AN ANALYSIS OF THE COSTS AND EFFECTS OF THREE LEVELS OF MATERNITY SERVICES IN WEST PHILADELPHIA

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DEDICATION

This paper is dedicated to my husband Larry for his love and understanding during my graduate studies and to my newly-arrived son Michael.

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ABSTRACT

AN ANALYSIS OF THE COSTS AND EFFECTS OF THREE LEVELS OF MATERNITY SERVICES IN WEST PHILADELPHIA

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Due to high rates of low birthweight infants and inadequate prenatal care, two programs were implemented in West Philadelphia--Maternity Care Advocates and enriched Healthy Beginnings Plus (HBP). Using an observational design, an economic evaluation was performed comparing three groups of clients at two public health centers (N=248): (a) basic maternity services (control), (b) basic services plus advocates (group A), and (c) basic services, advocates, and HBP (Group A+B; a midwifery practice). Care providers for the first two groups were nurse practitioners and physicians. Following data were collected on a sample of consecutive prenatal clients: (a) utilization of services (number of tests, prenatal visits, and emergency room visits), (b) all prenatal and delivery hospitalization charges for mothers and infants, and (c) outcomes (maternal and infant hospital length of stay; birthweight; and estimated gestational age at birth). To evaluate the advocates' efforts, the control and Group A were compared; all outcome measures, utilization of services, and charges were similar. Advocates' services added $303/client to the cost of prenatal care. Outcomes were also similar for

Group A+B and control group. Although prenatal charges were statistically higher for Group A+B as compared to the control, the total of all charges incurred for prenatal and hospital care for the women and infants was similar for the two groups. The control group had more emergency room/labor floor visits than Group A+B (1.6 vs. 1.0, respectively; p=.025). Groups A and A+B were compared to evaluate the HBP program. The latter group had shorter maternal and infant hospital stays ($p<.05$) and lower hospital charges which resulted in statistically significantly lower total charges as compared to Group A. Client self-selection and differences in providers and hospitals preclude concluding that the HBP program was the primary reason for these differences. Regression models of the outcome measures were performed. In conclusion, neither of the intervention groups demonstrated higher infant birthweights nor an improvement in the adequacy of prenatal care when compared to the control in spite of an increase in expenditures on prenatal care.

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CHAPTER I

Introduction

Despite improvements in access to prenatal care over the past twenty years, infant mortality rates in the United States (U.S.) remain higher than those of comparable countries (Kleinman, 1990). Some pregnant women do not avail themselves of prenatal care even when these services are made available. In order to promote early, consistent, and comprehensive prenatal care, two enhancements in maternity services have been implemented in a West Philadelphia public health center--Maternity Care Advocates and an enriched Healthy Beginnings Plus program. This study will compare the costs and effects of these two enhancements with those of the basic clinic-based services provided at a comparable site.

This chapter will address the following six topics: (a) an overview of the problem, (b) a brief introduction of the framework underpinning the study, (c) a statement regarding the purpose of the research, (d) the research questions to be addressed, (e) definition of terms, and (f) the significance of the study.

Problem

Infant mortality in the U.S. declined by nearly 5 percent per year from 1970 until 1981, but the rate of decline slowed to 3 percent annually from 1981 to 1985 (CDC, 1988). In 1987, the infant mortality rate was 10.1 deaths

per 1,000 live births (National Commission, 1990), but the rate for African Americans has been consistently double that of whites (Joyce, Corman, & Grossman, 1988).

Although the infant mortality rate has decreased substantially since 1970, the incidence of low birthweight (LBW)--a major contributor to infant death--has declined only modestly (Institute of Medicine [IOM], 1985; National Commission, 1990). About 7 percent of all infants in the U.S. weigh 2,500 grams or less at birth, the criterion for LBW. LBW infants are 40 times more likely to die during their first month of life and two to three times more likely to suffer from chronic conditions such as blindness, deafness, and mental retardation than larger infants (McCormick, 1985). The improvements in infant mortality have been attributed to increased survival of LBW infants, many of whom received neonatal intensive care services. Yet, neonatal intensive care is extremely costly; adequate prenatal care is a much more cost-effective strategy in reducing both neonatal mortality and LBW, especially for high risk women (Gorsky & Colby, 1989; Joyce et al., 1988).

Several socioeconomic and demographic characteristics place some women at an increased risk of bearing a LBW infant. Females who are African American, have less than 12 years of education, are disadvantaged socioeconomically, or are under age 18 or over 35 are at greatest risk (IOM, 1985). The Institute of Medicine's Committee to Study the

Prevention of Low Birthweight (1985) estimated that providing adequate prenatal services to women who are at risk of delivering a LBW infant could reduce total expenditures for medical care of their infants by $3.38 for each additional dollar spent on their prenatal care. These savings would be achieved if the added care resulted in a reduction of the incidence of LBW in the target group from 11.5 percent to 9 percent. [The target group was defined as the total national cohort of women aged 15 to 39 who received public assistance and had less than 12 years of education.] If the LBW rate decreased from 11.5 to 10.75 percent, the additional cost of prenatal care would equal the savings in life-time expenditures. The projected savings were based on data from the late 1970s and early 1980s. From 1970 to 1980, the rate of LBW infants declined steadily from 8 to 7 percent of all births (National Commission, 1990). However, the LBW rate stagnated at 6.8 percent in the early 1980s and even increased to 6.9 percent in 1987. These findings suggest that the desired 1990 LBW rate of 9 percent for the target group was not achieved. Yet, even if the IOM's projected cost savings were not realized, interest in providing adequate prenatal care to high risk women was renewed.

Social welfare programs such as the Title V Maternal and Child Health Services Block Grant and Medicaid have sought to improve women's access to prenatal services

(Cohen, 1990; Gold & Kenney, 1985; National Commission, 1988). Because the cost of care has often been cited as a barrier to services (Freeman et al., 1987; McDonald & Coburn, 1988; Miller, Margolis, Schwethelm, & Smith, 1989), the requirements for Medicaid eligibility have been modified recently in order that more women may qualify for prenatal benefits (Guyer, 1990). Nonetheless, Piper, Ray, and Griffin (1990) found that a large proportion of women who could have received free maternity care failed to utilize the services. In fact, the percentage of women who obtained late or no prenatal care increased by 25 percent for African Americans and 17 percent for whites between 1980 and 1987 (National Commission, 1990). Researchers have suggested that low utilization may be due to a lack of knowledge of available services and of the need for early prenatal care; an insufficient number of providers who accept Medicaid patients; transportation and child care costs; or dissatisfaction with the quality of care (IOM, 1985).

Two programs have been initiated recently in sections of Philadelphia that seek to improve the utilization and content of maternity services for women at risk of delivering a LBW infant. The first program, the Community Maternity Project, was initiated in 1989 by the Maternity Care Coalition of Philadelphia with funds from the city and private sources. Local women have been employed as Maternity Care Advocates (MCAs) to canvass specific areas of

West and Lower North Philadelphia to identify pregnant women; assist them in receiving prenatal care at the health centers; and act as their advocates throughout their pregnancy and for one year after delivery. [A more detailed description of these interventions is provided in Chapter II.] These two communities have the third and sixth highest rate of inadequate prenatal care for the 45 city neighborhoods, respectively, and rank third and second in terms of the rate of LBW births (16.2 and 16.3 percent, respectively) (Philadelphia Health Management Corporation, 1985b, 1985c). The MCAs also assist health center nurses with follow-up of clients who miss their scheduled prenatal visits. In this study, the work of the MCAs will be referred to as intervention A.

The second program, Healthy Beginnings Plus (HBP), is an expansion of Pennsylvania's Medical Assistance Program for pregnant women. Key components of the program include care coordination by a professional provider; enhanced nutritional and psychosocial services; childbirth and parenting education; and referral to treatment programs for substance abuse (Pennsylvania [PA] Department of Public Welfare, 1990). [These services are described more fully in Chapter II.] At the study site, the care coordinator and educator roles are performed by a nurse. The HBP program will be referred to as intervention B.

Beginning in August, 1990, the Maternity Care Advocates began working in the Millcreek-Parkside neighborhood of West Philadelphia which is served by Health Center #4. Basic maternity services at this health center are delivered by two provider groups, a private nurse midwifery practice and practitioners from a large Philadelphia teaching hospital (Hospital A). The healthcare personnel from the midwifery practice have been qualified providers for the HBP program since February, 1991. Prior to their first prenatal visit, new clients attend an orientation session at the center that includes a presentation by the two provider groups regarding their services and hospital affiliation. At the end of the session, each client selects one of the provider groups. Clients who select Hospital A providers receive basic maternity plus advocacy services; this group will be referred to as the Intervention A group. Clients who choose the midwifery providers receive basic maternity services, advocacy, and an enriched HBP package; this group will be referred to as the Intervention A + B group. Women with similar socioeconomic and demographic characteristics who receive basic maternity services at Health Center #3 in Southwest Philadelphia will serve as the control group. The healthcare providers at this center are from Hospital A (Appendix A).

This study will examine the costs relative to outcomes of the enhanced maternity services provided by the Maternity

Care Advocates (intervention A) and the enriched HBP program (intervention B) at one of the care sites, Health Center #4 in West Philadelphia, and compare them to costs and outcomes obtained from the basic maternity services offered at Health Center #3.

Framework

The framework for this study is that of an economic appraisal. In a time of limited economic resources, ". . . choices in health care should be made so as to derive the maximum total benefit from the resources at the community's disposal" (Drummond, 1980, p. 3). Beginning an economic appraisal presumes that each of the alternatives being considered has demonstrated that it can accomplish its stated goal; the service to be provided is valued; and the treatment is accessible to the target population (Sackett, 1980). Having met these criteria, each treatment can be evaluated economically to determine if the benefits gained from the service exceed the input costs and whether this method is more efficient in reaching the desired health outcome than alternative ones. One explanatory note is required at this point. In this study, the resources consumed to provide prenatal care will be quantified in terms of charges for services rather than true costs. An accurate accounting of actual costs incurred by the various professionals providing services is beyond the scope of this project.

Ideally, an economic appraisal would take a societal perspective by considering all groups which might be affected by the implementation of the treatment. However, such an encompassing analysis is generally reserved for governmental agencies. More often, economic appraisals consider a program's effectiveness from the perspective of a subsection of society, e.g. the client, payor, or provider. In this study, most of the participants will be relying on public funds to pay for their prenatal care. Thus, the analysis will examine the direct expenses incurred by the public for prenatal services.

Many types of analyses fall under the rubric of economic evaluation, including cost-minimization, cost-effectiveness, cost-utility, and cost-benefit (Appendix B). The primary feature that distinguishes between these four evaluative methods is the measurement of the benefits or outcomes of the treatment (Drummond, Stoddart, & Torrance, 1987; Appendix C). In the present study, either a cost-minimization or a cost-effectiveness analysis will be performed comparing several maternal and infant outcomes.

Purpose

The purpose of this study is to determine whether women who receive the expanded (and more expensive) services provided at Health Center #4 have better maternal and infant outcomes than women who receive care at the control site, Health Center #3. All quantifiable prenatal expenses will

be examined, including clinic costs, outpatient diagnostic testing, and associated professional fees. In addition, data regarding hospital and professional services charges for the mothers and infants will be collected.

Research Questions

An economic appraisal of a healthcare program examines resource consumption in relation to health outcomes. To examine the effectiveness of the two enhancements in maternity services, the control group will be compared to the two intervention groups. In addition, all clients who received the interventions will be combined into one group and then compared to the control group to eliminate the possible self-selection bias present in this study. For each comparison, three categories of variables will be examined--utilization of services; charges for services; and maternal and infant outcomes.

In terms of utilization of services, the following three questions were posed:

1. Is the week of entry into prenatal care different for clients who have had potential access to the maternity care advocates as compared to the control group?
2. Do prenatal clients who have access to the enhanced program(s) have more prenatal visits than those in the control group?
3. In regard to prenatal care, do the three client groups differ in the (a) number of ultrasounds, (b) the number

of nonstress tests, or (c) the number of emergency room/labor floor visits they had during their pregnancy?

To evaluate charges for services, the following four questions were posed:

1. What is the average charge to the public for prenatal care for clients who receive the following services: (a) basic maternity services, (b) basic maternity services plus advocacy, and (c) basic maternity services, advocacy, and enriched HBP package?
2. In regard to the mothers' hospitalization for delivery, do the three groups differ in (a) the total charges incurred or (b) in the charges incurred per individual hospital department (e.g. pharmacy, laboratory, and radiology)?
3. In regard to the infants' birth hospitalization, do infants born of women in the three groups differ in (a) the total charges incurred or (b) in the charges incurred per individual hospital department (e.g. pharmacy, laboratory, and radiology)?
4. Do the three client groups differ in the total charges incurred for prenatal care and the mothers' and infants' hospitalizations?

The following question was posed to address maternal and infant outcomes:

Do clients in the expanded care groups have a (a) shorter length of hospital stay (LOS) for the mother, (b) shorter infant LOS, (c) higher infant birthweight, or (d) higher infant gestational age at birth as compared to the control group?

Definition of Terms

For the purpose of this study, the following definition will be used:

LBW is a birthweight less than 2,500 grams regardless of gestational age (Frigoletto & Little, 1988). LBW may result from prematurity (duration of pregnancy less than 37 weeks from the last menstrual period), poor fetal weight gain for a given duration of pregnancy (intrauterine growth retardation), or both (IOM, 1985).

Significance of the Study

Although many studies have examined the cost-effectiveness of various components of maternity services, the present study can make two unique contributions. First, evolution of prenatal services in West Philadelphia has created a situation in which the efficacy of two enhancements in care can be examined simultaneously and in the same setting: (a) casefinding/advocacy services and (b) casefinding/advocacy plus expanded care and nurse care coordination from the enriched HBP program. No comparable study design was found in the literature. In an ideal world all healthcare consumers would have the most sophisticated

equipment and highly trained professionals readily available to them whenever the need arose, but this healthcare utopia does not exist. Scarce resources must be used in the most effective manner possible. Lay advocates are considered by some to be a highly effective and relatively low cost mechanism to provide social support to poor pregnant women (Moore, 1992; Peoples-Sheps, Efird, & Miller, 1989). However, to demonstrate improvements in maternal and infant health outcomes, research suggests that professional intervention such as nurse care coordination may be required (Olds, 1990). The current study will examine these issues.

This study can make another contribution, a relatively comprehensive analysis of program costs and outcomes from local data in a concurrent time frame. Many reports of the cost-effectiveness of prenatal care come from national studies or from research performed in other states. The national report completed by the Institute of Medicine (1985) assessed the total cost of a package of prenatal services from a series of cost estimates from national data. These estimates may not accurately reflect the cost of providing prenatal care in an urban setting with a large, indigent African American population. Private local endowments have contributed heavily to the Maternity Care Coalition's Community Maternity Project in Philadelphia. They are anxious to know the return on their investment. The data collected from this study can assist local

policymakers and private contributors in their assessment of the effectiveness of the Community Maternity Project and the enriched HBP program. This research may also facilitate future evaluations of these programs.

The generalizability of these research findings will be limited to the population of indigent urban African American women. Yet, the high rate of infant mortality and LBW among African American women nationally and in Philadelphia specifically makes this study worth the investment.

CHAPTER II

This chapter is comprised of three sections: (a) a description of four types of economic evaluations, (b) a synopsis of the programs being evaluated, and (c) a review of the literature that has addressed the medical and cost-effectiveness of specific components of prenatal care services.

Types of Economic Evaluations

An economic evaluation of a healthcare program seeks to examine the relationship between the resources consumed to provide a treatment or service and the improvement in clients' health tnat results from the intervention (Appendix C). The resources which are consumed are either direct, indirect, or intangible costs. Health improvements can be measured in three ways: (a) natural units, (b) quality-adjusted units, or (c) monetary units. This delineation in measurement of health outcomes is the distinguishing feature between the four primary types of economic evaluation, cost-minimization, cost-effectiveness, cost-utility, and cost-benefit analyses. Each of these evaluations, however, includes a comparison of two or more alternative treatments (Appendix B).

In cost-minimization analyses, the outcomes of the treatments being compared are identical or the differences are so minor as to be considered unimportant (Drummond et al., 1987). The analysis would then focus on assessing the

cost of each program. The least costly alternative would be selected.

In a cost-effectiveness analysis, the second type of economic evaluation, the treatments being compared may have a common outcome but the outcome is achieved to different degrees (Drummond et al., 1987). For example, two antihypertensive agents may both extend patients' lives, but information from the clinical trials indicates that one drug offers a greater longevity than the second with the same incidence of side effects. The decision between which drug to approve could be made based on the cost per life-year gained or, conversely, on the life-years gained per dollar spent. In this case, similar treatments were compared, but dissimilar programs can be compared using a cost-effectiveness analysis if the outcome under consideration is the same.

Cost-utility analyses, the third category of economic evaluation, examine the value or utility each client or family member places on a particular state of health. This methodology seeks to quantify individual preferences. The outcome measurement in cost-utility analyses is often quality-adjusted life-years. For example, Feeny and Torrance (1989) used a quality-of-life instrument to assess expectant couples preferences toward two techniques used to detect fetal abnormalities, chorionic villi sampling and genetic amniocentesis. Because the two techniques are

performed at different times in a pregnancy, a couple might wait as much as eight weeks longer to receive the results of an amniocentesis than for the other procedure. By using utility analyses, the importance couples place on the anxiety associated with this waiting period can be measured.

The fourth economic evaluation technique is cost-benefit analysis. With this analysis, treatments that have different outcomes are compared in terms of a common measure, often dollars. The input costs of each treatment are compared to the total benefit expected from each alternative. In contrast to cost-effectiveness analyses, a monetary value is assigned to indirect or intangible benefits such as a year of human life or a year of disability avoided in a cost-benefit analysis (Warner & Luce, 1982). In order to compare alternative treatments, similar techniques must be applied in computing the costs and benefits of each program. Both cost-effectiveness and cost-benefit analyses frequently rely on data from existing or past treatments to forecast future economic effects of the alternatives under consideration.

In this study, either a cost-minimization or a cost-effectiveness analysis will be performed, because the outcome measures are in natural units, such as weight in grams or gestational age in weeks. If outcomes of the three levels of maternity services do not differ, the preferred treatment would be based on a cost-minimization evaluation.

If the outcomes vary, a cost-effectiveness analysis will be performed.

Programs to be Evaluated

Two programs aimed at reducing the incidence of inadequate prenatal care, LBW infants, and infant mortality in West Philadelphia have been implemented recently--the Community Maternity Project and an enriched Healthy Beginnings Plus program. The Community Maternity Project is a collaborative effort between public and private organizations, including the City of Philadelphia, the Maternity Care Coalition, and several private foundations. The objective of the project is to promote healthy behaviors by assisting clients to: (1) initiate prenatal care earlier in their pregnancies, (2) obtain consistent, rather than episodic, prenatal care, (3) participate in all related programs, such as WIC, Food Stamps, Aid to Families with Dependent Children (AFDC), and Medicaid, (4) increase their knowledge of prenatal health, infant health, and infant development, (5) give birth to babies weighing more than 5.5 pounds [2,500 grams], and (6) follow through with appropriate first year well-baby checkups (Maternity Care Coalition, 1988). To achieve this objective, the Community Maternity Project has employed Maternity Care Advocates (MCAs) to canvass the Millcreek-Belmont and Strawberry Mansion communities of Philadelphia to publicize the free prenatal services offered at the Health Centers (#4 and #5);

assist pregnant women in setting up clinic appointments; maintain contact with clients throughout their pregnancies including follow-up concerning missed appointments; assist clients in referral to related services; offer educational programs for clients on prenatal and infant health; and follow the mother for one-year postpartum to reinforce compliance with well-baby care. Additional resources offered to clients include transportation tokens and child-care at the clinics. Many of the MCAs' functions are performed in cooperation with the nurse care providers at the health centers.

The second program being offered to clients is a package of enhanced Healthy Beginnings Plus (HBP) services. HBP is an expansion of Pennsylvania's Medical Assistance program for pregnant women. Three features distinguish the HBP program from traditional prenatal services provided by Medical Assistance: (1) client empowerment, (2) care coordination, and (3) continuity of care (PA Department of Public Welfare, 1990). Client empowerment refers to the expectation that clients will actively participate in the design and delivery of their care and that a mechanism for critique of the providers' services is available. Clients who participate in the HBP program sign a letter of agreement with the provider that emphasizes the importance of prenatal visits and instructions received from the healthcare team. The care coordination component requires

the services of a healthcare professional who performs client interviews on intake and periodically thereafter to assess obstetrical, nutritional, and psychosocial health and risks. Each client is assigned a care coordinator to serve as the client's primary contact in the program and to ensure that arrangements for supplemental services are completed. The third distinguishing feature of the HBP program is continuity of care. Continuity of care is enhanced through two mechanisms: (a) use of the care coordinator as the client's advocate and (b) efforts made to ensure that the client delivers at the prearranged hospital. At Health Center #4, the care coordinator is a nurse. A $100 financial incentive is available to providers for each client who initiates prenatal care in the first trimester and continues with the same provider throughout the pregnancy.

Benefits provided in the HBP program include obstetric services to screen for high-risk conditions; health promotion services appropriate to the stage of pregnancy; ongoing screening for psychosocial and nutritional risks; and monitoring of supplemental services. The frequency of obstetric services are a minimum of one visit per month for the first 28 weeks gestation, then one visit every 2-3 weeks until the 36th week, and weekly thereafter (PA Department of Welfare, 1990). For women with an identified medical, nutritional, or psychosocial risk, additional services are

provided: (a) in-depth nutrition counseling, (b) smoking cessation counseling, (c) substance abuse problem identification and referral counseling, (d) genetic risk assessment, information and referral counseling, (e) in-depth psychosocial counseling, and (f) outreach visits. Additional services are available to medically high-risk women, such as prenatal home nursing care and homemaker services for those on bedrest. Appendix D illustrates the fees that providers receive from the state HBP program for rendering services.

Both the MCAs and enriched HBP programs are offered at Health Center #4 in addition to the basic maternity services which are provided. Basic services provided at both Health Centers #3 and #4 include the following: (a) vaginal examination at the first visit, during the third trimester, and other times as indicated, (b) serum, urine, and cervical laboratory tests, (c) measurement of weight and fundal height at each prenatal visit, (d) referral to the AIDS counselor if desired, (e) referral to a high-risk or teen prenatal clinic if medical conditions or age warrant, and (f) referral to other medical or social services as indicated.

Cost-Effectiveness of Maternity Services

The following section will review literature that has described either the medical effectiveness, costs, or economic effectiveness of treatments that resemble the

Community Maternity Project's Maternity Care Advocates or the HBP program. The information will be presented in three segments: changes in community resource use; changes in hospital resource use; and changes in health state (Appendix E). The first two segments address the resource consumption side of the framework for economic evaluations whereas the third describes the outcomes, anticipated health improvement.

Changes in Community Resource Use

Joyce et al. (1988) examined the cost-effectiveness of alternatives to reduce neonatal mortality and LBW, including teen family planning, use of WIC, neonatal intensive care, abortion, prenatal care, and community health services. For whites, initiation of prenatal care in the first trimester was the most cost-effective way to prevent neonatal deaths. For African Americans, prenatal care and WIC were almost equally cost-effective. Neonatal intensive care was three times more effective than prenatal care in averting neonatal deaths, but the high cost made neonatal intensive care the least cost-effective strategy. In regard to LBW, prenatal care was the most cost-effective intervention for whites and African Americans based on the upper-bound estimates. When more conservative estimates were used for African Americans, WIC was more cost-effective. For African Americans, the cost per LBW birth averted was estimated to be $1,900 to $9,400 for prenatal care and $2,600 to $6,300 for WIC. With

one exception, all interventions were more cost-effective for African Americans than for whites. Buescher, Larson, Nelson, and Lenihan (1991) also found prenatal WIC services to be a cost-effective strategy to reduce the incidence of LBW infants at the modest expense of $170 per participant ($1988). However, not all WIC studies have had such impressive results (IOM, 1985); these findings will be addressed in the next section.

Some specific services provided as part of basic prenatal care, such as screening for asymptomatic bacteriuria, sickle hemoglobin, hepatitis B virus, syphilis, and gonococcal cervicitis, have been shown to be medically and economically effective primarily because they avert future medical care for the mother and/or infant (Arevalo & Washington, 1988; Leppert & Namerow, 1985; Nagey, 1989; Wadland & Plante, 1989). Other components of prenatal services such as screening for gestational diabetes have not been shown to be cost-effective, yet the screening is usually performed based on recommendations of various professional groups (Everett, 1989; Singer, Samet, Coley, & Nathan, 1988). Similarly, reports of programs resembling the Community Maternity Project's Maternity Care Advocates have not clearly demonstrated medical or economic effectiveness.

Role of Maternity Care Advocates

The MCAs have four major roles: casefinding, social support, education, and referral to related community support services.

Casefinding. One goal of the Community Maternity Project is to increase the early use of prenatal services by pregnant women in the vicinity by employing MCAs as casefinders. The endeavor is often a costly one.

An outreach program in Central Harlem hired four local residents to seek out pregnant women by canvassing the community (Brooks-Gunn et al., 1989). The number of pregnant women contacted in the first 6 months of the program was 0.39 per hour, but declined to 0.14 per hour in the second 6 months. With 52 women being identified as having come to one of the Harlem clinics because of an outreach worker, the unit cost for the program per woman enrolled was $846. Women with outreach did not enter prenatal care significantly earlier than those without such contact (15.8 vs. 17 weeks, respectively) (McCormick et al., 1989). However, of the 348 study participants, many had little social support; 30 percent scored in the range of clinically significant mental distress. Information regarding maternal and infant outcomes were not included. The investigators recommended that a direct mail or telemarketing campaign might have reached a larger audience at a lower cost. Then outreach workers could be assigned to

contact interested individuals personally and potentially provide longer-term follow-up and advocacy. Although casefinding may not be a cost-effective strategy, the social support offered by MCAs may improve women's consistent use of prenatal care (Heins, Nance, & Ferguson, 1987).

Social Support. The Resource Mothers Program, a social support system aimed at reducing infant mortality in rural South Carolina, significantly reduced the incidence of LBW infants and improved the adequacy of prenatal care for the 575 teenage study participants as compared to the matched controls (Heins et al., 1987). Requirements for the Resource Mothers included personal warmth, successful personal parenting experience, knowledge of community resources, and live in the community being served. The Mothers received six-weeks of training to prepare them for their roles as teacher, role model, reinforcer, friend, and facilitator. With an average caseload of 30-35 teenagers, the Mothers made monthly home visits during a client's pregnancy, daily visits during the hospital stay, and periodic home visits during the infant's first year of life. Although the health outcomes were impressive, the contribution made by the Resource Mothers could not be separated from the simultaneous improvement in prenatal care.

The training and role of the Resource Mothers closely resemble that of the MCAs in the Community Maternity

Project, but a few differences exist. Prenatally, the MCAs only make home visits when clients have missed two consecutive prenatal appointments; a home visit is made routinely in the first month after delivery (Jenkins, 1991). Additional contacts with clients are at the health center or by telephone every 2 to 3 months during the infant's first year. MCAs manage a caseload of 85-105 clients of various ages.

The current study will examine whether the social support and advocacy efforts in West Philadelphia can replicate the findings from South Carolina. However, due to the MCAs' large caseloads and their small number of home visits, the social support component of the intervention may not be strong enough to significantly affect birth outcomes (Olds & Kitzman, 1990; Peoples-Sheps et al., 1989). Some reports suggest that prenatal home visits by nurses at 1 to 2 week intervals are required to produce demonstrable improvements in maternal health and infant birthweight (Olds, 1990; Olds, Henderson, Tatelbaum, & Chamberlin, 1986). Randomized clinical studies are needed to compare client outcomes following home visits by trained lay advocates and nurses; economic evaluations could be conducted subsequently.

Education. The third major role of the MCAs is education. They receive training designed to prepare them for the bimonthly Mother's Outreach Meetings (MOMs meetings)

that they sponsor. At the MOMs meetings, basic information on prenatal and infant health and development is discussed with maternity and postpartum women. In Dallas, trained lay volunteers provided similar educational programs to pregnant adolescents at the prenatal clinic site (Jones & Mondy, 1990). Although most maternal and infant outcomes did not differ between the intervention and comparison groups, teens who attended at least eight classes (high-treatment) had infants with significantly longer gestational ages than those who did not attend any classes. The findings must be interpreted with caution, however, because participants were not randomly assigned to groups and the high-treatment group had significantly more prenatal visits than the low-treatment or comparison group indicating that self-selection had occurred. The absence of random assignment is a frequent shortcoming of clinical research. Although the high-treatment group had infants with longer gestational ages, this finding may not be a result of the educational sessions but simply reflect other factors in the mothers' environment that promoted a positive outcome. Possibly the high-treatment adolescents attended more prenatal visits because their socioeconomic milieu was more supportive than that of the other two groups. In the current study, all clients are to have an assigned MCA at Health Center #4. Yet attendance at the MOMs meetings and other prenatal classes is voluntary, posing the risk of a selection bias.

Referral. The final major role of MCAs is to refer clients to related community support services when a need is identified. Referrals are made for emergency and permanent housing, utilities, emergency food, food stamps, WIC, clothing, and others. The greatest number of referrals, in descending order of frequency, are for permanent housing, transportation tokens, emergency food, and WIC (White, 1991). This illustrates the dire economic situation of some West Philadelphia clients. Although a comprehensive economic evaluation would account for the increased utilization of publicly provided services, resource constraints in the current study preclude such thoroughness.

Studies of the WIC program have found that food supplements can significantly reduce the incidence of premature and LBW infants (Kotelchuck, Schwartz, Anderka, & Finison, 1985; Rush, Alvir, Kenny, Johnson, & Horvitz, 1988). However, at least 7 months of participation was required before the mean birthweight of infants of WIC mothers was significantly greater than that of infants in the non-WIC group; the difference for African American women was a modest 80 grams (Stockbauer, 1987). Analysis of the relationship between nutritional intake and birth outcomes is confounded by the negative correlation between prepregnancy weight and weight gain during pregnancy (IOM, 1985). Being overweight prior to conception can compensate for a poor pregnancy weight gain and vice versa. The most

detrimental situation is an inadequate prepregnancy weight combined with a low pregnancy weight gain.

These research findings suggest that WIC participation can provide positive yet modest improvements in birth outcomes. Unfortunately, data regarding the level of WIC participation by pregnant women who reside in the geographic areas served by the health centers in this study could not be obtained due to restrictions on data access.

Healthy Beginnings Plus Program

The HBP program has many facets, including care coordination and counseling regarding nutrition, smoking cessation, substance abuse, and psychosocial problems for women identified as at risk. Studies that have addressed the effectiveness of such interventions will be described and compared to the West Philadelphia intervention.

Care Coordination. A key feature in the Pennsylvania HBP program is care coordination, use of a healthcare professional to act as the client's advocate and provide continuity of care. North Carolina implemented a similar program in 1987, the Baby Love Program, for Medical Assistance-eligible women (Buescher, Roth, Williams, & Goforth, 1991). Maternity care coordinators were available to assist clients with their medical, nutritional, psychosocial, emotional, and resource needs. The coordinators were either registered nurses or social workers (M. Roth, personal communication, Feb. 13, 1992). After

matching birth certificate records for women with and without maternity care coordination, the incidence of LBW births and infant deaths was significantly lower for mothers who received care coordination. Also, a significantly greater number of these mothers used WIC services than did the comparison group. Claims for service incurred by the newborn which began within 60 days of birth were also examined. The average Medicaid costs for infants born of women who received care coordination were significantly less than those of the comparison group ($1,694 and $1,971, respectively). The average cost for maternity care coordination was $137 whereas the average savings from the newborns' care was $277, an average net savings of $140 for each of the 15,526 women or $2.02 saved for each dollar spent on care coordination. [The increased expenditures on WIC for study participants were not included in the calculations.] Cost savings from care coordination might have been even greater if the program had included postpartum home visitation by nurses. Olds, Henderson, Tatelbaum, and Chamberlin (1988) found that this latter intervention reduced the number of unintended subsequent pregnancies in the treatment group and their reliance on public assistance as compared to women in the comparison group.

The role of the care coordinator in the HBP program is virtually identical to that of coordinators in the Baby Love

Program. The HBP program places a strong emphasis on continuity of care and health promotion and education. Hopefully these features will entice clients to continue prenatal care according to the prescribed schedule. Using a case-control design with a sample of 1,484, Libbus and Sable (1991) found that pregnant women who had frequent prenatal visits received more counseling about diet, smoking, alcohol, drugs, and symptoms that are to be reported to the healthcare provider than women who had an inadequate number of visits. Although infant birthweight and gestational age did not differ between the two groups of women, a significant predictor of risk for a preterm LBW infant was the mother's lack of instruction to call the healthcare provider if preterm labor was suspected. The association was not significant for term LBW infants. Bleeding, contractions, or cramps may signal preterm labor, possibly caused by placenta previa, an incompetent cervix, or infectious processes (Fadel, 1982). If detected in time, preterm labor can be arrested in some cases. Instructing prenatal clients to report signs and symptoms of preterm labor to the healthcare provider is an important health promotion activity.

The increased emphasis on education in the two intervention groups in the current study may reduce their rates of premature delivery. Estimated gestational age at birth is one of the outcome variables. A related variable

is the frequency of emergency room/labor floor visits a woman has during the pregnancy.

Measuring the outcomes of education received regarding the signs of preterm labor is complicated by the fact that approximately 45 percent of poor pregnancy outcomes arise from women who do not have identifiable risks (Frigoletto & Little, 1988). Nonetheless, the increased social support and continuity of care provided by the MCAs and care coordinators in the intervention groups may reduce the stress of the clients and decrease the number of emergency room/labor floor visits they have. Conversely, because of the increased availability of prenatal education to the intervention women, they may recognize symptoms of preterm labor more promptly and therefore seek intervention at the acute care sites at a higher rate. Due to the paucity of literature in this area, the number of prenatal emergency room/labor floor visits of women in the three study groups will be examined.

Nutrition Counseling. Although increased participation in WIC has been shown to improve infant outcomes, in-depth, individualized nutrition counseling directly associated with prenatal services has received little attention. Given that the study population was found to have an inadequate intake of calories, calcium, and iron (Brooten et al., 1987), individualized counseling could be very useful. For HBP clients at Health Center #4, a comprehensive dietary

assessment is performed by the nutritionist at a client's first prenatal visit (M. Kellogg, personal communication, April 26, 1992). The assessment includes an appraisal of a woman's prepregnant weight and weight gain; hemoglobin and hematocrit; the quality of her diet; her home environment; and financial resources. Clients are instructed to increase their intake of milk products and to take their iron supplements; many clients are referred to WIC. About a third of the clients require a follow-up assessment later in pregnancy to evaluate their weight gain. Women with gestational diabetes are monitored more frequently.

The nutrition counseling provided by the enriched HBP program is relatively similar to a program described by Splett, Caldwell, Holey, and Alton (1987). Nutrition services were provided to a group of low-risk, healthy pregnant women at a city health department and a county hospital. At their first prenatal visit, clients received an initial assessment of their diet, hemoglobin and hematocrit, and anthropometric measurements. Based on these data, teaching was initiated and referral to additional nutrition resources was made if necessary. The client had at least one follow-up visit with the nutritionist in the third trimester to reassess her nutritional state and prepare for infant feeding. The nutritionist monitored clients' weight gain and iron status at each prenatal visit; additional direct client contacts were made if warranted by

her condition. The cost per client was $72 at the health department and $121 at the hospital; the higher cost at the hospital was primarily due to greater overhead expenses. In relation to successful client outcomes, the total cost per client for an improved diet was $82 at the city health department. The cost per client for achieving the recommended weight gain was $231.

Although this study provides useful baseline data, further research is needed to examine the cost-effectiveness of this program of nutrition counseling as compared with other protocols and to study the effects on infant birthweight. In contrast, smoking cessation programs have been shown to be both medically and cost-effective.

Smoking Cessation. The adverse effects of smoking on fetal development have been reported for several years (IOM, 1985). Smoking slows fetal growth and increases a mother's risk of having a stillbirth or a LBW infant; it contributes to 20 to 40 percent of LBW infants. Oster, Delea, and Colditz (1988) estimated that maternal smoking increased national expenditures for neonatal intensive care unit (NICU) services by $175 million in 1983. The average cost of NICU services was $189 to $288 higher for infants born to smokers than for those born to nonsmokers.

Windsor, Warner, and Cutter (1988) conducted a randomized clinical trial to examine the cost-effectiveness of three self-help smoking cessation methods for pregnant

women in public health maternity clinics. The most successful and cost-effective method used a pregnancy-specific smoking cessation manual, an American Lung Association pamphlet, and 10 minutes of instruction from the health educator at a cost of $7.13 per patient. Fourteen percent of the women stopped smoking in this group compared to 2 and 6 percent in the other groups. For the most successful method, the cost of the intervention per woman who stopped smoking was $51--a relative modest investment for averting a LBW infant and the potential increase of $189 in NICU costs.

Ershoff, Quinn, Mullen, and Lairson (1990) examined the outcomes of 227 pregnant women from a health maintenance organization who participated in a randomized trial of another self-help smoking cessation program. Twenty-two percent of the women in the experimental group stopped smoking compared to 8.6 percent in the control group. Although the differences were not significant, women in the experimental group were 45 percent less likely to deliver a LBW infant and had infants with birthweights that were 57 grams higher than those of the control group (3,366 and 3,309 grams, respectively). The rate of intrauterine growth retardation was significantly lower for the experimental group. Economically, the average cost per delivery was $46 lower for women in the experimental group than for those in the control group ($1,028 and $1,074, respectively). This

produced a benefit-cost ratio of 2.8:1 for the organization, i.e. a savings of $2.80 for each $1 spent on the program.

At Health Center #4, formal instruction regarding smoking cessation for HBP clients is provided in three sessions by the social workers (S. Branch, personal communication, March 25, 1992). The first session is conducted during the initial prenatal clinic visit; the physiological effects of smoking and psychological addiction are discussed. The social worker assists clients in setting realistic goals to minimize the risk of failure, such as to reduce smoking from a pack to 3 cigarettes a day. The two subsequent sessions are done at a clinic visit or over the telephone. Clients are given suggestions to help them deal with nicotine withdrawal, prevent excessive weight gain, and to avoid situations that might cause them to resume or increase smoking after delivery. Besides smoking, substance abuse by pregnant women can have a deleterious effect on the unborn fetus.

Substance Abuse Identification. In 1981, the Surgeon General advised pregnant women not to drink alcoholic beverages to remove the risk or fetal alcohol syndrome, a condition characterized by intrauterine growth retardation and congenital abnormalities (IOM, 1985). Alcohol has also been associated with LBW deliveries (Mills, Graubard, Harley, Rhoads, & Berendes, 1984). Besides alcohol, many illicit drugs including cocaine may be abused by pregnant

women. Fetal exposure to cocaine has been associated with LBW, cerebral infarctions, urogenital malformations, neurobehavioral impairment, and abruptio placentae (Phibbs, Bateman, & Schwartz, 1991). However, Chasnoff, Griffith, MacGregor, Dirkes, and Burns (1989) found that assisting women who had used cocaine in their first trimester to abstain from use for the remainder of the pregnancy resulted in improved infant outcomes, including a significant reduction in the incidence of LBW infants.

A study of 207 infants born of cocaine-abusing women found that their hospital costs far exceeded those of infants born of noncocaine-abusing mothers (Chiu, Vaughn, & Carzoli, 1990). For infants in the normal nursery, cocaine-exposed infants' hospital costs averaged $801 higher than those of other infants. Half of these additional costs were a result of extended hospital stays caused by the need to investigate home placement. Another $77 was for antibiotics to treat possible or confirmed congenital syphilis. At this site, almost 80 percent of the symptomatic congenital syphilis cases were from infants of cocaine-abusing mothers. For cocaine-exposed infants who required NICU services, their hospital costs exceeded those of matched infants by $17,721 per patient. A General Accounting Office study found that median hospital charges were $1,100 to $4,100 higher for drug-exposed neonates than for non-drug-exposed infants (Chasnoff, 1991). With about 4.5 percent of

pregnant women between the ages of 12 and 34 years using cocaine during pregnancy and many more using other illicit drugs, the conservative estimate of the economic impact of substance abuse is $385 million.

The Millcreek-Parkside community in which Health Center #4 is located has the fourth highest rate of mortality from accidents and adverse effects of drugs (33.6/100,000) of Philadelphia's 45 neighborhoods (Philadelphia Health Management Corporation, 1985b). A recent study of low-income women from West Philadelphia who delivered at a local hospital found that 20 percent of them had consumed alcohol and 17 percent had used cocaine during their pregnancy (Goldfarb et al., 1991). Based on findings of the aforementioned studies, maternity services that encourage early prenatal care including identification and treatment of substance abuse are likely to improve the outcomes of newborns and avert future medical costs.

Combined Services: Education, Psychosocial and Nutrition Counseling. Several studies have examined the effectiveness of prenatal programs which provided comprehensive and coordinated services (Baldwin & Chen, 1989; Olds et al., 1986). At the University of Utah, The Teen Mother and Child Program was developed to provide medical, psychosocial, and nutritional services to pregnant adolescents and their infants (Elster, Lamb, Tavare, & Ralston, 1987). Adolescents in the intervention group

received many services: (a) in-depth psychosocial and nutritional assessments at entry into the program, during late gestation, and every six months after delivery for two years, (b) information about pregnancy, delivery, contraception, and infant health, and (c) individualized counseling regarding school, work, family, or interpersonal relationships. Measures of psychosocial status, maternal and infant health, and parental behaviors were obtained during the pregnancy and at 12 and 26 months after delivery. Although adolescents in the intervention group attended a significantly greater number of the expected prenatal visits than did the control group, many of the maternal and infant outcomes were similar for the two groups. Significantly more infants from the intervention group had hospital stays greater than two days following a vaginal delivery or six days following a cesarean birth. Even though perinatal outcomes showed little variation between the two groups, adolescents in the intervention group were less dependent on entitlements, used preventive health practices more frequently, and had more successfully completed their infants' immunizations at 12 and 26 months after delivery.

The major feature that differentiates this program from the HBP program in West Philadelphia is the age of the target group. The latter program is available to all prenatal clients, not just adolescents. Adolescents are more likely to delay prenatal care and have LBW infants than

women over age 20 (IOM, 1985). Because the social situation of adolescents is often dissimilar from that of women over age 20, generalizing the findings of the Utah study to non-adolescent clients is confounded. Additional studies are needed to examine whether comprehensive maternity services have the same or different effects on females over age 20.

Prenatal Care Visits

No single component of prenatal care has been identified as the "magic bullet" that guarantees a healthy baby at delivery. Diverse methods and skills are required to identify and then hopefully reduce the medical or socioeconomic factors that can place a mother or her infant at risk. However, research has demonstrated that the risk of a LBW infant is significantly diminished when pregnant women initiate prenatal care in their first trimester and continue care at regular intervals throughout the pregnancy (IOM, 1985). A major function of the MCAs is to promote these behaviors. As clients' professional advocate, the HBP nurse care coordinator role is designed to increase the probability that women will obtain regular and comprehensive prenatal care once they have entered the healthcare system. Thus, data regarding the number and timing of clients' prenatal care visits will be collected as one measure of the effectiveness of these two interventions.

Summary of Community Resource Use

Based on the literature regarding community resource consumption for prenatal care, the medical and cost-effectiveness of the Maternity Care Advocates and the enriched HBP program in West Philadelphia is difficult to predict. Although casefinding and advocacy efforts of the MCAs may increase the social support available to clients, the intervention may not be cost-effective unless an improvement in infant outcomes is evident. The enriched HBP program is multi-faceted. An evaluation with multivariate analyses of the effectiveness of each component requires a very large sample. The present study can only evaluate the cost and effects of the West Philadelphia HBP program as a whole. Yet, successful identification and treatment of even a small number of women who smoke or are abusing illicit substances could lower the average hospital charge for infants born of mothers participating in the HBP program. A more speculative issue is whether the intervention will demonstrate significant improvements in clinical outcomes such as birthweight given the sample size of the current study.

Changes in Hospital Resource Use

Outpatient Care

The majority of services provided to maternity clients on public assistance are available at the district health centers. However, for special services such as

ultrasonography, nonstress tests, and genetic counseling, clients are obliged to go to another site, often the hospital. The charges incurred for these services will be included in the cost of prenatal care.

Inpatient Care

One of the outcomes to be measured in this study is the cost of the delivery/birth hospitalization for the mother and infant. Of the $16 billion spent on maternity care in the U.S. in 1985, $11.3 billion went to hospital care of the mother and infant (Alan Guttmacher, 1987). The bill for an uncomplicated pregnancy, normal delivery, and healthy infant was $2,900 in 1985; the average cost for having a baby was $4,300. Although the demographic characteristics of the groups being compared are similar, the educational preparation of the prenatal healthcare providers varies. At the control site (Health Center #3), obstetrical medical residents and nurse practitioners provide the prenatal care; deliveries are attended by the residents. At Health Center #4, the intervention site, these same providers provide prenatal and delivery services to about half of the clients. The other clients receive prenatal care from nurse-midwives and nurse practitioners in private practice; the nurse-midwives attend clients' deliveries.

In the past, certified nurse-midwives have faced resistance from many obstetricians (Cushner, 1986), but research that has demonstrated comparable maternal and

infant outcomes for low-risk obstetrical patients who received care from nurse-midwives and physicians has helped to abate the resistance (U.S. Congress, 1986). However, professional practice patterns differ between the two groups. Nurse-midwives tend to use medical technology less often than physicians but generally communicate more with their patients. These variations in practice patterns influence the cost of care. Using patients matched by delivery date, maternal age, and infant weight, Krumlauf et al. (1988) found that although hospital charges for most services provided by nurse-midwives and physicians during the hospitalization for birth were similar, charges for the mother's labor, delivery, and postpartum care were significantly higher for the physicians' patients. The physicians used electronic fetal monitoring and anesthesia more often than the nurse-midwives.

Having addressed the community and hospital resources that are consumed in providing prenatal care, the discussion will now turn to outcomes, i.e. changes in health state.

Changes in Health State

Three health status outcomes will be examined in this study: infant birthweight; estimated gestational age at birth; and maternal and infant hospital length of stay as a reflection of morbidity. Many factors that reduce the incidence of LBW have already been described, such as prenatal care and WIC services. LBW may also result from

premature birth, birth that occurs prior to the beginning of the 38th week of gestation (less than 259 days from the mother's last menstrual period) (Frigoletto & Little, 1988). About 50 percent of infants born prior to 35 weeks gestation will be LBW (Fuchs & Stubblefield, 1984). However, premature infants may have an adequate weight and full-term infants may be LBW. Survival chances are best for infants born at or after 37 weeks and weighing 2,500 grams or more. Many of the factors associated with LBW are also associated with prematurity, such as young maternal age, low social status, low educational attainment, and smoking. Other factors associated with prematurity include previous pregnancy loss, previous LBW infant, antepartum bleeding, and various medical conditions. For most women, the highest prematurity rate is with the first birth and then the rate declines. Yet for women whose first birth occurred prior to age 20, the risk of prematurity increases with succeeding pregnancies (Fuchs & Stubblefield, 1984). Prevention and early detection of maternal risk factors are critical to minimize maternal and neonatal morbidity and mortality (Frigoletto & Little, 1988).

One reflection of morbidity is length of the hospital stay. For mothers, cesarean deliveries and complications including birth canal injuries and infection are the primary reasons for prolonged postpartum hospital stays (Clark, Mugford, & Paterson, 1991). LBW and prematurity are the

primary contributors for infants. For example, in the early 1980s, the average neonatal hospital stay for infants of normal birthweight who survived to the first year of life was 3.5 days (McCormick, 1985). In contrast, those with birthweights between 1,501 and 2,000 grams spent an average of 24 days in the hospital. Infants that weighed 1,500 grams or less had average neonatal stays of 57 days.

A factor closely associated with length of stay is utilization of services. Patients with longer stays consume more resources, such as radiology, laboratory, and pulmonary services (Finkler, Brooten, & Brown, 1988). Neonates who are premature and/or LBW often require NICU services. Although these services have contributed to the reduction in the rate of neonatal mortality, the costs of care are high with estimates for an "average" NICU stay ranging from $20,000 to $60,000 (Boyle, Torrance, Sinclair, & Horwood, 1983; Budetti, McManus, Barrand, & Heinen, 1981; IOM, 1985). The lower the infant's birthweight, the greater the resource consumption and cost of services; developmental disabilities also increase expenses. In a case-control study of 60 infants over a 3-year period, NICU graduates with moderate to severe developmental disabilities were found to have a monthly cost for medical services that was 10 times higher than that for NICU infants without disabilities, $651 and $63 respectively (Shankaran, Cohen, Linver, & Zonia, 1988). The estimated total lifetime cost for NICU graduates ranges

from $40,647 to $362,992 (Walker, Feldman, Vohr, & Oh, 1984). The modest cost for prenatal care aimed at reducing the incidence of LBW pales in comparison. Preventing LBW and prematurity are highly desirable goals and are often cost-effective.

Summary

The current study was an economic evaluation of two prenatal interventions in West Philadelphia, Maternity Care Advocates and the enriched HBP benefit package. Changes in community and hospital resource consumption induced by these interventions were compared to the health status outcomes experienced by mothers and infants. The next chapter will describe the study's methodology.

CHAPTER III

Methodology

This study is an example of evaluation research, research performed to provide decision makers with information regarding treatment program effectiveness (Polit & Hungler, 1983). Maternal and infant outcomes of women who received expanded prenatal services at Health Center #4 were compared with outcomes of women and infants from the control site, Health Center #3. The research design was passive observational (Cook & Campbell, 1979); the interventions began at a precise point in time yet they were not within the control of the investigator. This chapter will address the study's setting, sample, data collection procedure, data analysis, and ethical considerations.

Setting

The setting for this study was two health centers operated by the Department of Public Health, City of Philadelphia. The Maternity Care Advocates, intervention A, began work in August, 1990 in a portion of the Millcreek-Parkside community of West Philadelphia served by Health Center #4 (Appendix F). The Millcreek-Parkside area includes census tracts 92, 103-111, and 124. [In more recent reports, the Millcreek-Parkside community is referred to as Mantua.] The census tracts canvassed by the Maternity Care Advocates (MCAs) are 92 and 104-107. Although the MCAs' canvassing area does not include the entire Health

District #4, all women who present at Health Center #4 for prenatal care are assigned arbitrarily to one of the five advocates. The threat of a client selection bias is removed. The control client group received care at Health Center #3 which is located in a nearby Southwest Philadelphia community, Paschall-Kingsessing (census tracts 63-66, 69-75).

At the time of the study, Health Center #4 clients could choose between two groups of healthcare providers: (a) obstetric medical residents and nurse practitioners from Hospital A or (b) nurse practitioners and certified nurse-midwives in a private practice. [The latter group will subsequently be referred to as the "midwifery practice" for simplicity.] Patients who chose the providers from Hospital A were to deliver there; those who chose the nurse midwifery practice were to deliver at a different urban teaching hospital in the city (Hospital B). The differences in providers and the lack of random assignment to groups posed a threat to the study's internal validity. In order to identify possible differences in observable attributes, sociodemographic characteristics of the women were compared. Data regarding delivery practices and outcomes such as the number of cesarean deliveries were collected to assess the effect of these factors on hospital charges. Nonetheless, subtle disparities that are not easily measured may exist between the women who chose Hospital A providers and those

who chose the caregivers from the midwifery practice due to the availability of self-selection (Polit & Hungler, 1983). Because of this study limitation, it is not permissible to attribute a causal relationship between the unique features of each of the two enhanced programs and any outcome differences that are found.

Prenatal care at Health Center #3 (the control site) is provided entirely by professionals from Hospital A; these providers are the same individuals who serve about half of Health Center #4 clients. Health Center #3 clients deliver at Hospital A.

Sample

To accurately evaluate a program, the outcomes of all program participants are examined. Therefore, permission was obtained from the healthcare provider groups and Institutional Review Boards of the hospitals to waive the requirement of client consent. All prenatal clients who presented at Health Centers #3 and #4 during the study period and could be traced through their delivery were added to the study groups in a consecutive fashion unless they fell into one of three categories for exclusion. Because the prenatal clients at Health Center #4, the intervention site, are almost all African American women, women of any race other than African American or African descent were excluded from the study due to reported differences in race-specific infant birthweights (Shiono, Klebanoff, Graubard,

Berendes, & Rhoads, 1986). [Approximately 20 percent of clients at the control site are from Asia or the Middle East.] Women who had a multiple gestation were excluded due to the increased risk of LBW and infant morbidity (IOM, 1985). Approximately 10 percent of women who registered for prenatal care at the two health centers were lost during the course of their pregnancy, i.e. the care providers could not determine if the women moved out of the area, sought care elsewhere, had a miscarriage, etc. Because of this high rate of untraceable clients, an accurate accounting of the number of pregnancies which resulted in a non-viable infant was not possible. Thus, any prenatal client who delivered an infant that would not be considered viable (less than 501 grams and/or less than 22 weeks gestation) was excluded from the study (Bobak & Jensen, 1987). [Appendix G is a population flow chart of the study.]

Women in the control group and the intervention A group had an estimated date of delivery on or after August 1, 1991. The care providers for these two groups introduced the HBP program to a few of their health center clients in December, 1991. By February 1, 1992 many of their new clients were enrolled in the HBP program. Therefore, to avoid contaminating the current study with this intervention, the sample of clients in the control group ended with those women who delivered prior to April 1, 1992 (n=93); any clients who were enrolled in the HBP program

were excluded from the study. Because of the smaller number of clients of Hospital A providers at Health Center #4 (intervention A group), data collection for this group continued until May 6, 1992; only 5 of the 75 women in this intervention A group delivered after April 1, 1992. [One client was excluded from this group because she was attending school in a distant state during several months of her pregnancy.]

Clients of the midwifery practice who had an estimated date of delivery after October 22, 1991, were included in the intervention A + B group (advocacy plus enriched HBP). Clients were added to the group until a sample size of 80 was reached. The latest delivery was July 30, 1992. Twenty-four of the eighty women in the group delivered after April 1, 1992. Although the midwifery practice had a new contract with the City of Philadelphia beginning July 1, 1992, the charge structures used for the previous fiscal year were used throughout this study to maintain consistency. Two of the midwifery practice's prenatal clients delivered at Hospital A. The women were retained in the intervention A + B group for analysis; their inpatient charges were from Hospital A.

Health Center #3 was chosen as the control site from the nine remaining Philadelphia health centers because the healthcare providers and the sociodemographic characteristics of the clients most closely resembled those

at Health Center #4. However, the median family income and educational attainment of residents in the area served by Health Center #3 (Paschall-Kingsessing) are higher than that of those residing in the area served by Health Center #4 (Millcreek-Parkside) (Table 1). The frequency of LBW infants and inadequate prenatal care is lower in the Paschall-Kingsessing area than in the intervention community. In 1989, the incidence of LBW infants and inadequate prenatal care was 12.7% and 19.2% in the Paschall-Kingsessing community compared to 16.4% and 21.6%, respectively, in the Millcreek-Parkside area (Philadelphia Department of Public Health, 1989).

Clients who received prenatal care at both health centers were of relatively low medical risk. Women receiving care from Hospital A providers (the control and intervention A groups) are referred to the hospital's High-Risk Clinic if they develop conditions such as gestational diabetes, hypertension, or premature labor; have a multiple pregnancy; or are HIV positive. Hospital A clients age 17 or younger are encouraged to attend the Teen Clinic at the hospital. Prenatal care for clients at the High-Risk and Teen Clinics is provided by obstetric residents. Health Center #4 clients that are cared for by the midwifery practitioners are referred to their physician associate only when the aforementioned conditions appear to be complicating the pregnancy. For example, a cocaine-abusing woman

Table 1

Select Demographic and Socioeconomic Characteristics of the Two Philadelphia Neighborhoods

	Paschall-Kingsessing (#3)	Millcreek-Parkside (#4)
Race, % African American	73%	95%
Age, % 18 to 64 years old	56%	55%
Median Age	27.1	30.7
Percentage of Women of Childbearing Age	46.3%	39.9%
Family Income, % below Poverty Level	26%	38%
Median Family Income	$13,053	$9,189
Percentage of Adult Who are High School Graduates	52%	40%

Note. From Neighborhood Health Profiles: Vol. 3, Southwest Philadelphia (pp. 153-156) and Neighborhood Health Profiles: Vol. 4, West Philadelphia (pp. 203-206) by Philadelphia Health Management Corporation, 1985, Philadelphia: Author.

expecting twins or a woman with severe preeclampsia is sent to the physician (F. Kuber, personal communication, December 19, 1991). Based on these selection criteria, the population of the midwifery practice at Health Center #4 (the intervention A + B group) may be at a slightly higher risk of adverse outcomes than Hospital A's Health Center clients (the control and intervention A groups). Because clients referred to Hospital A's High-Risk or Teen Clinic or to the physician associated with the midwifery practice are at an increased risk of adverse maternal or infant outcomes, they were excluded from the study. The small number of patients that were expected to be referred to these three sites during the study period precluded a meaningful analysis. Yet due to this exclusion, the incidence of LBW infants for pregnant women who initially presented at Health Centers #3 and #4 that will be reported in this study's findings is likely to be lower than the true rate.

Instrumentation

Most of the data required for this study was obtained from prenatal providers and hospital billing and medical records. The medical record data extraction form is illustrated in Appendix H. The only instrument used in this study was the Kessner index (Appendix I). This index categorizes prenatal care as adequate, intermediate, or inadequate based on three factors: (a) the month in which prenatal care was begun, (b) the number of prenatal visits,

and (c) the infant's estimated gestational age at birth (Kessner, 1973). Although no reliability or validity data was found, the index is considered to be a precise measure of prenatal care and is frequently used by researchers (Brown, 1988; Giblin, Poland, & Ager, 1990).

Data Collection Procedure

Data for this study were obtained from four sources: (1) prenatal records of the healthcare provider groups, (2) medical and billing records of outpatient and inpatient services provided to women from the study areas that delivered at the two hospitals, (3) billing records for infants' birth hospitalization, and (4) cost reports from the Department of Public Health, City of Philadelphia and the Maternity Care Coalition (Table 2). The number of prenatal ultrasounds, biophysical profiles (BPPs), and non-stress tests were obtained from examination of the medical and billing records. Charges for hospital services were recorded by categories, such as laboratory, pharmacy, anesthesia, respiratory, radiology, and labor and delivery services, to detect potentially subtle utilization effects that may not be discerned from total charges or length of stay data alone (Finkler et al., 1988). Data extracted from the medical record included the mother's obstetric history present pregnancy course, receipt of additional healthcare services, and labor and delivery information (Appendix H).

Table 2

Charges and Expenses Included in Study

Charges/Expenses	Data Source
Prenatal:	
Basic Maternity Services	City Cost Reports
Maternity Care Advocates	Maternity Care Coalition
Care Coordinators Salary	City
Healthy Beginnings Plus Package	Prenatal Billing Records (individual units of service)
Other Prenatal Charges:	
Emergency Room Visits	Outpatient Billing Records
Hospitalizations	Inpatient Billing Records
Other Diagnostic Tests	Outpatient Billing Records
Professional Fees	Billing Records & Estimation
Hospital Care at Birth:	
Mother & Infant	Inpatient Hospital Bill
Professional Fees for Mother & Infant	Inpatient Hospital Bill, Professional Services Offices, & Estimation

On numerous occasions, the medical record indicated that clients had had an emergency room or labor floor visit for which no record was found on the hospitals' outpatient billing computer tracking system. [Within a few months after a bill is paid or is transferred to bad debt, notation of the event on the computer system is often no longer available. The charge records are permanently maintained on microfiche.] Charges and the number of diagnostic tests for such visits were estimated based on the average charges incurred or tests performed for emergency room/labor floor visits of other clients in the group. Similar estimations were made for missing professional obstetrical and pediatric fees and ultrasound charges.

To maintain an adequate sample size, two women who had received additional prenatal care elsewhere in the area were retained in the intervention A group. When the number of "outside" prenatal visits were known, charges for this care were estimated based on the prevailing rates for Hospital A providers.

In a prospective study design, program participants can be asked to record any additional healthcare services they receive during their pregnancy. Illnesses or injuries during the course of pregnancy may adversely affect the maternal or infant outcome. However, patient reports were not possible in this retrospective evaluation study. In lieu of direct patient reports, any medical record notations

of additional healthcare services were entered on the data extraction form. The charges for these services were estimated based on the respective charge structures of the primary prenatal provider.

Permission was received from the Executive Director of the Maternity Care Coalition of Greater Philadelphia to review the West Philadelphia Community Maternity Project data. The Director of Maternal and Infant Health, Department of Public Health, City of Philadelphia made available cost data relating to prenatal services provided at Health Centers #3 and #4 during the study period. The billing departments of the two hospitals provided the investigator with access to subjects' billing information after the proposal had received Institutional Review Board approval at the respective organizations. Permission was granted by the director of the midwifery practice to review their clients' medical and billing records. Data regarding professional fees associated with the mothers' and infants' delivery/birth hospitalization were obtained from the individual provider groups. WIC participation data was not available; individual client permission is required to access these data.

Hospital records at Hospital A were not obtained after a minimum of three attempts for 1 client in the control group and 1 intervention A client. Prenatal data were missing from the medical records of 3 clients in the control

group and 3 in the intervention A group. Whenever possible the number of prenatal visits was reconstructed from attendance records at the respective clinics. Inpatient hospital charge data was not obtained for one client in the control group and her infant due to the bills being on hold for many months.

Data Analysis

Due to the lack of random assignment of prenatal clients in this study, various sociodemographic characteristics of the three groups were compared to test the possibility that any differences in outcomes might be due to disparities in such characteristics.

To compare utilization of services, charges, and outcomes associated with the three levels of maternity care (i.e. basic services; basic services plus advocacy; and basic services plus advocacy and enriched HBP), a series of one-way analysis of variance (ANOVA) tests were performed. The Tukey-b test was used for post-hoc analyses. These ANOVAs were performed based on the assumption that no self-selection bias occurred at Health Center #4. However, a self-selection bias may have operated at Health Center #4 when women chose between the two healthcare provider groups. Although some sociodemographic variables were examined, the women's choice of providers might have been influenced by factors that were not measured, e.g. self-care attitudes; preference for midwives rather than physicians for delivery;

hospital location; site of a previous delivery, etc. To eliminate the potential bias, a series of t-tests were performed to compare the control group at Health Center #3 to all clients at Health Center #4, the intervention site. The specific variables examined in both the ANOVAs and the t-tests included the following: (a) the week of entry into prenatal care, (b) total number of prenatal visits, (c) number of tests performed, (d) number of emergency room/labor floor visits, (e) total prenatal charges, (f) total and departmental hospital charges for the mothers and infants, (g) total charges incurred by the mother/infant dyad, (h) mothers' and infants' hospital length of stay (LOS), (i) birthweight, and (j) estimated gestational age at birth (EGA). Finally, a series of regression analyses were performed to examine the predictive power of group membership, relevant social and medical variables, and the Kessner index on maternal and infant outcomes.

Sample size was determined based on Cohen's (1988) methodology. Although a medium effect size is often chosen, a more conservative effect size (f=.2) was selected for the ANOVAs in this study because the literature suggests that advocacy may not by itself improve health outcomes. To have power=.80 with f=.2 and alpha=.05, the target sample size was 81 subjects in each of the 3 groups (total n=243). Multiple regression analyses were used to compare outcomes of the three levels of prenatal care: (a) LOS of the

mother, (b) LOS of the infant, (c) infants' birthweight, and (d) infants' EGA at birth. As many as ten independent variables were entered into the regression analyses. To achieve a medium effect size (f^2=.15), power=.8, and alpha=.05 with ten independent variables, the total sample should have 160 subjects (Cohen, 1988). The total sample of prenatal clients in the study was 248.

Besides explicitly addressing the research questions, additional findings related to the study will be reported: (a) collections received for services, (b) cost savings associated with the enriched HBP program, and (c) the adequacy of prenatal care and the incidence of LBW births in the study sample. As mentioned in Chapter 1, this economic evaluation was posed from the perspective of public expense. Most of the data are reported in terms of charges. However, actual public expenditures were less than total charges because the provider groups rarely received the amount charged. Therefore, actual (and estimated) monies collected by the providers for services rendered to the three groups were examined. [Collection information by insurer was not available from some providers. Appendix J illustrates the actual and estimated collection rates that were used. Actual collections were available from the midwifery practice for diagnostic tests performed in the office and HBP charges. Collections for inpatient hospitalizations at both hospitals were available for about 70 percent of

clients. Collections for the remaining clients were estimated based on a comparison of the length of stay, diagnostic related group, and insurer of other clients from the respective hospital.]

Secondly, the intervention A + B group was compared with the intervention A group to examine the costs associated with the enriched HBP program (intervention B). The analysis sought to determine whether increased expenditures for the enriched HBP prenatal program for clients in the intervention A + B group resulted in eventual cost savings to the public by reducing the mothers' and/or infants' hospital LOS.

Finally, the adequacy of prenatal care and the incidence of LBW births in the study sample were examined. One goal of the Community Maternity Project's MCA program is to assist clients in obtaining early and consistent prenatal care, i.e. to receive adequate prenatal care. The related implied goal is to reduce the incidence of LBW births in the area. Thus, the adequacy of prenatal care and the LBW rate in the study sample are reported; the adequacy of prenatal care was defined according to Kessner (Appendix I).

Ethical Considerations

The additional services provided to clients at Health Center #4 reflect increased expenditures by public and private sources at the site which were not within the investigator's control. The only potential risk to clients

who were included in this study was a breach of confidentiality. Client names were used to link the prenatal, hospital, and billing records. However, client information was coded for the data analysis and findings are reported as group data. The key of clients' identification codes was kept in a locked file by the investigator.

CHAPTER IV

Results

The findings of this study will be presented in four major sections: (a) comparison of the three prenatal care groups, (b) comparison of the control group with the combined intervention group, (c) regression analyses of the outcome measures, and (d) additional findings. The last section addresses three topics: (a) collections received for services, (b) cost savings associated with the enriched HBP program, and (c) the adequacy of prenatal care and the incidence of LBW infants in the study sample.

Comparison of the Three Prenatal Care Groups

In this section, the three prenatal care groups are compared as to (a) sociodemographic and medical characteristics and (b) utilization of services, charges for services, and maternal and infant outcomes.

Sociodemographic and Medical Characteristics of the Sample

All women in the study were African American except for 6 of the 93 clients in the control group (6.5%); 1 of the 75 intervention A clients (1.4%); and 3 of the 80 intervention A + B clients (3.8%). These women had relocated from Africa, Jamaica, or Trinidad. Neither the average age nor education of women in the three prenatal care groups was significantly different. [The mean age was 23.7 years for the intervention A + B group and 25.0 years for both the control and the intervention A groups. The average

education of the groups was 12.1 years for intervention A + B group; 11.9 years for intervention A group; and 11.7 years for the control group.]

In regard to medical history, no statistically significant differences were found among the three groups in the number of past pregnancies, past spontaneous abortions, or past premature deliveries (Appendix K). However, clients in the intervention A group had a history of significantly more cesarean deliveries than did the control group (Table 3). The average prenatal hemoglobin was the same for the three groups (11.7). Chi-square analyses found no statistically significant differences among the three groups in gravidity or parity.

The rate of cesarean deliveries for the current pregnancy did not differ significantly in statistical terms among the three prenatal groups. However, the rate varied from 12.9% for the control group to 22.7% for the intervention A group; the caregivers were the same for these two groups. For the intervention A + B group (the midwifery practice), the rate of cesarean deliveries was 17.5%

Maternal social behaviors that have been shown to influence infant birthweight or health were also examined, including tobacco, alcohol, and cocaine use. For clients for whom the amount of tobacco use was specified only as "yes, amount unknown" or "occasional" (n=6; 2%), the data were recoded as an average of 5 cigarettes per day. [In the

Table 3

Medical and Social Risk Factors for the Prenatal Care Groups

	Control	Intervtn. A	Intervtn. A + B
Past # Cesareans, Mean	0.06[a]	0.27[a]	0.15
(S.D.)	(0.44)	(0.68)	(0.42)
n	93	75	80
Tobacco (# cig./day), Mean	1.8[b]	4.9[b]	3.5
(S.D.)	(3.3)	(6.7)	(5.5)
n	93	74	79
Alcohol (# drinks/wk), Mean	0.12	1.89	0.45
(S.D.)	(0.55)	(10.08)	(1.68)
n	92	73	79

[a] Two groups differ significantly (F=3.13, df=2, p=0.045); confirmed by Kruskal-Wallis

[b] Two groups differ significantly (F=6.94, df=2, p=0.001; confirmed by Kruskal-Wallis

study by Olds et al. (1986), women who smoked less than 5 cigarettes per day were labeled nonsmokers; smokers smoked more than 5 per day. Therefore, "yes, amount unknown" or "occasional" tobacco use was conservatively assigned a value of 5 cigarettes per day.] Tobacco use was statistically greater for women in the intervention A group than for women in the control group (4.9 vs. 1.8 cigarettes/day, respectively) (Table 3). To examine alcohol consumption, data from patients for whom the amount of alcohol was specified as "yes, amount unknown" or "occasional" (n=20; 8%) were recoded arbitrarily as an average of 1 drink per week. "Excessive" alcohol use was recoded as 10 drinks per week (n=1). [Although heavy drinking has been defined as 2 or more drinks per day (14 drinks/week), light alcohol intake is not consistently defined (Mills et al., 1984; Mullen & Glenday, 1990).] No statistically significant difference in alcohol consumption was found among the three prenatal groups. Table 4 illustrates the breakdown of tobacco and alcohol consumption by group.

Cocaine use was the third social behavior that was examined. Hospital A providers did not routinely screen prenatal clients for drugs. However, some women were screened during an emergency room or labor floor visit, or an inpatient hospitalization. Of the 23 women from the control group who were screened, 13 percent tested positive for cocaine. This compared to a rate of 41 percent positive

Table 4

Tobacco and Alcohol Consumption by the Prenatal Care Groups

	Control	Intervtn. A	Intervtn. A + B
Tobacco Use:			
n	93	74	79
None	72 %	50 %	61 %
1 - 5 cigarettes/day, occasional, and amount unknown	13 %	19 %	14 %
6 - 10 cigarettes/day	15 %	20 %	20 %
11 - 20 cigarettes/day	0	10 %	5 %
≥ 20 cigarettes/day	0	1 %	0
Alcohol Use:			
n	92	73	79
None	93 %	82 %	80 %
1 - 5 drinks/week, occasional, and amount unknown	7 %	11 %	19 %
6 - 9 drinks/week	0	1 %	0 %
≥ 10 drinks/week and excessive	0	6 %	1 %

tests for the 29 women from the intervention A group who were screened. The midwifery practitioners performed a drug screen routinely on prenatal clients. Twenty-four percent of the 76 intervention A + B clients tested positive for cocaine at least once during their pregnancy. Because of the lack of routine screening, these data were not compared statistically.

Utilization of Services, Charges, and Outcomes

A series of ANOVAs were performed to compare the three prenatal groups simultaneously in terms of utilization of services, charges, and outcomes. [The data are reported in Tables 5, 6, 7 and 8]. All statistically significant results of analyses which failed to meet the ANOVA assumption of homogeneity of variance were confirmed by the more conservative non-parametric Kruskal-Wallis test. Due to large standard deviations of the infants' charge data, a square root transformation was performed on all the infant charge data.

Utilization of Services

Three research questions were posed to compare utilization of services among the three prenatal care groups. The specific variables examined were: (a) week of entry into prenatal care, (b) number of prenatal visits, (c) number of ultrasounds and biophysical profiles (BPPs), (d) number of nonstress tests, and (e) number of emergency room/labor floor visits during the pregnancy. [Because a

BPP includes an ultrasound test, the number of BPPs were combined with the ultrasounds.] The findings are displayed in Table 5. The mean week of entry into prenatal care was not statistically different for the three groups. On average, clients in all three groups entered prenatal care in the second trimester. The mean number of prenatal visits ranged from 6.8 for the intervention A group to 8.1 for the intervention A + B group; the F-value for this ANOVA was statistically significant but no two groups were statistically different. The number of inpatient/emergency room ultrasounds and BPPs performed were statistically fewer for the intervention A + B group than for the other two groups. However, when both the outpatient and inpatient/emergency room ultrasounds and BPPs were totaled, there was no difference among the three groups. Also, the number of nonstress tests performed did not differ statistically among the three groups. The final utilization of service variable that was examined was the number of emergency room/labor floor visits during a pregnancy. Intervention A + B group had statistically fewer visits than did the control group (1.Ø vs. 1.6, respectively). The number of emergency room/labor floor visits did not differ significantly between the control and intervention A groups.

Table 5

Utilization of Services by Prenatal Care Groups

	Control	Intervtn. A	Intervtn. A + B
	n=92-93	n=69-75	n=80
Week of Entry into Prenatal Care, Mean	16.3	19.2	18.4
(S.D.)	(7.6)	(9.5)	(7.7)
Total # Prenatal Visits,[a] Mean	8.0	6.8	8.1
(S.D.)	(3.5)	(4.4)	(3.5)
# Ultrasounds & BPPs Outpatient, Mean [b]	1.7	1.6	2.2
(S.D.)	(1.8)	(1.6)	(1.2)
# Ultrasounds & BPPs Inpatient/ER, Mean	1.1[c]	0.7[d]	0.1[c,d]
(S.D.)	(1.5)	(0.8)	(0.4)
Total # Ultrasounds & BPPs, Mean	2.8	2.4	2.3
(S.D.)	(2.2)	(1.7)	(1.2)
# Emergency Room/ Labor Floor Visits, Mean	1.6[e]	1.2	1.0[e]
(S.D.)	(1.7)	(1.6)	(1.1)

[a] F=3.06, df=2, p=0.049, but no two groups differ significantly; Kruskal-Wallis p=0.062

[b] F=3.08, df=2, p=0.048, but no two groups differ significantly

[c,d] Two groups differ significantly (F=18.63, df=2, p=0.000; confirmed by Kruskal-Wallis

[e] Two groups differ significantly (F=3.77, df=2, p=0.025; confirmed by Kruskal-Wallis

Charges for Services

Four research questions were posed to compare the charges incurred by the three groups for prenatal and hospital services. The variables examined were: (a) total prenatal charges, (b) total and departmental hospital charges for the mothers, (c) total and departmental hospital charges for the infants, and (d) grand total of all charges incurred for prenatal and hospital care of the mothers and infants. Significant findings are illustrated in Tables 6 and 7.

The first charge variable examined was total prenatal charges, which included diagnostic and professional fees; costs for the health center providers; and cost for the MCAs. Total prenatal charges were significantly higher for the intervention A + B group ($4,988) as compared with both the control ($4,165) and intervention A ($3,590) groups (Table 6). Total prenatal charges for the control and intervention A groups did not differ significantly.

The second set of charge variables examined were mothers' total and departmental hospital charges (Table 6). Mothers' total hospital charges were significantly lower for the intervention A + B group as compared with both the control and intervention A groups, by $1,442 and $1,755 respectively. In examining the individual departmental charges, the intervention A + B group had significantly lower room and pharmacy charges than both the control

Table 6

Mothers' Prenatal and Hospitalization Charges for Prenatal Care Groups

	Control	Intervtn. A	Intervtn. A + B
	n=92-93	n=73-74	n=80
Total Prenatal Charges ($), * Mean	4,165[a]	3,590[b]	4,988[a,b]
(S.D.)	(4,579)	(3,804)	(3,488)
Hospital Charges & Tests:			
Total Charges ($), Mean	6,042[c]	6,355[d]	4,600[c,d]
(S.D.)	(4,339)	(3,058)	(1,929)
No. of Tests, Mean	10.2	9.5	8.5
(S.D.)	(18.4)	(7.6)	(6.8)
Test Charges ($), Mean	930[e]	822	450[e]
(S.D.)	(1,642)	(621)	(387)
Room Charges ($), Mean	2,445[f]	2,526[g]	1,469[f,g]
(S.D.)	(1,872)	(1,471)	(626)
Pharmacy Charges ($), Mean	523[h]	713[i]	225[h,i]
(S.D.)	(737)	(781)	(339)

* Significant differences based on square root transformation of the raw data

[a,b] Two groups differ significantly (F=6.21, df=2, p=0.002)

[c,d] Two groups differ significantly (F=6.28, df=2, p=0.002)

[e] Two groups differ significantly (F=4.51, df=2, p=0.012)

[f,g] Two groups differ significantly (F=13.28, df=2, p=0.000)

[h,i] Two groups differ significantly (F=11.08, df=2, p=0.000)

Table 6 (continued)

Mothers' Prenatal and Hospitalization Charges for Prenatal Care Groups

	Control	Intervtn. A	Intervtn. A + B
	n=92	n=74	n=80
Hospital Charges & Tests (continued):			
Labor & Delivery Charges ($) Mean	1,285[j]	1,361[k]	1,812[j,k]
(S.D.)	(867)	(698)	(828)
Anesthesia Chgs.($), Mean	301	359[l]	219[l]
(S.D.)	(230)	(229)	(317)
Hospital Professional Fees ($), Mean	2,665	2,758[m]	2,036[m]
(S.D.)	(850)	(1,084)	(630)

[j,k] Two groups differ significantly (F=10.24, df=2, p=0.000)

[l] Two groups differ significantly (F=5.60, df=2, p=0.004)

[m] Two groups differ significantly (F=16.37, df=2, p=0.000)

Table 7 *

Infants' Hospitalization Charges for Prenatal Care Groups

	Control	Intervtn. A	Intervtn. A + B
	n=92	n=74	n=80
Total Charges ($), Mean	8,975[a]	11,001[b]	2,674[a,b]
(S.D.)	(33,313)	(37,252)	(9,110)
Room Charges ($), Mean	3,821[c]	4,402[d]	1,261[c,d]
(S.D.)	(12,787)	(12,228)	(2,630)
# Radiologic Tests, Mean	0.38	0.80	0.26
(S.D.)	(2.27)	(3.90)	(1.37)
Radiology Charges ($), Mean	70	148[e]	27[e]
(S.D.)	(435)	(625)	(138)
Central Supply Charges ($), Mean	2,269[f]	2,720[g]	229[f,g]
(S.D.)	(8,036)	(7,877)	(786)
Professnl. Charges ($), Mean	1,853	2,600[h]	732[h]
(S.D.)	(4,600)	(7,100)	(845)

* All significant differences based on square root transformation of the raw data

[a,b] Two groups differ significantly (F=4.71, df=2, p=0.010)

[c,d] Two groups differ significantly (F=4.36, df=2, p=0.014)

[e] Two groups differ significantly (F=3.45, df=2, p=0.033)

[f,g] Two groups differ significantly (F=11.71, df=2, p=0.000)

[h] Two groups differ significantly (F=6.41, df=2, p=0.002)

and intervention A groups. In contrast, the intervention A + B group had significantly higher labor and delivery charges than both the other two groups. Hospital anesthesia charges and professional fees were significantly lower for the intervention A + B group as compared to the intervention A group. The difference in anesthesia charges can be attributed to the less frequent use of epidural or general anesthesia for the intervention A + B group; 54 percent of the intervention A + B group received anesthesia compared to 78 percent of the intervention A group. Neither the total nor the departmental mothers' hospital charges differed significantly between the control and intervention A groups.

The third set of charge variables examined were infants' total and departmental hospital charges (Table 7). [The statistically significant results reported in Table 7 are from analyses of a square root transformation of the raw data.] Infants' mean total hospital charges for the intervention A + B group were significantly lower than both the control and the intervention A groups by $6,301 and $8,327, respectively. On the departmental level, room and central supply charges were significantly lower for the intervention A + B group than for the other two groups. Also, radiology and professional charges for the intervention A + B group were significantly lower than those of the intervention A group. Neither the total nor the

departmental infants' hospital charges differed significantly between the control and intervention A groups.

Finally, all the mothers' and infants' prenatal and hospital charges were added to the prenatal care costs incurred by the city and the Maternity Care Coalition (Table 8). The grand total of these charges and costs did not differ significantly between the control group and either of the two intervention groups. However, the grand total for the intervention A + B group was significantly lower than that of the intervention A group.

Maternal and Infant Outcome Measures

Table 9 displays the findings of the ANOVAs of the maternal and infant outcome measures--mothers' and infants' hospital length of stay (LOS), infants' birthweight, and infants' EGA at birth. Outcome measures for the two intervention groups did not differ significantly from those of the control groups. However, mothers and infants in the intervention A + B group had statistically significantly shorter hospital stays than did those in the intervention A group. The EGA of infants in the intervention A + B group was also statistically longer than that of the intervention A group but the difference has little clinical relevance since the EGA of both groups is considered full-term (38 weeks or more).

Table 8

Grand Total of All Maternal and Infant Care Charges and Costs

	Control	Intervtn. A	Intervtn. A + B
	n=92	n=74	n=80
Grand Total of All Mother & Infant Charges with City & Maternity Care Coalition Costs $			
Mean	23,716	26,481[a]	15,031[a]
(S.D.)	(38,976)	(44,914)	(11,386)
Range	6,811- 305,499	6,342- 366,535	6,615- 96,080

[a] Two groups differ significantly (F=3.96, df=2, p=0.02 on square root transformation; confirmed by Kruskal-Wallis)

Table 9

Maternal and Infant Outcomes for Prenatal Care Groups

	Control	Intervtn. A	Intervtn. A + B
	n=92-93	n=74-75	n=80
Mothers' Hospital Length of Stay at Birth, Mean	3.2	3.6[a]	2.6[a]
(S.D.)	(1.9)	(2.1)	(1.1)
Infants' Hospital Length of Stay, Mean	4.6	5.8[b]	3.0[b]
(S.D.)	(8.1)	(10.4)	(3.1)
Birthweight, Mean	2999	2929	3099
(S.D.)	(650)	(721)	(548)
Est. Gestational Age at Birth, Mean	38.0	37.7[c]	38.8[c]
(S.D.)	(2.7)	(3.5)	(2.4)

[a] Two groups differ significantly (F=5.91, df=2, p=0.003; confirmed by Kruskal-Wallis)

[b] Two groups differ significantly on square root transformation (F=4.19, df=2, p=0.016; confirmed by Kruskal-Wallis)

[c] Two groups differ significantly (F=3.24, df=2, p=0.041)

Comparison of the Control and Combined Intervention Groups

Few differences were found among the three prenatal groups in terms of sociodemographic and medical characteristics. However, clients at Health Center #4 chose between two groups of healthcare providers. This lack of random assignment to groups introduced the possibility of a self-selection bias at the intervention site. Women in the two groups might differ in some unmeasured characteristic(s) that would bias the maternal and/or infant outcome measures. To eliminate the possible effects of such a bias, the two intervention groups at Health Center #4 were combined. Then all intervention clients in the combined group were compared with the control group in a series of two group t-tests of independent samples. These comparisons assessed the effects of the blend of maternity enhancements offered at Health Center #4. Table 10 summarizes the significant findings.

In regard to social and medical variables, tobacco use and the number of past cesarean deliveries was statistically greater for the combined intervention group as compared to the control group. Clients in the control group began prenatal care 2.2 weeks earlier than those in the intervention group, although both groups began care in the second trimester. [Chi-square analysis of the adequacy of prenatal care as defined by the Kessner index found no statistically significant difference between the two groups (p=0.07).]

Table 10

Comparison of Control Group with All Intervention Clients

	Control Mean (SD)	All Intervtn. Mean (SD)	t	p
	n=93	n=152-154		
Tobacco (# cig/day)	1.8 (3.3)	4.1 (6.1)	-3.79	.00
# Past Cesareans	.06 (.44)	.21 (.57)	-2.22	.03
Began Care (week)	16.3 (7.6)	18.5 (8.8)	-2.11	.04
# ER Visits	1.6 (1.7)	1.1 (1.4)	2.38	.02
# Ultrasounds & BPPs, Inpatient/ER	1.1 (1.5)	0.4 (0.7)	4.20	.00
Prenatal Ultrasound, BPP, NST Charges	$ 1107 (1130)	835 (828)	2.17	.03
Room Charge, Mom	$ 2445 (1872)	1977 (1231)	2.14	.03
Labor/Deliv Chrg.	$ 1285 (867)	1595 (799)	-2.85	.01
Total Professional Fees, Mom	$ 3360 (1271)	3001 (1301)	2.11	.04
City & CMP Charge	$ 513 (229)	1655 (1134)	-12.1	.00
Payment for Delivery Hospitalization, Mom	$ 4080 (1995)	3200 (2223)	3.12	.00
Outcome Measures:				
Mothers' Hospital Length of Stay	3.2 (1.9)	3.1 (1.7)	.44	.66
Infants' Hospital Length of Stay	4.6 (8.2)	4.4 (7.7)	.24	.81
Birthweight	2999 (650)	3030 (622)	-.37	.71
Est. Gestational Age at Birth	38.0 (2.7)	38.4 (2.8)	-1.13	.26

The next step in comparing the control group with the combined intervention group was to examine the utilization of and charges for services. The number of emergency room/labor floor visits was statistically lower for the combined intervention group as compared with the control group (Table 1Ø). The number of inpatient/emergency room ultrasounds and BPPs performed for the intervention group was statistically fewer than the number performed for the control group, but the total number of such tests during the pregnancy was similar for both groups. The groups were also similar in the total number of prenatal tests performed and the number of tests performed on both the mothers and infants while hospitalized. Consistent with the findings of similar utilization of services, few differences were found between the groups in charges incurred for prenatal and hospital care. The average hospital room charge for women in the control group was statistically greater than that for women who received the intervention(s) in spite of a similar length of stay. [The latter group delivered at either Hospital A or B whereas all clients in the control group delivered at Hospital A.] In contrast, the intervention group's labor and delivery charges were significantly higher than those of the control group. The charges incurred by the city and the Community Maternity Project for prenatal care at the two sites were significantly greater for the intervention group as compared with the control group ($1655

vs. $513). Yet, when all the charges incurred for the mothers' and infants' prenatal and hospital care were totaled, the two groups did not differ significantly.

The final step in comparing the control and combined intervention groups was to examine outcomes. The two groups were similar in infant birthweight; EGA at birth; and mothers' and infants' hospital length of stay.

Regression Analyses of Outcome Measures

A series of multiple regression analyses sought to examine the predictive power of group membership, relevant social and medical variables, and the Kessner index on maternal and infant outcomes. Three models were tested for each outcome using forced entry: (a) group membership alone, (b) group membership plus social and/or medical variables, and (c) group membership, social and/or medical variables, and the Kessner index. The three prenatal groups were entered into the regression equations using orthogonal coding with two vectors (Munro, Visintainer, & Page, 1986). [The t-value of vector 1 tests the difference between the mean of all clients in the two intervention groups and the mean of the control group. The t-value of vector 2 tests the difference between the means of the two intervention groups.] The three categories of the Kessner index were entered into the regression equations using dummy coding with two vectors. [The t-value of the Kessner 1 vector tests the difference between the mean of clients categorized

as receiving inadequate prenatal care with the mean of clients categorized as receiving adequate prenatal care. The t-value of the Kessner 2 vector tests the difference between the mean of clients categorized as receiving an intermediate level of prenatal care with the mean of those categorized as receiving adequate prenatal care.] The outcome measures included the mothers' hospital LOS; infants' LOS; estimated gestational age at birth; and birthweight.

With mothers' hospital LOS as the dependent variable, only 4.6% of the variance was explained by group membership (Table 11). The difference in the LOS for the two intervention groups was the significant contributor to R^2. The relevant social and medical variables that were considered in model 2 were type of delivery; alcohol use; tobacco use; laceration; episiotomy; and number of past cesarean deliveries (Table 12). All but the last variable were entered as dichotomous variables. The explained variance improved to 32.0% with the only additional significant contributor being the type of delivery. [The LOS for women who had a cesarean delivery was 1.6 to 3.0 days longer than that of women with vaginal deliveries in their respective group.] In the final model, the Kessner index was added to the previous list of variables

Table 11

Regression Analysis for Mothers Length of Stay: Groups Alone

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	.4843	.1420	3.41	.001
Vector 1 [b]	.0287	.0771	.37	.710
Constant	3.1255	.1126	27.76	.000

Multiple R	.215	Analysis of Variance:	
R Square	.046	Regression DF:	2
Adjusted R Sq	.038	Residual DF:	244
Stand. Error	1.761	F=5.916	p=.003

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

Table 12

Regression Analysis for Mothers Length of Stay: Groups Plus Relevant Social and Medical Variables

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	.4125	.1325	3.11	.002
Vector 1 [b]	.0812	.0697	1.17	.245
Type of Delivery	1.2533	.1500	8.36	.000
Alcohol Use	-.1133	.3227	-.35	.726
Laceration	.0557	.2193	.25	.800
Episiotomy	.0544	.2473	.22	.826
Tobacco Use	.0270	.2324	.12	.908
Past Cesarean	.0087	.1954	.05	.964
Constant	1.4099	.2985	4.72	.000

Multiple R	.566	Analysis of Variance:	
R Square	.320	Regression DF:	8
Adjusted R Sq	.297	Residual DF:	234
Stand. Error	1.513	F=13.781	p=.000

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

(Table 13). R^2 was 32.6% with this addition; the Kessner index did not contribute significantly.

The second dependent variable considered was the infants' LOS. [Because the data for this variable were highly skewed, a square root transformation was used.] Group membership accounted for only 3.3% of the variance, with the significant contributor being the difference in the LOS for the two intervention groups (Table 14). Once other variables were added, group membership was no longer significant (Table 15). The significant contributors to the infants' LOS in model 2 were EGA at birth and birthweight with an R^2 of 37.2%. As expected, these two variables were negatively correlated with the LOS. Adding the Kessner index to the analysis resulted in an R^2 of 37.4% (Table 16). The significant contributors to R^2 in this third model were the same two variables as in model 2, EGA and birthweight.

Table 13

Regression Analysis for Mothers Length of Stay: Groups Plus Relevant Social and Medical Variables and Kessner Index

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	.4457	.1353	3.29	.001
Vector 1 [b]	.0718	.0709	1.01	.312
Type of Delivery	1.2401	.1519	8.16	.000
Alcohol Use	-.1377	.3296	-.42	.676
Laceration	.0681	.2223	.31	.760
Tobacco Use	.0396	.2342	.17	.866
Past Cesarean	.0278	.1970	.14	.888
Episiotomy	-.0093	.2512	-.04	.971
Kessner 2 [c]	.0943	.2404	.39	.695
Kessner 1 [d]	-.2782	.2764	-1.01	.315
Constant	1.4704	.3525	4.17	.000

Multiple R	.571	Analysis of Variance:	
R Square	.326	Regression DF:	10
Adjusted R Sq	.296	Residual DF:	229
Stand. Error	1.520	F=11.061	p=.000

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

[c] Kessner 2 compares clients categorized as receiving intermediate prenatal care with those categorized as receiving adequate prenatal care.

[d] Kessner 1 compares clients categorized as receiving inadequate prenatal care with those categorized as receiving adequate prenatal care.

Table 14

Regression Analysis for Infants Length of Stay: Groups Alone

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	.2251	.0790	2.85	.005
Vector 1 [b]	.0194	.0431	.45	.653
Constant	1.8637	.0627	29.71	.000

Multiple R	.183	Analysis of Variance:	
R Square	.033	Regression DF:	2
Adjusted R Sq	.025	Residual DF:	243
Stand. Error	.980	F=4.191	p=.016

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

Table 15

Regression Analysis for Infants Length of Stay: Groups Plus Relevant Social and Medical Variables

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	.1117	.0643	1.74	.084
Vector 1 [b]	-.0069	.0352	-.19	.846
Est. Gest. Age	-.1584	.0266	-5.94	.000
Birthweight	-2.65E-04	1.20E-04	-2.21	.028
Tobacco Use	-.1137	.1196	-.95	.343
Alcohol Use	-.0970	.1652	-.59	.557
Constant	8.7616	.7971	10.99	.000

Multiple R	.610	Analysis of Variance:	
R Square	.372	Regression DF:	6
Adjusted R Sq	.356	Residual DF:	234
Stand. Error	.777	F=23.150	p=.000

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

Table 16

Regression Analysis for Infants Length of Stay: Groups Plus Relevant Social and Medical Variables and Kessner Index

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	.1207	.0660	1.83	.069
Vector 1 [b]	-.0106	.0361	-.30	.768
Est. Gest. Age	-.1579	.0269	-5.87	.000
Birthweight	-2.57E-04	1.22E-04	-2.12	.036
Tobacco Use	-.1075	.1210	-.89	.375
Alcohol Use	-.1135	.1687	-.67	.502
Kessner 2 [c]	.0626	.1253	.50	.618
Kessner 1 [d]	-.0795	.1413	-.56	.574
Constant	8.7104	.8201	10.62	.000

Multiple R	.612	Analysis of Variance:	
R Square	.374	Regression DF:	8
Adjusted R Sq	.352	Residual DF:	229
Stand. Error	.783	F=17.098	p=.000

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

[c] Kessner 2 compares clients categorized as receiving intermediate prenatal care with those categorized as receiving adequate prenatal care.

[d] Kessner 1 compares clients categorized as receiving inadequate prenatal care with those categorized as receiving adequate prenatal care.

The third dependent variable examined by regression analyses was EGA. With group membership as the only independent variables, the analysis approached significance at p=.Ø6 (Table 17). The difference in EGA of the two intervention groups was the relevant contributor, but only accounted for 2.3% of the variance. The analysis was also not significant with the addition of alcohol and tobacco use (Table 18). Adding the Kessner index to the list of independent variables resulted in a statistically significant analysis although the explained variance was low, 5.5% (Table 19).

The fourth dependent variable examined was infant birthweight. The analysis was not significant when group membership was the only independent variable (p=.3). When some social and medical variables were added to the analysis, the results were statistically significant although no single variable was significant (Table 2Ø). The explained variance was low, only 4.8%. Adding the Kessner index to the analysis improved the R^2 to 6.6%; the index was the only statistically significant variable (Table 21).

Table 17

Regression Analysis for Estimated Gestational Age at Birth: Groups Alone

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	-.4735	.2255	-2.10	.037
Vector 1 [b]	-.1321	.1222	-1.08	.281
Constant	38.2319	.1785	214.12	.000

Multiple R	.151	Analysis of Variance:	
R Square	.023	Regression DF:	2
Adjusted R Sq	.015	Residual DF:	243
Stand. Error	2.787	F=2.855	p=.059

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

Table 18

Regression Analysis for Estimated Gestational Age at Birth: Groups Plus Social Variables

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	-.4498	.2288	-1.97	.051
Vector 1 [b]	-.1669	.1255	-1.33	.185
Tobacco Use	-.4902	.4275	-1.15	.253
Alcohol Use	-.4084	.5875	-.69	.488
Constant	38.4937	.2305	166.99	.000

Multiple R	.187	Analysis of Variance:	
R Square	.035	Regression DF:	4
Adjusted R Sq	.019	Residual DF:	237
Stand. Error	2.786	F=2.157	p=.075

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

Table 19

Regression Analysis for Estimated Gestational Age at Birth: Groups Plus Social Variables and Kessner Index

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	-.4998	.2320	-2.16	.032
Vector 1 [b]	-.1753	.1272	-1.38	.170
Tobacco Use	-.5359	.4276	-1.25	.211
Alcohol Use	-.1994	.5954	-.34	.738
Kessner 2 [c]	-1.0021	.4377	-2.29	.023
Kessner 1 [d]	-.5208	.5002	-1.04	.299
Constant	39.0981	.3745	104.40	.000

Multiple R	.234	Analysis of Variance:	
R Square	.055	Regression DF:	6
Adjusted R Sq	.030	Residual DF:	232
Stand. Error	2.779	F=2.250	p=.039

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

[c] Kessner 2 compares clients categorized as receiving intermediate prenatal care with those categorized as receiving adequate prenatal care.

[d] Kessner 1 compares clients categorized as receiving inadequate prenatal care with those categorized as receiving adequate prenatal care.

Table 20

Regression Analysis for Birthweight: Groups Plus Social and Medical Variables

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	-57.1574	51.3017	-1.11	.266
Vector 1 [b]	-23.6425	28.0410	-.84	.400
Alcohol Use	-199.5575	131.6979	-1.51	.131
Tobacco Use	-127.2580	95.4187	-1.33	.184
Prev. LBW Infant	-69.7400	62.6022	-1.11	.266
Constant	3114.2135	52.0654	59.814	.000

Multiple R	.219	Analysis of Variance:	
R Square	.048	Regression DF:	5
Adjusted R Sq	.028	Residual DF:	237
Stand. Error	622.817	F=2.394	p=.038

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

Table 21

Regression Analysis for Birthweight: Groups Plus Social and Medical Variables and Kessner Index

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	-73.7346	51.6431	-1.43	.155
Vector 1 [b]	-23.8882	28.3046	-.84	.400
Tobacco Use	-146.4081	95.4253	-1.53	.126
Alcohol Use	-154.7464	132.2135	-1.17	.243
Prev. LBW Infant	5.0754	83.5062	.06	.952
Kessner 2 [c]	-251.6992	98.0032	-2.57	.011
Kessner 1 [d]	-103.3458	111.4840	-.93	.355
Constant	3249.2752	83.4986	38.91	.000

Multiple R	.256	Analysis of Variance:	
R Square	.066	Regression DF:	7
Adjusted R Sq	.038	Residual DF:	232
Stand. Error	619.132	F=2.334	p=.026

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

[c] Kessner 2 compares clients categorized as receiving intermediate prenatal care with those categorized as receiving adequate prenatal care.

[d] Kessner 1 compares clients categorized as receiving inadequate prenatal care with those categorized as receiving adequate prenatal care.

One final set of analyses sought to examine variables that would predict the total number of tests performed on the mother/infant dyad during the pregnancy and delivery hospitalization. Group membership did not significantly predict the number of tests (p=.7). When five demographic and medical variables were added, the infants' LOS and EGA were the significant predictors of the number of tests performed (Table 22). Adding the Kessner index did not improve the predictive power of the regression equation.

Additional Findings

Collections Received for Services

In the current health care environment, medical charges are only rarely paid in full by insuring agencies. Therefore, one analysis was added to address the issue of actual expenditures by the insurers for health services that were provided. [Appendix L illustrates the type and frequency of insuring agencies by group.] The collections (actual and estimated) for all services were combined with the expenses incurred by the city and the Maternity Care Coalition to compare the three prenatal care groups. The total collections received by the providers for the three groups did not differ significantly (mean of $10,714 for the control group; $10,175 for intervention A group; and $9,517 for the intervention A + B group). This small difference in collections is a stark contrast to the $11,450 difference in total charges between the intervention A and

Table 22

Regression Analysis for Total Number of Tests--Mother & Infant: Groups Plus Demographic and Medical Variables

Variable	b wt.	SE b	t	Sig t
Vector 2 [a]	-4.5847	2.9446	-1.56	.121
Vector 1 [b]	-.7211	1.5511	-.47	.643
Infants LOS	4.8488	.4003	12.11	.000
Est. Gest. Age	-3.2876	1.3427	-2.45	.015
Birthweight	-8.08E-04	.0054	-.15	.881
Mothers LOS	-.1733	1.3641	-.13	.899
Mothers Age	.0299	.4091	.07	.942
Constant	152.6091	46.1342	3.31	.001

Multiple R	.784	Analysis of Variance:	
R Square	.614	Regression DF:	7
Adjusted R Sq	.603	Residual DF:	236
Stand. Error	35.031	F=53.648	p=.000

[a] Vector 2 compares the intervention A group with the intervention A + B group.

[b] Vector 1 compares the control group with the two intervention groups.

intervention A + B groups (Table 8). The small difference in collections is probably attributable to the predominance of public funding for healthcare in this sample. As illustrated in Appendix J, often only one-fourth of billed charges are received by providers.

Cost Savings Associated with the Enriched HBP Program

To determine whether the enriched HBP program resulted in cost savings, an additional comparison of the intervention A and the intervention A + B groups was performed. All prenatal charges/expenses were compared with the outcome charges, i.e. mothers' and infants' hospitalizations. [The prenatal charges included diagnostic and professional fees; costs for the clinic providers; and Community Maternity Project expenses for the MCAs. Determination of the average cost per prenatal visit is described in Appendix M.] Prenatal charges averaged $3,590 for the intervention A group compared to $4,988 for the intervention A + B group, a difference of $1,398/client. However, the shorter hospital stays of clients in the intervention A + B group resulted in an average saving for hospitalization of $4,264. The overall saving in charges for the intervention A + B group over the intervention A group was $2,866 per client. These savings were achieved while still offering many additional services not immediately available to the intervention A group, including counseling in nutrition, smoking cessation, and substance

abuse (Tables 23 and 24). Most clients in the intervention A + B group received at least one counseling session with the dietitian and the social worker. Seventy percent of the clients attended either labor preparation or labor review classes.

Adequacy of Prenatal Care and LBW Incidence

Although many components of prenatal care charges and outcomes have been discussed, two additional topics require notation: (a) the adequacy of prenatal care and (b) the incidence of LBW births in the study sample.

One goal of the Community Maternity Project at Health Center #4 is to assist clients in obtaining consistent, rather than episodic, prenatal care. Implicit in this statement is a desire to reduce the number of prenatal clients who obtain inadequate prenatal care as defined by Kessner (Appendix I). Many prenatal clients in this study obtained an inadequate level of care according to this definition--ranging from 17 percent of the control group to 36 percent of the intervention A group (Table 25). Efforts by the HBP nurse care coordinator from the midwifery practice may have contributed to the somewhat lower 25 percent inadequate care rate for this intervention A + B group. According to client records, 37 of the 80 women in the intervention A + B group were sent an average of 2 letters each regarding missed appointments. In addition, an average of 1.6 phone calls were made to 41 clients for

Table 23

Healthy Beginnings Plus Referrals for Clients in Intervention A + B Group

Nature of Referral	Number of Clients Referred
Nutrition	74
Labor Preparation Classes	54
Prenatal Parenting	27
Social Work Intake	25
Substance Abuse Counseling	21
Psychosocial Counseling	17
Labor Review Classes	17
Smoking Cessation	6
Home Assessment	3
Teen Classes	2
Other (client education, prenatal exercises, etc.)	5

Table 24

Services Provided to Clients in the Intervention A + B Group

Service	No. of Clients Using Service	Ave. Number of Services/Client
Labor Preparation	41	3.7 classes
Labor Review	15	1.9 classes
Teen Classes	2	2.0
Prenatal Classes	1	1.0
Nutrition Counseling	74	1.8 contacts
Social Work Contacts	66	2.7 contacts

Table 25

Comparison of the Prenatal Care Groups' Kessner Index

	Kessner Index		
	Inadequate Prenatal Care	Intermediate Prenatal Care	Adequate Pren. Care
Group			
Control	16/92 (17%)	47/92 (51%)	29/92 (32%)
Intervtn. A	26/73 (36%)	27/73 (37%)	20/73 (27%)
Intervtn. A+B	20/79 (25%)	42/79 (53%)	17/79 (22%)

X^2=9.38, df=4, p=.052; N=244

missed appointments. Direct comparison with clients of Hospital A providers was not possible due to differences in record keeping. However, notes in Hospital A's prenatal clinic records indicated that the nurse practitioners made telephone calls to many clients for missed appointments.

The second finding of interest is the rate of LBW infants in this relatively low medical risk sample. The rate of LBW deliveries was 15 percent for both the control group and the intervention A + B group; the rate was 19 percent for the intervention A group. [These differences were not statistically significant.] Of the 40 LBW infants from the total sample of 248, 13 were small for gestational age (33%). The remaining 27 were average size for their gestational age.

Having described the findings of this study, the next chapter will discuss the results in relation to program goals and the related literature.

CHAPTER V

This final chapter is divided into six sections: (a) a summary of study findings, (b) the economic evaluation, (c) assessment of the interventions, (d) comparison with previous research, (e) limitations, and (f) conclusions and recommendations.

Summary

The purpose of this study was to compare the costs and outcomes of two programs that enhanced maternity services at Health Center #4 to the costs and outcomes of basic maternity services provided at Health Center #3. The two program enhancements were advocacy and casefinding services provided by the Maternity Care Advocates (intervention A) and the enriched Healthy Beginnings Plus program (intervention B). Three client groups were compared: (a) a control group which received basic maternity services, (b) intervention A group which received basic services plus advocacy, and (c) intervention A + B group which received basic services, advocacy, and the enriched HBP package.

In the first set of analyses, the three groups were compared as to utilization of services such as the number of ultrasounds, BPPs, nonstress tests, and emergency room/labor floor visits. Utilization of services was similar for the three groups except for the significantly fewer number of emergency room/labor floor visits made by the

intervention A + B group as compared with the control group (1.0 vs. 1.6 visits, respectively).

The next set of analyses compared the three groups in terms of charges incurred for care: (a) prenatal, (b) departmental and total hospital charges for mothers and infants, and (c) grand total of all charges and expenses incurred for care of the mothers and their infants. Charges and expenses for the control and intervention A groups were similar in all of these analyses. In contrast, prenatal charges for the intervention A + B group were statistically higher than those of the control group. For delivery services, the intervention A + B group had statistically significantly lower charges in the following areas when compared with the control group: (a) mothers' room, pharmacy, and total hospital charges, and (b) infants' room, central supply, and total hospital charges. However, when the expenses incurred by the city and the Maternity Care Coalition were added to the prenatal and hospital charges to calculate the grand total, the intervention A + B and control groups were no longer statistically different. These findings indicate that the increased prenatal expenditures for the intervention A + B group were offset by their lower maternal and infant hospital charges to render the group's grand total of charges and expenses no different from those of the control group. The intervention A and control groups were similar on all charge measures.

The final comparison of the three client groups was maternal and infant outcomes: (a) mothers' hospital LOS, (b) infants' hospital LOS, (c) birthweight, and (d) EGA at birth. Outcomes of the two intervention groups did not differ statistically from the control group.

A series of regression models were tested to study the influence of group membership on the maternal and infant outcomes and the total number of tests performed. Group membership was a significant contributor to the explained variance of the mothers' and infants' LOS due to differences between the intervention A and intervention A + B groups. However, less than 5% of the variance was explained by group membership. Group membership did not contribute significantly to the prediction of EGA, birthweight, or the total number of tests. Most of the significant outcome predictors were consistent with previous reports (Clark et al., 1991; McCormick, 1985). Adding the type of delivery to group membership raised the predictive power to 32% for mothers' LOS. EGA and birthweight explained 37% of the variance in an infant's LOS. For the prediction of EGA at birth, the Kessner index and differences between the two intervention groups were the significant variables; the explained variance was 5.5%. The results might have changed if cocaine use could have been tested. The Kessner index was the only variable which contributed significantly to the prediction of infant birthweight (R^2=.066) even though group

membership, alcohol use, tobacco use, and history of a previous LBW infant were entered into the analysis first. An infant's hospital LOS and EGA were the significant predictors of the total number of tests performed on the mother/infant dyad (R^2=.61).

The Economic Evaluation

As described in Chapter II, an economic evaluation of programs compares costs with outcomes. When the program outcomes are similar and costs are the sole measure of resource consumption, a cost-minimization strategy is generally selected, i.e. the program with the lowest cost is chosen. In this study, the measured outcomes of the intervention groups were similar to those of the control group. From the perspective of cost-minimization, the group with the lowest total cost in this study was the intervention A + B group, recipients of both the advocacy and enriched HBP programs (Table 8). This finding must be interpreted cautiously, however, due to differences in providers and hospitals.

The control group received prenatal care from obstetric medical residents and nurse practitioners; they delivered at Hospital A. The intervention A + B group received prenatal care from nurse midwives and nurse practitioners and delivered at Hospital B. Although the mothers' hospital LOS for the control group was not substantially longer than that of the intervention A + B group (3.2 vs. 2.6, respectively),

the difference was sufficient to contribute largely to the statistically significant higher charges for the control group's mothers' total hospital charges. [The mothers' average total hospital charge per day was $1,769 for the intervention A + B group and $1,888 for the control group.] Similarly, the infants' hospital LOS for the control group was not significantly different from that of the intervention A + B group (4.6 and 3.0 days, respectively) but the difference was sufficient to create statistically significantly higher infants' total hospital charges for the control group as compared with the intervention A + B group. [The infants' average total hospital charge per day was $891 for the intervention A + B group compared to $1,951 for the control group even though the number of tests performed was similar for the two groups. Room and daily central supply charges varied substantially for the two hospitals. Thus, the control group's higher infants' total hospital charges are due to a higher hospital charge structure combined with a longer hospital stay.] No reports comparing the hospital LOS of maternity clients of physicians and nurse midwives were found in the literature. Nonetheless, one cannot dismiss the possibility that the disparity in LOS and hospital charges in this study was influenced by the differences in providers and hospitals rather than by the combination of the two interventions. The intervention A + B group may not have been the group with the lowest total

cost if the providers and hospitals had been the same for all three client groups in this study.

Assessment of the Interventions

The two interventions examined in this study were the MCAs (intervention A) and the enriched HBP program (intervention B). The best way to isolate the efforts of the MCAs was to compare the control group with the intervention A group; these two groups had the same providers and hospital site. To examine the HBP program alone, the intervention A and intervention A + B groups were compared.

Maternal and infant outcomes of the control and intervention A groups were similar; all charges were also similar. Thus the MCAs' advocacy efforts did not translate into a demonstrable improvement in client outcomes. However, a concurrent study found that the number of women who entered prenatal care in the MCAs' casefinding area during the one-year period was statistically significantly greater than expected by 41 clients (Jenkins, 1993, unpublished dissertation) (Appendix N). Longitudinal studies are needed to determine if this was an isolated one-year event or the beginning of a trend toward improved utilization of prenatal care in the area that may be related to the MCAs' casefinding efforts. In this study, the average cost of the MCAs' services was $303 per prenatal client. If future studies can demonstrate a relationship

between the MCAs' casefinding efforts and utilization of prenatal care, the additional prenatal investment of $303 per client might easily be offset by less morbidity and thus shorter infant hospital stays for women who receive adequate prenatal care versus those who do not (IOM, 1985).

The second intervention at Health Center #4 was the enriched HBP program provided by the midwifery practice. To evaluate the program, the intervention A group was compared with the intervention A + B group (the midwifery practice). Birthweights for infants in the two groups were similar in statistical terms. The intervention A + B group had a statistically significant one-week longer EGA than the intervention A group. However, the difference has little clinical significance because the mean EGA of both groups is considered full-term. The enriched HBP package of prenatal services provided to the intervention A + B group cost the public $1,398 more per client than the services for intervention A clients. However, the shorter hospital stay and lower hospital charge structure for the intervention A + B group resulted in an actual overall charge saving of $2,866 per mother/infant dyad for these clients as compared to intervention A clients. Thus, applying a strictly cost-minimizing strategy, the enriched HBP program provided by the midwifery practice would be preferred over the MCA services. However, this conclusion must be interpreted cautiously due to differences in providers and hospitals (as

described previously) and the potential of a client self-selection bias.

To remove the potential bias in outcomes created by self-selection into groups at Health Center #4, the two intervention groups were combined and then compared with the control group. No significant differences in maternal or infant outcomes were found between the two groups. Also, the average grand total of all prenatal and hospital charges and expenses were no different ($23,716 for the control vs. $20,494 for the combined intervention group). Additional analyses also found that neither the adequacy of prenatal care as defined by Kessner nor the rate of LBW infants for Health Center #4 clients improved over previous levels. For women who remained at Health Center #4 throughout their pregnancy, the rate of inadequate prenatal care was 30 percent and the rate of LBW infants was 17 percent. This compares to the 1989 rates of 21.6 and 16.4 percent, respectively, for this area (Philadelphia Department of Public Health, 1989). The primary reason for the label of "inadequate" was failure to enter prenatal care within the first trimester. Even if the MCAs' efforts contributed to more women receiving prenatal care at Health Center #4 during the study period, many women still failed to obtain early and/or adequate prenatal care.

These findings indicate that the two interventions failed to demonstrate improvements in infant birthweight or

the adequacy of women's prenatal care. However, the combined intervention group had less favorable social and economic conditions when compared with the control group,. They used statistically significantly more tobacco (4.1 vs. 1.8 cigarettes/day) and began prenatal care 2.2 weeks later than women in the control group. Yet, the clinical relevance of the difference in tobacco use is somewhat uncertain because the relationship between one's amount of smoking (dose) and the associated outcomes is not clearly defined (Mullen, 1990). The difference in initiation of prenatal care may also be relatively unimportant because on average both groups initiated care in the second trimester. Cocaine use was higher for the combined intervention group than for the control group, but inconsistent testing precluded analysis of this variable. The number of families with an income below the poverty line is greater in the area in which the intervention groups reside than in the control group's locale (Table 1). A comparison of the outcomes of the control and intervention groups might have been different if all of these socioeconomic differences could have been controlled for in the analyses.

Utilization of most services was similar for the control and combined intervention groups, however clients in the combined intervention group had statistically fewer emergency room/labor floor visits as compared to the control group (1.1 and 1.6 visits, respectively). The increased

availability of prenatal education for clients at Health Center #4 due to the interventions may explain this finding. Possibly frequent and consistent contact with the HBP's nurse care coordinator or attendance at the MCAs' educational programs improved clients' knowledge of how to respond to the normal and abnormal signs and symptoms of pregnancy, including recognition of which events warrant immediate attention from a healthcare provider. Prenatal education for the control group was limited to individual instruction with the care provider during the prenatal visit. Because several providers were employed at the control site, the amount and consistency of prenatal education given to clients is uncertain. Further research is needed to determine whether these differences in utilization of emergency room/labor floor services can be attributed to improvements in health education.

Comparison with Previous Research

Although the MCAs' casefinding efforts may have contributed to an increased number of women who eventually received prenatal care, women in the MCA canvassing area did not begin care any earlier than women in the control group. McCormick et al. (1989) had similar findings. Perhaps increasing local awareness of prenatal services by direct mailings or telemarketing would reach as many women as is presently accomplished by MCA casefinding. With the MCAs large caseloads (85-105 clients), these alternatives may

become the only viable options. Yet, a recent study found that almost 1 in 4 of Hospital A's Health Center #4 clients were in need of permanent housing (Jenkins, 1993, unpublished dissertation). Informing women who do not have permanent housing of prenatal services will be a challenge.

The large caseloads of MCAs in the Community Maternity Project may also prevent them from providing as much social support as was demonstrated by the South Carolina Resource Mothers Program, a program that included monthly home visits (Heins et al., 1987). The adequacy of prenatal care improved significantly for pregnant teenagers in the latter program. The adequacy of prenatal care (as defined by Kessner) for the two intervention groups in the current study was no better than that of the control group. On average, women from all three groups began prenatal care during their second trimester. If casefinding efforts can raise the number of women obtaining prenatal care in the first trimester, an increase in the number of home visits might improve attendance at subsequent prenatal visits. The MCAs will only be able to make more home visits, however, if their caseloads are reduced.

The second program that was examined in this study was nurse care coordination and enhanced HBP services provided by the midwifery practice. Besides consistent contact with a care coordinator, almost all clients in the group received social work and nutrition counseling. In a previous study,

the incidence of LBW births was significantly lower for women who received care coordination compared to those without the service (Buescher et al., 1991). In the current study, clients who received care coordination had a lower LBW rate when compared to Hospital A's clients at the same site (15 vs. 19%, respectively), but the difference was not statistically significant. Additional research with a larger sample would be required to delineate the effectiveness of individual components of the enriched HBP package.

Limitations

This study offers some useful descriptive information for payors and providers of prenatal care in the areas served by Health Centers #3 and #4. However, because the study was a passive observational program evaluation, it was limited by the lack of random assignment; differences in hospital charge structures; shortcomings in program implementation; and inconsistent drug screening. Random assignment of clients to one of the two provider groups at Health Center #4 would have removed the potential of a self-selection bias. Differences in provider groups and the hospital delivery sites may make such assignment difficult, however. The infants' room and central supply charges were disparate for the two hospitals, but quantifying the units of service minimized this shortcoming. The third study limitation was in regard to program implementation. As the

client population increased at Health Center #4, the MCAs had to focus increasingly on advocacy efforts and less on casefinding. Their caseloads were much larger than those reported in the literature and the number of home visits was small. The prenatal provider groups did not consistently receive feedback from the MCAs regarding specific client-related requests. Efforts were made by the MCAs' director to remedy these communication issues. Finally, in the area of health risk, routine drug screening of all clients at the time of delivery would have provided a mechanism to evaluate the influence of illicit substances on maternal and infant outcomes, particularly birthweight and EGA. With reports that suggest an increasing use of illicit substances including cocaine in urban areas (Jones & Lopez, 1990), early identification and treatment of substance abuse is necessary to reduce the potential deleterious effects of these substances--premature births, intrauterine growth retardation, neurological morbidity, etc.

Conclusions and Recommendations

In this study, neither the MCAs nor the enriched HBP program demonstrated improved client outcomes yet they added to the cost of prenatal care. The MCAs' casefinding and advocacy efforts did not improve maternal or infant outcomes, early entry into prenatal care, or the total number of visits obtained by women. However, efforts of the MCAs may have contributed to an increased number of women

receiving prenatal care during the study period. Longitudinal studies are needed to determine whether this finding is an artifact or an actual trend of improved utilization of prenatal care services which can be attributed to the casefinding efforts of the MCAs. If casefinding and advocacy can be shown to increase the number of women who receive **adequate** prenatal care, this small additional investment in prenatal services ($303/client) may be cost effective by reducing the costs of infant morbidity associated with women who receive inadequate care (IOM, 1985). However, in order to perform longitudinal studies, casefinding efforts must be continued. Increasing caseloads have already reduced the time available for MCAs to do door-to-door casefinding. If these constraints persist, consideration may be given to mass media or telemarketing in order to maintain or increase public awareness of the prenatal services which are available.

Nurse care coordination and enhanced social work and nutrition counseling offered by the enriched HBP program did not significantly improve infant birthweight or reduce the incidence of LBW births. Women who received the enriched HBP services had statistically shorter hospital stays and total charges as compared to women who only received the basic services plus advocacy. Of the three prenatal care groups in the study, the group which received the enriched HBP package (plus advocacy) had the lowest total charges and

expenses for prenatal and delivery care. Based on cost-minimization criteria, the latter package of services would be chosen--enriched HBP plus advocacy. However, differences in providers and hospitals preclude an unequivocal conclusion that the enriched HBP program was the primary reason for the shorter stays and lower charges.

Since the beginning of this study, the HBP program has been implemented by all provider groups at Health Centers #3 and #4. Based on the findings of this study, this expansion in prenatal services may not demonstrate improvements in infant birthweight while costing an average of $823 more per client (intervention A + B group vs. control). Although alcohol and tobacco use have been linked to adverse infant outcomes, they were not significant predictors of the four outcomes measured in this study. Further research is required to determine whether the HBP program's goals of early identification and treatment of substance abuse and smoking cessation counseling can demonstrate significant improvements in client outcomes. Nutrition counseling and WIC participation also warrant further investigation. These individual HBP interventions require additional studies with large samples to evaluate both their clinical and cost effectiveness.

Numerous reports have documented the adverse effects of cocaine use during pregnancy. Because of the high incidence of positive cocaine screenings in the midwifery practice's

group, future studies of this population should include routine urine drug screening. Until consistent data is available, the impact of illicit substances on maternal and infant outcomes in this population can only be speculated.

A close assessment of the nurse care coordination role was confounded in this study because of additional services that were offered concurrently. Theoretically, prenatal contact with the care coordinator should encourage postpartum utilization of healthcare services, including well-baby care and family planning. Additional research at the study site could examine these issues.

Hopefully future maternity services programs which seek evaluative research will have fewer of the design limitations present in this study. In regard to the economic appraisal, the fee structures of the sites of inpatient care would preferably be more similar than was the case here. Reducing such dissimilarities would ease interpretation and generalizability of the study findings. Another mechanism to improve generalizability would be to randomly assign clients to groups in order to remove the potential self-selection bias.

Finally, to evaluate the long-term effects of programs such as the Community Maternity Project's MCAs and HBP, longitudinal studies are required. Researchers could examine compliance with well-baby care, adequacy of prenatal care in subsequent pregnancies, reduction in substance

abuse, smoking cessation, and other health-promotion activities.

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APPENDIX A

Outline of the Study

Group:	Control	Intervention A	Intervention A + B
Site:	Health Center #3	Health Center #4	Health Center #4
Providers:	Hospital A's Physicians & Nurse Practitioners	Hospital A's Physicians & Nurse Practitioners	Nurse Midwives & Nurse Practitioners
Intervention:	Basic Maternity Services	Basic Maternity Services & Advocates	Basic Maternity Services & Advocates & Enriched Healthy Beginnings Plus Program
Delivery Site:	Hospital A	Hospital A	Hospital B
Outcome Measurements:	Hospital Length of Stay: Maternal & Infant Infant Birthweight Infant's Estimated Gestational Age at Birth		

APPENDIX B

Distinguishing Characteristics of Health Care Evaluations

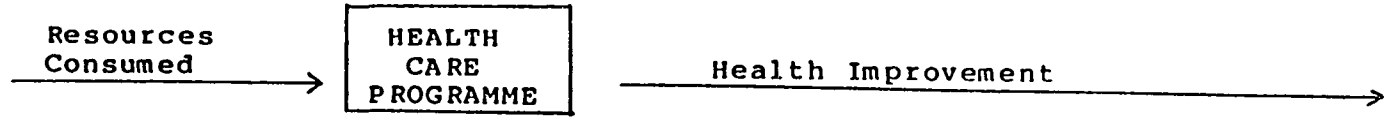
Are both costs (inputs) and consequences (outputs) of the alternatives examined ?

Is there comparison of two or more alternatives?	NO			YES
		Examines only consequences	Examines only costs	
	NO	1A PARTIAL EVALUATION Outcome description	1B Cost description	2 PARTIAL EVALUATION Cost–outcome description
	YES	3A PARTIAL EVALUATION Efficacy or effectiveness evaluation	3B Cost analysis	4 FULL ECONOMIC EVALUATION Cost–minimization analysis Cost–effectiveness analysis Cost–utility analysis Cost–benefit analysis

Note. From Methods for the Economic Evaluation of Health Care Programmes (p. 8) by M. F. Drummond, G. L. Stoddart, and G. W. Torrance, 1987, New York: Oxford University Press.

APPENDIX C

Components of Economic Evaluations



Cost:
- C1=Direct Costs
- C2=Indirect costs (Production losses)
- C3=Intangible costs

Effects: Health effects in natural units

Utilities: Health effects in quality-adjusted life-years

Benefits: Associated economic benefits
- B1=Direct benefits
- B2=Indirect benefits (Production gains)
- B3=Intangible benefits

Source: M. F. Drummond, G. L. Stoddart, and G. W. Torrance (1987), Methods for the Economic Evaluation of Health Care Programmes (p. 2). New York: Oxford University Press.

APPENDIX D

Healthy Beginnings Plus Fee Schedule

MEDICAL ASSISTANCE PROGRAM FEE SCHEDULE

Type Service	Procedure Code	Terminology	Limits	Fee
HB	W5950	HEALTHY BEGINNINGS PLUS INTAKE PACKAGE	1 PER CLIENT PER PREGNANCY	175.00
HB	W5951	FIRST TRIMESTER BASIC MATERNITY CARE PACKAGE	1 PER CLIENT PER PREGNANCY	76.00
HB	W5952	SECOND TRIMESTER BASIC MATERNITY CARE PACKAGE	1 PER CLIENT PER PREGNANCY	139.00
HB	W5953	THIRD TRIMESTER BASIC MATERNITY CARE PACKAGE	1 PER CLIENT PER PREGNANCY	961.00
HB	W5954	FIRST TRIMESTER HIGH RISK MATERNITY CARE PACKAGE	1 PER CLIENT PER PREGNANCY	114.00
HB	W5955	SECOND TRIMESTER HIGH RISK MATERNITY CARE PACKAGE	1 PER CLIENT PER PREGNANCY	252.00
HB	W5956	THIRD TRIMESTER HIGH RISK MATERNITY CARE PACKAGE	1 PER CLIENT PER PREGNANCY	1,151.00
HB	W5957	COMPREHENSIVE CHILDBIRTH PREPARATION	1 PER CLIENT PER PREGNANCY	60.00
		(OR)		
HB	W5958	CHILDBIRTH PREPARATION REVIEW	1 PER CLIENT PER PREGNANCY	20.00
+HB	W5960	PRENATAL HOME NURSING CARE		69.00
HB	W5961	OUTREACH BONUS FOR FIRST TRIMESTER RECRUITMENT	1 PER CLIENT PER PREGNANCY	100.00
#HB	W5962	IN-DEPTH NUTRITION COUNSELING		15.00
#HB	W5963	SMOKING (TOBACCO) CESSATION COUNSELING		15.00
HB	W5964	SUBSTANCE ABUSE PROBLEM IDENTIFICATION AND REFERRAL COUNSELING		25.00
+HB	W5965	GENETIC RISK ASSESSMENT, INFORMATION AND REFERRAL COUNSELING	2 UNITS PER PREGNANCY	60.00
+HB	W5966	OBSTETRICAL HOME CARE		120.00
HB	W5967	PARENTING PROGRAM	1 PER CLIENT PER PREGNANCY	30.00
HB	W5968	OUTREACH VISIT	3 VISITS PER PREGNANCY	45.00
HB	W5969	URGENT TRANSPORTATION ONLY (CAR)		.22 mile
#HB	W5970	IN-DEPTH PSYCHOSOCIAL COUNSELING		15.00
+HB	W5971	HOMEMAKER SERVICE (PRIOR APPROVAL REQUIRED)	2 UNITS PER VISIT/2 VISITS PER WEEK	40.00 PA
+HB	W5972	HOME HEALTH AIDE CARE		45.00

490D

MEDICAL ASSISTANCE PROGRAM FEE SCHEDULE

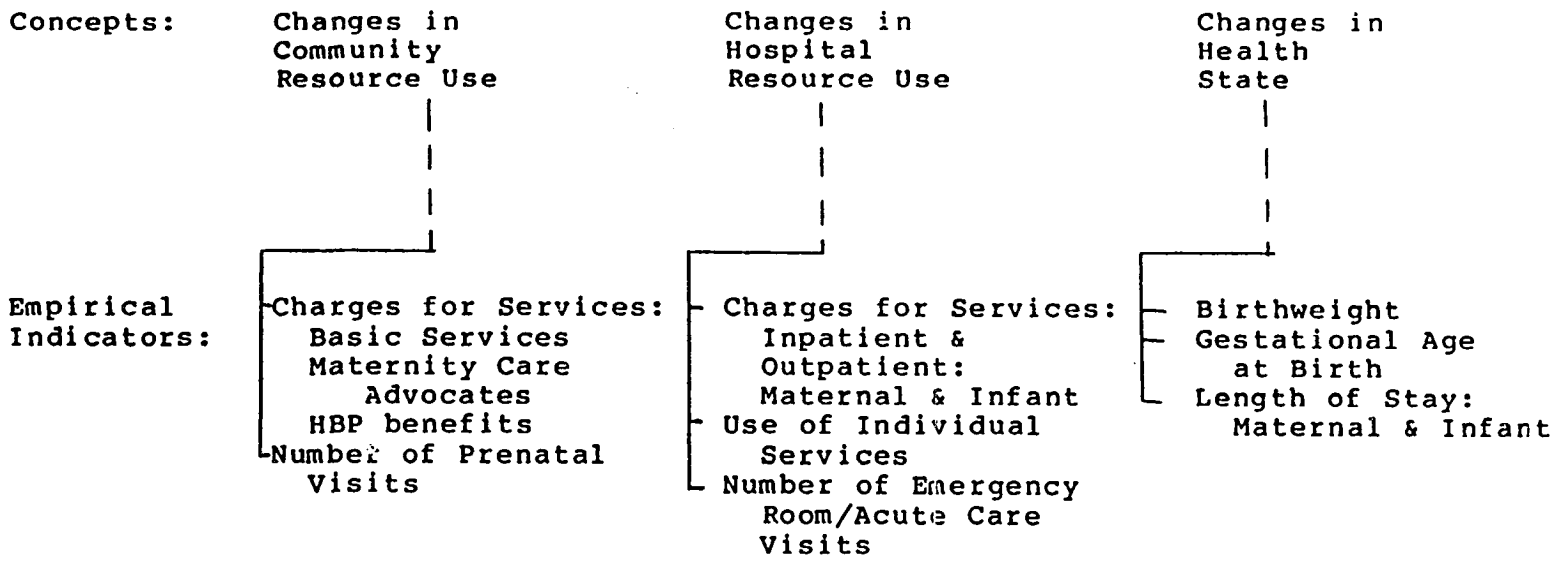
Type Service	Procedure Code	Terminology	Limits	Fee
HB	W5973	PRENATAL EXERCISE SERIES	1 PER CLIENT PER PREGNANCY	65.00
+ HB	W5974	HOME ASSESSMENT/CLIENT EDUCATION	2 UNITS PER VISIT/2 VISITS PER WEEK	69.00
HB	W5975	FIRST TRIMESTER, BASIC MATERNITY CARE, VISIT		23.00
HB	W5976	FIRST TRIMESTER, HIGH RISK MATERNITY CARE, VISIT		23.00
HB	W5977	SECOND TRIMESTER, BASIC MATERNITY CARE, VISIT		23.00
HB	W5978	SECOND TRIMESTER, HIGH RISK MATERNITY CARE, VISIT		23.00
HB	W5979	THIRD TRIMESTER, BASIC MATERNITY CARE, VISIT		23.00
HB	W5980	THIRD TRIMESTER, HIGH RISK MATERNITY CARE, VISIT		23.00
HB	W5981	URGENT TRANSPORTATION ONLY (PUBLIC CARRIER)	RECEIPTED SERVICES	I.C.
HB	W5982	MILEAGE, ADDITIONAL ALLOWANCE FOR HOME VISITS		.10 mile
HB	W5983	BASIC THIRD TRIMESTER PACKAGE - DELIVERY NOT PERFORMED BY DESIGNATED HEALTHY BEGINNINGS PLUS PROVIDER	1 PER CLIENT PER PREGNANCY	461.00
HB	W5984	HIGH RISK THIRD TRIMESTER PACKAGE - DELIVERY NOT PERFORMED BY DESIGNATED HEALTHY BEGINNINGS PLUS PROVIDER	1 PER CLIENT PER PREGNANCY	551.00
HB	W5985	SECOND TRIMESTER DELIVERY	1 PER CLIENT PER PREGNANCY	1130.00

+ 1 unit = 45 minutes
# 1 unit = 15 minutes

NOTE: Please refer to the Provider's Clinical Services Manual for a detailed description and requirements for specific procedure codes.

APPENDIX E

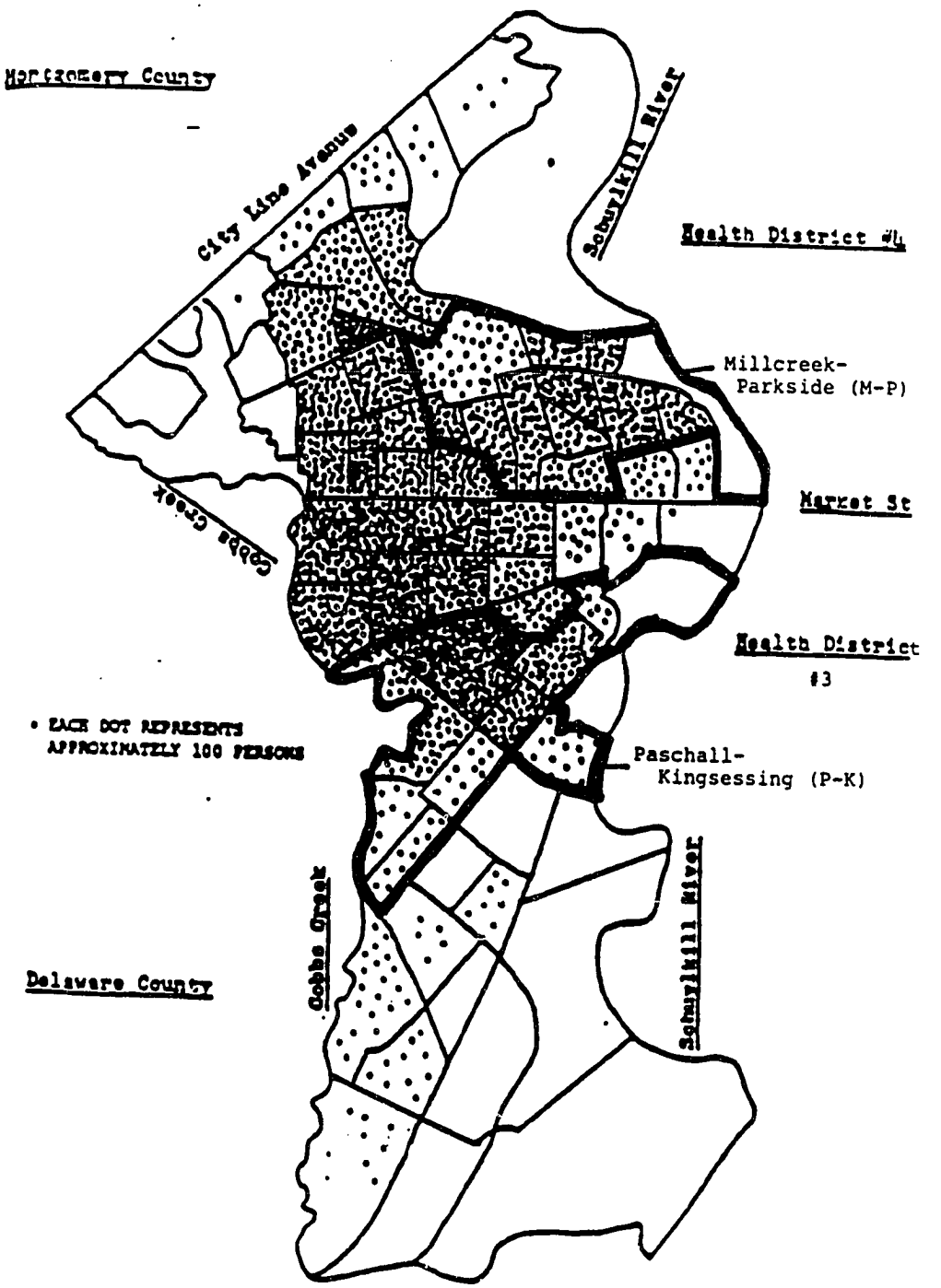
Concepts and Empirical Indicators



APPENDIX F

Map of Study Regions

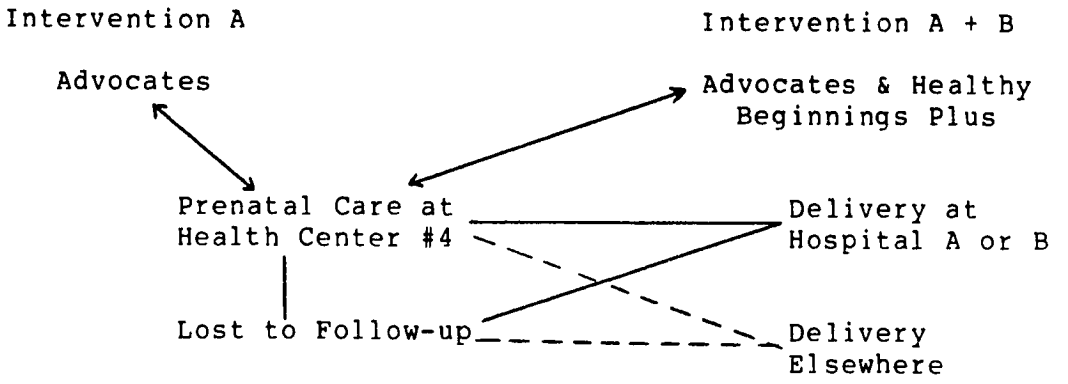
1980 Distribution of Black Population
in Health Districts 3 and 4



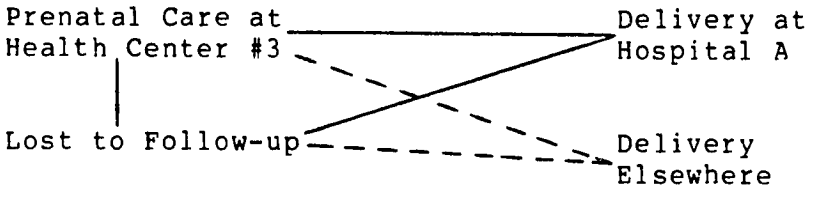
APPENDIX G

Population Flow Chart

Intervention Groups



Control Group



APPENDIX H

Medical Record Extraction Form

Subject Name: _____

Birth Date (Mother): _____ Admission Date: _____
Final ICD 9 Diagnoses (list by code):

_____ _____ _____ _____

_____ _____ _____ _____

Procedures (list by code):

_____ _____ _____ _____

_____ _____ _____ _____

Present OB/GYN or Medical Problems:

LABOR DESCRIPTION:
Onset: ____ Spontaneous ____ Augmented
____ Induced

Membranes: ____ Spontaneously Ruptured Before Admission
____ Spontaneously Ruptured After Admission
____ Artificially Ruptured

Intrapartum Fetal Evaluation:
____ Scalp Electrodes ____ Other (specify):
____ Pressure Catheter
____ External Monitor
____ Scalp Sampling

PostPartum Course:
___ Mother and infant Discharged Alive
___ Other (specify):

BIRTH CERTIFICATE DATA: Mother's Race _____
Mother's Education (yrs completed) _____
Tobacco Use (Ave. # cigarettes/day): _____
Alcohol Use During Pregnancy (Ave. # drinks/week): _____

OBSTETRIC History:
Past Pregnancies (birth weights, problems, etc.):
Past Pregnancies _____ # Premature Deliveries _____
Term Pregnancies _____ # Living Children _____
Spon. Abortions _____ Birth Weights: _____
C-sections _____ _____, _____
_____, _____

Other past pregnancy-related problems:

EDC, corrected: _____
Dates of All Prenatal Visits: _____

_____ Total # _____

Antenatal Hbg _____
Ultrasound Tests: _____

Hospitalizations During Pregnancy:

Date Admitted	Date Discharged	Diagnosis/es

Outpatient Visits:

Date	Test Performed	Diagnosis

Emergency Room/Acute Care Visits:

Date/Time Admitted	Date/Time Discharged	Diagnosis

HOSPITAL DATA
Vaginal or Cesarean Delivery Note:
Type of Delivery:

___ Spontaneous Vaginal ____ Outlet Forceps-low
___ Operative Forceps-Medium ____ Vacuum Extraction
___ Cesarean

Anesthesia: _____ Epidural Specify Other: _____

Episiotomy: _____ Laceration: _____

Baby's Gender: ___ Male ___ Female Wt. _____ grams

Est. Gest. Age _____ weeks; LGA ____; AGA ___; SGA ___.

APGAR Score: 1 minute _____ 5 minutes _____
Findings/Complications:

___ Bradycardia, infant ___ Moder/Heavy Meconium
___ Pitocin augmentation
___ Decreased Beat to Beat Variability
___ Elevated Maternal Temper.
___ Chorioamnionitis
Other (specify):

URINE DRUG SCREEN (in lab section of birth hospitalization):
Amphetamines: Negative _____; Positive _____.
Cocaine Metabolites: Negative ____; Positive _____.
Opiates: Negative _____; Positive _____.

APPENDIX I

Kessner Index

Medical Care Index	Gestation (weeks)		Number of Prenatal Visits
Adequate[a]	13 or less	and	1 or more or not stated
	14-17	and	2 or more
	18-21	and	3 or more
	22-25	and	4 or more
	26-29	and	5 or more
	30-31	and	6 or more
	32-33	and	7 or more
	34-35	and	8 or more
	36 or more	and	9 or more
Inadequate[b]	14-21[c]	and	0 or not stated
	22-29	and	1 or less or not stated
	30-31	and	2 or less or not stated
	32-33	and	3 or less or not stated
	34 or more	and	4 or less or not stated
Intermediate	All combinations other than specified above		

[a] In addition to the specific number of visits indicated for adequate care, the interval to the first prenatal visit had to be 13 weeks or less (first trimester), and the delivery must have taken place on a private obstetrical service.

[b] In addition to the specific number of visits indicated for inadequate care, all women who started their prenatal care during the third trimester (28 weeks of later) were considered inadequate.

[c] For this gestation group, care was considered inadequate if the time of the first visit was not stated.

Note. From Infant Death: An Analysis by Maternal Risk and Health Care by D. M. Kessner, 1973, Washington, DC: Institute of Medicine.

APPENDIX J

Actual and Estimated Payments for Services as a Percentage of Billed Charges

Service	Medical Assistance	HealthPass	All Others
Outpatient Services Hospital A & B	32 %	25 %	64 %
Professional Anesthesia Services, Hosp. A & B	5 %	11 %	25 %
Pediatrics, Hospital A	27 %	31 %	
Neonatology, Hosp. A	23 %	23 %	23 %
Pediatrics, Hosp. B	27 %	40 %	40 %

APPENDIX K

Medical Risk Factors for the Prenatal Care Groups

	Control HCtr. #3	Intervtn. A HCtr. #4	Intervtn. A + B HCtr. #4
	n=93	n=75	n=80
# Past Pregnancies, Mean	1.96	2.07	1.96
(S.D.)	(1.99)	(1.81)	(2.03)
# Past Spon. Abortions, Mean	0.24	0.29	0.35
(S.D.)	(0.52)	(0.69)	(0.81)
# Past Premature Deliv., Mean	0.15	0.12	0.16
(S.D.)	(0.47)	(0.37)	(0.51)
Past # Cesareans, Mean	0.06[a]	0.27[a]	0.15
(S.D.)	(0.44)	(0.68)	(0.42)
Previous LBW Infants, Mean	0.15	0.31	0.14
(S.D.)	(0.41)	(1.00)	(0.41)

[a] Two groups differ significantly (F=3.13, df=2, p=0.045; confirmed by Kruskal-Wallis)

APPENDIX L

Insurers by Client Group, Reported as Percentages of Total

Insurer	Control (n=93)	Intervention A (n=75)	Intervention A + B (n=80)
Self-pay	1 %	3 %	0 %
Medical Assist.	58	32	21
HealthPass	30	47	44
Mercy Health	2	16	21
Greater Atlantic	1	1	5
Blue Cross/Blue Shield	2	0	3
Other	4	0	6
Missing	1	1	0

(All columns do not equal 100% due to rounding.)

APPENDIX M

Determination of Average Cost per Prenatal Visit

To compute the average expense per prenatal visit for each of the three prenatal care groups, the city's contractual payments to each of the provider groups for fiscal year 1991-92 were divided by the estimated number of prenatal visits for that same period. There were 2,224 visits reported at Health Center #3 and 2,392 at Health Center #4. Based on the information available, half of the Health Center #4 visits were attributed to Hospital A providers and an equal number to the midwifery practice. Some overhead expenses incurred by the city for the health centers' operation could not be obtained, e.g. use of the buildings and pharmacy costs. Direct expenses for city employees operating the prenatal clinics were available. Both Health Centers utilized a clerk, a nurse aide, and a licensed practical nurse for routine operations. Health Center #3 also employed interpreters for non-English speaking Asian clients. Combining the contractual expenses with the direct labor expenses, the average prenatal visit at Health Center #3 cost the city $49. The average expense per visit for Hospital A's clients at Health Center #4 (intervention A group) was $64. For the midwifery practice (the intervention A + B group), the average expense per visit to the city was $270. [This high cost was caused by two factors: (a) hiring additional personnel and (b) assignment of uninsured patients to this provider group. The intent of the city's contract with the midwifery practice was to provide all uninsured clients with services equal to the HBP program. In addition, the city was subsidizing additional health education, social work services, and nutrition counseling beyond that required by the HBP program for all the midwifery clients.]

The Community Maternity Project employed Maternity Care Advocates as casefinders and as client advocates during pregnancy and for one year post-partum. This program was operated by the Maternity Care Coalition and supported by a combination of private and public (city) monies. Approximately 90 percent of the program costs were used for prenatal services. Based on an estimate of 600 prenatal patients being served annually, the average cost per client for this program was computed to be $303.

In summary, the average expense for clients in the control group was $49 per visit. For the intervention A group, the average expense per client was $303 plus $64 for each visit. For clients in the intervention A + B group, the cost was $303 plus $270 per visit.

APPENDIX N

Enrolled or Not Enrolled in Prenatal Care by Casefinding Area

Prenatal Care	In Casefinding Area		Outside Casefinding Area	
Enrolled	282/373	75.6%	269/481	55.9%
Not Enrolled	91/373	24.4%	212/481	44.1%

X^2=35.47, df=1, p < .001

Note. From The Effects of Prenatal Outreach and Nurse-Coordinated Care (p. 70) by M. L. Jenkins, 1993, University of Pennsylvania, Philadelphia. Reprinted by permission.