality [4, 8, 25, 33, 35,

39, 40, 48, 55, 63–66]. This study, albeit limited in scope and findings, provides promising results related to an approach that has a strong social determinants component.

Evidence from community interventions has shown some effectiveness in focusing on the socio-economical and behavioral risk factors which affect the decisions for pre-conception and inter-conception care [43, 54], while clinic-based interventions focus on chronic disease, dietary and physical behavioral risk factors [43, 44, 46, 48, 61, 64, 67]. Recommendations from prenatal interventions have also suggested that a more holistic approach is needed; one utilizing a multi-determinants model to address the multiple contributing factors (social, psychological, behavioral, environmental, and biological) affecting pregnancy outcomes [52, 54, 59].

Recognizing the need for robust multiple determinants including social determinants, the evaluation for the Magnolia Project began to pilot test specific measures of social influence early in enrollment and after 9 months of enrollment in the Magnolia Project. These measures—which included perceived stress, social support, goals and future orientation, and self efficacy—reflect more immediate outcome measures related to social determinants and could be particularly valuable in demonstrating the impact of multiple (including social) determinants based interventions. Pilot testing of these tools was promising but inconclusive due to small sample sizes. However, further validation of the measurement tools and linkage of these immediate outcome measures to more distal birth outcomes could substantially advance the evidence base for multiple determinants models for reducing poor birth outcomes.

The results of the evaluation were important because of the Magnolia Project's focus on building individual capacity to mitigate the effects of social determinants, but the evaluation also highlighted the need for greater clarification concerning what approaches are effective in addressing social determinants and what are the essential components of those successful programs. Other case management programs, such as the work described by Olds [60], may also benefit from clarifying the specific social determinants components that are effective in producing desired outcomes. This raises challenging research and evaluation issues. In addition to the challenges of addressing the complex and interactive nature of social determinants, the very nature of social and cultural context also creates competing needs for replicable interventions versus the need for interventions tailored to the unique needs and contexts of local communities, as well as to the unique needs of individuals within those contexts. Psychology and social work methods of assessing achievement, such as the Goal Attainment Scaling (GAS), may be important methods that can overcome the challenge of balancing competing interests of fidelity and flexibility, or adoption versus adaptation [68]. Goal attainment scaling provides key strategies to the case management process to monitor and inform the provider and client of personalized goal achievement [69–73]. Creating replicable interventions that are also adaptable to unique communities and groups of people may require flexible methods for intervening and monitoring effectiveness of interventions that have major social determinants components.

This evaluation of the Magnolia Project in Jacksonville documents promising outcomes of pre-conception/inter-conception interventions to improve birth outcomes, and highlights areas for continued development. Further investigation is clearly warranted to confirm these results and to generalize the results to other settings. Further study is also indicated to refine replicable models that can be adapted to unique communities. Policymakers should consider requiring social components of multiple determinant models to mitigate the effects of social class and stress that are increasingly being linked to health disparities.

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