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Assessing the Quality of Prenatal Care Received by Women in Vespasiano, Brazil

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Assessing the Quality of Prenatal Care Received by Women in Vespasiano, Brazil

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2011

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An abstract of
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Abstract

Assessing the Quality of Prenatal Care Received by Women in Vespasiano, Brazil
By Dan Na Luo

Background: The adequacy of prenatal care (PNC) is often assessed through the timing of initiation and number of visits. Few studies have assessed the adequacy of PNC in terms of the quality or content of care received.

Goal: The goal of this study was to identify variations in and predictors of inadequate care through self-reports of recommended PNC procedures received by women in Vespasiano, Brazil between October 2009 and September 2010.

Methods: A total of 252 women who received PNC between October 2009 and September 2010 were surveyed on demographic characteristics and information about their pregnancy and PNC. Reliability of self-reported data was assessed by a comparison with data recorded on PNC cards. The outcome was self-reported receipt of 11 recommended procedures, a proxy for the quality of PNC received. Factors associated with self-reported procedures were assessed. Additionally, factors associated with the client's satisfaction with PNC were assessed as an overall index of the quality of services received.

Results: Agreement between self-reported receipt of procedures and procedures listed on prenatal care cards (blood pressure, blood analyses, urine analysis, uterine height) was high. Self-reported receipt of specific procedures varied among women. Whereas measurements such as blood pressure (100%) and urine analysis (97%) were reported almost universally, procedures including mammograms (35%) and pap smears (17%) were reported by fewer women. Enrollment in Bolsa, Brazil's social welfare program, and the frequency of community health worker (CHW) visits was positively associated with reported receipt of PNC procedures. The odds of receiving specific procedures were lower among women with lower versus higher educational attainment. Overall, women were satisfied with the PNC services they received. Women who reported receiving at least one visit from a CHW were more likely to be satisfied; whereas women who identified the quality of available services as a barrier to care were less likely to be satisfied with the care they received.

Conclusion: The quality of PNC received by women in Vespasiano varied in reported content and satisfaction with care, especially by socioeconomic status, enrollment in Bolsa, utilization of private care, and frequency of CHW visits.

Implication: Evaluating PNC based on the content of care received and satisfaction can better inform strategies to improve the quality of PNC than simply the number and timing of PNC visits. Exploring the reasons for socioeconomic differentials in reporting of PNC procedures is warranted.

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CHAPTER #1: INTRODUCTION

Background

Despite global efforts to improve maternal and child health, rates of maternal and child mortality are still of considerable concern. Approximately 300,000 women die each year from complications resulting from pregnancy and childbirth [1]. Perinatal deaths are also of considerable concern—nearly 6 million babies are stillborn or die before they reach one month of age [1]. Causes of death, for both mother and child, are largely preventable. Low-cost interventions, such as prenatal care, are available. However, in some cases, these interventions, tools, and procedures are not reaching women. Gaps exist in terms of availability, access, and quality of maternal and child health services.

For decades, Brazil has been active in improving conditions in maternal and child health through strategies such as social welfare programs and healthcare schemes [2]. In 1985, Brazil introduced the Program for Comprehensive Women's Health Care (PAISM). The goal of PAISM was to improve prenatal care by improving the infrastructure for service delivery. In 1994, the Family Health Program (FHP) established and introduced regionalized health teams, which improved access to prenatal care services and increased the number of prenatal care visits women received. Given continued need, Brazil in 2000 introduced the Program for Humanization of Prenatal Care and Childbirth. PHPN introduced specific measures for health promotion and care for pregnant women and newborns. In addition to guaranteeing access to care, PHPN established criteria for upgrading prenatal care, which included requirements for initiation, number of visits, and procedures to be performed during prenatal care. Specifically, women should initiate care by month 4 of their pregnancy, have a total of 7 visits, and receive a total of 11 essential

procedures: 1) measurement of uterine height, 2) measurement of blood pressure, 3) gynecological exam, 4) breast exam, 5) pap smear (cervical cancer), 6) administration of tetanus toxoid, 7) prescription of iron, 8) prescription of multivitamins, 9) breastfeeding counseling, 10) blood analysis, and 11) urine analysis. Access to and utilization of prenatal services have improved in Brazil, but causes of maternal and child mortality persist, creating a need to closely examine other characteristics of prenatal care, such as the quality of services available and delivered to women.

Evaluating the quality of prenatal care is essential for improving the delivery of care and outcomes in maternal and child health. The adequacy of prenatal care is often assessed through variables such as the timing of initiation and the number of visits a woman attends during her pregnancy. However, these measures do not indicate the quality of services a woman receives, both in terms of her satisfaction with care as well as the content of care. A woman's satisfaction with care is not only important for assessing perceived quality of care, but also important for understanding health behaviors, specifically a woman's decision to utilize prenatal care services. Similarly, the quality of prenatal care is reflected by the content of care and range of services a woman receives during her care. Further, evaluating prenatal care based on specific procedures performed rather than timing of initiation and number of visits attended can provide more useful information for improving pregnancy and birth outcomes. The guidelines established by PHPN enable the assessment of quality of care received by women for setting parameters for the content of care.

Theoretical Framework

Health theory serves as a useful tool for understanding the provision, utilization, and receipt of health care. Evaluating the provision of prenatal care through a theoretical lens will demonstrate how the quality, rather than mere coverage, of prenatal care can be maximized and ensured. The Diffusion of Innovations (DOI) theory provides a useful model for understanding the provision of prenatal care, especially in Brazil. Diffusion, according to DOI, is the process by which an idea or innovation is communicated through certain channels over time among the members of a social system. The other major component of the DOI theory, dissemination, is defined as the planned and systematic efforts to make a program or innovation more widely available to a target audience or members of a society [3]. Inherent to DOI is the claim that unless effective public health programs, products, and practices are *widely and effectively* disseminated, the potential of these interventions will not be realized [3]. While PHPN has increased coverage and access to prenatal care, it is less clear whether prenatal care has been *effectively* disseminated in Brazil.

The four elements of DOI are the innovation, "idea, practice, or object" for adoption, communication channels, time, and the social system [4]. The five stages of the adoption process are knowledge, persuasion, decision, implementation, and confirmation [5]. The first stage, *knowledge*, refers to an individual's acknowledgement of an innovation's existence and a general understanding of how the innovation functions. The second stage, *persuasion*, refers to the attitudes an individual develops about the innovation. These attitudes, favorable or unfavorable, directly impact an individual's choice to adopt or reject an innovation; also the *decision* stage of the DOI process. The fourth stage of the process, *implementation*, is the actual utilization of an innovation. The

final stage, *confirmation*, is the reinforcement stage. Confirmation may determine whether an innovation is utilized to its greatest potential or rejected by an individual. Further, the five factors identified as characteristics of innovations that ultimately impact an individual's decision to adopt or reject an innovation include: relative advantage, compatibility, complexity, triability, and observability. These factors relate to the perceived benefits, ease of use, and suitability of the innovation. The primary focus of this study, quality of care, directly impacts the stages of the adoption process and the factors associated with the sustained utilization or rejection of prenatal care.

On an individual level, the Health Belief Model (HBM) provides helpful constructs for understanding why people take action to prevent, screen for, and control illnesses [3]. HBM complements DOI by exposing factors that support, and in some cases, inhibit uptake and utilization of innovations such as prenatal care. The constructs of HBM include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy [3]. The constructs of interest for this study include perceived benefits and perceived barriers. The issue of quality, specifically, falls into the construct of perceived benefits. The experienced quality of care may impact an individual's perception of how well treatment or action is reducing disease or threat. Perceived barriers to care were directly assessed in this study; women are asked to report whether specific factors impacted their ability to seek care or treatment (i.e. cost of care, transportation, time burden). Modifying factors of the HBM include age, gender, ethnicity, personality, socioeconomic status, and knowledge—several of these factors will be accounted for in the analysis of this study.

Prenatal care, as an innovation, is diffusing in Brazil. The dissemination of prenatal care, as planned and proposed by the MoH, however, has not been clearly evaluated. Evaluating prenatal care through the DOI and HBM framework will lead to improvements in programming and policy to ensure that the delivery of prenatal care results in the intended outcomes to reduce maternal and infant morbidity and mortality.

Study Site

Data for this project were collected in Vespasiano, Brazil by an Emory Global Health Institute team in 2011. Vespasiano Municipality is located in the metropolitan area of Belo Horizonte, Minas Gerais—a state of the southeast region in Brazil. According to 2010 Census data, the population of Vespasiano was 104,527 [6]. The municipality is marked by moderate inequality and a poverty rate of 21% [7]. The study population consisted of pregnant women enrolled in SISPRENATAL at one of ten Family Health Units (FHU) in Vespasiano between October 2009 and September 2010. During the study period, there were 10 FHU serving the Vespasiano municipality. The utilization of prenatal care among pregnant women in Vespasiano similar to national patterns, but low compared to other municipalities in the metropolitan area and state [8].

Study Goal and Aims

Goal: The goal of this study is to identify variations in and predictors of inadequate care through self-reported indicators of prenatal care received by women in Vespasiano, Brazil between October 2009 and September 2010.

Aim 1: To evaluate whether there is variation in the self-reported quality of care received by women in Vespasiano, Brazil.

Aim 2: To identify predictors of inadequate prenatal care, defined by the content of care received.

Aim 3: To determine the relationship between self-reported receipt of prenatal care procedures and the level of satisfaction as indication of the quality of prenatal care.

Aim 4: Evaluate the provision of prenatal care through a theoretical lens to determine how the quality (rather than mere coverage) of prenatal care can be maximized or ensured.

Evidence of inequalities in maternal and child health causes us to expect variations in terms of the self-reported content of care received by women in Vespasiano, Brazil. We hypothesize that women of low socioeconomic status (i.e. low educational attainment, enrollment in social welfare program) are less likely to receive quality care in terms of procedures received during care. We expect utilization of the private health sector to be a positively associated with women receiving quality care, and hypothesize that women who utilized the private health sector for prenatal care are more likely to receive recommended procedures during care. The second component of quality we examine in this study is satisfaction. We expect women who received all 11 recommended procedures during care to be satisfied with care and women who identified barriers to care to be dissatisfied with care received.

Significance

There is a global need to improve maternal and child health services, especially prenatal care. Socioeconomic inequalities are pervasive in maternal and child health. The provision and uptake of prenatal care is one area of maternal and child health that is

greatly impacted by inequity. Still, very few studies assess the relationship between the quality of prenatal care and factors such as type of care and maternal characteristics. This is an important area for investigation, however, given global inequalities in maternal and child health. This study seeks to expose the factors that make women more vulnerable to unequal treatment in the health care system. Further, data from this research may offer insight to programs and initiatives seeking to improve the implementation and delivery of prenatal care. By analyzing how the frequencies of procedures performed during prenatal care vary according to factors such as utilization of care, demographic characteristics, type of care, and perceived barriers to care, interventions or strategies may be developed to better assure women are receiving recommended procedures, in turn improving the quality of care and possibly the outcomes associated with prenatal care.

Policies concerning prenatal care have generally been concerned with increasing the availability and access to care. SINASC data indicates that the coverage of prenatal care is high, however, the coverage rates do not speak to the quality of care received by women. This discrepancy reflects the need to promote the delivery of quality care and make optimal use of women's contact with health services [9]. The adequacy of prenatal care is usually determined by the initiation of care and number of visits, but it is less common to assess, as this study does, the adequacy of care based on the perceived incentives and barriers to care, components of care, or characteristics of care (e.g. doctor-patient relationship, time spent). Assessing the adequacy of care based on these factors, however, is important given that quality of care is a key determinant of a woman's health-seeking behavior [10]. In addition to shifting the focus to the quality and content of care, this study will evaluate women's satisfaction with care. This evaluation of the

PHPN is necessary to guide improvements in the quality and delivery of prenatal care in Brazil.

CHAPTER #2: REVIEW OF THE LITERATURE

Maternal and Child Mortality: a global concern

Maternal and child mortality is a global problem. Approximately 800 women die each day as a result of complications of pregnancy and childbirth [11]. According to the World Health Organization (WHO), 287,000 women died as a result of pregnancy or childbirth in 2010 [11]. The major causes of maternal mortality include obstetric hemorrhage, anemia, hypertensive disorder, infection (i.e. sexually transmitted infections, urinary tract infection), and obstructed labor [9]. Moreover, approximately 6.9 million children under the age of five died in 2011 [12]. Newborns and infants represent 40 percent of all deaths among children under five—the majority of newborn deaths occur within a week of birth [13, 14]. Low birth weight, asphyxia, infections (i.e. sexually transmitted, respiratory) and birth trauma are the primary risk factors and causes of death among newborns [13-15]. Prevention strategies for the mother and child are available to prevent such deaths from occurring. Providing prenatal care for the mother can safeguard against the risks of maternal and child mortality [16].

Global Introduction and Utilization of Prenatal Care

A Scottish physician formally introduced prenatal care at the end of the 19th century as a preventative measure to reduce complications during and after pregnancy [17, 18]. It was proposed that prenatal care would prevent fetal abnormalities while also reducing maternal morbidity and mortality [18]. The promise of prenatal care made the provision and practice of prenatal care universal, reflected by widespread use in developed and developing countries. In many developing countries, prenatal care receives the largest allocation of budgetary resources [19]. Prenatal care utilization and coverage

also is high, with 68 percent of women having at least one prenatal care visit during the course of a pregnancy [20]. Prenatal care utilization is high because of the low cost of prenatal care services, long window of opportunity to receive care, and the multiple points of provision [20]. Prenatal care content and quality, in different settings, may vary.

Health Impact of Prenatal Care

The benefits of prenatal care are two-fold .The primary benefit of prenatal care is its capacity to identify early signs of, and risk factors for morbidity or mortality during pregnancy [16]. Most of the complications leading to maternal and infant morbidity develop during pregnancy or are exacerbated by the progression of a pregnancy. Although prenatal care alone is not an absolutely effective strategy, both women and infants can benefit from care during pregnancy [17, 18]. Prenatal care has been associated with reductions in pregnancy-induced hypertension, infections, and other negative health consequences [21, 22]. Prenatal care also has both primary and secondary prevention opportunities [17]. Primary prevention measures include the prescription of multivitamins and iron supplements before and during pregnancy [17]. Secondary prevention measures include the prevention of Rhesus disease, maternal congenital syphilis, vertical transmission of HIV, and vaccination against influenza [17]. Counseling during prenatal care also is beneficial, especially to young mothers. During prenatal care, mothers should be instructed on the importance of taking multivitamins, getting proper amounts of folic acid, eating appropriate foods, and avoiding certain exposures. This knowledge, in turn, ensures a healthy start to pregnancy.

Further, by attending prenatal care consultations, a mother can also increase her infant's chances of survival. Certain interventions administered during prenatal care are

effective in improving perinatal health [9]. Infant outcomes related to the receipt of prenatal care include infant mortality, neonatal mortality, perinatal mortality, low birth weight, and preterm birth (reviewed in [23]). Although some reviews argue that the effect of prenatal care on birth outcomes is clear [24-27], others suggest that current evidence does not satisfy the necessary criteria to indicate that prenatal care improves birth outcomes [23].

While the benefits of prenatal care require further study, researchers have sought to identify a causal relationship between receipt of care and positive birth outcomes. Existing research regarding the effectiveness of prenatal care has largely centered around the issue of birth weight, however, evaluation of other measures including maternal mortality, infant mortality, maternal health behaviors, and health care utilization may lead to a more thorough understanding of its efficacy (reviewed in [18]). The rationale provided for the provision of prenatal care is that it permits timely intervention in detection of early signs or risk factors for disease or abnormalities (reviewed in [9]). At its core, prenatal care provides an opportunity to focus on a woman's and her child's health and wellbeing.

Global and National Guidelines for Prenatal Care Visits

Guidelines for prenatal care vary across contexts, and are country-specific. Generally, guidelines for care provide recommendations on the number and frequency of visits and also procedures to be performed during care. The guidelines reflect the ritualistic nature of prenatal care, and wide variation reflects the lack of consensus or evidence-base used for the development of prenatal care programs [16].

The WHO's *Pregnancy, Childbirth, Postpartum and Newborn Care: A guide for essential practice* provides evidence-based recommendations for the management and provision of care for women during pregnancy [28]. In this guide, the WHO specifies that women should receive at minimum four routine prenatal care visits. The first visit should occur before 16 weeks, the second between weeks 24 and 28, the third between weeks 30 and 32, and the fourth visit between weeks 36 and 38 [28]. Additional visits are recommended if a woman is perceived as being high-risk or if the expected date of delivery is surpassed by two weeks.

For the United States (U.S.), the American Academy of Pediatrics (AAP) and American College of Obstetricians and Gynecologists (ACOG) published *Guidelines for Perinatal Care* [29]. In these guidelines, AAP and ACOG recommend that women with uncomplicated pregnancies receive prenatal care every four weeks until week 28, every two weeks until week 36, and every week until pregnancy [29]. The U.S. Department of Health and Human Service's (DHHS) Agency for Healthcare Research and Quality (AHRQ) also provides recommendations for routine prenatal care [30]. The guideline summary recommends 8 to 11 visits during the course of a pregnancy with the first visit occurring between weeks 6 and 8, the second visit between weeks 10 and 12, the third visit between weeks 16 and 18, the fourth visit at 22 weeks, the fifth visit at week 28, the sixth visit at week 32, the seventh visit at week 36, and eighth through eleventh visits, as appropriate, during weeks 38 and 41.

In Brazil, the geographic focus for this research, prenatal care delivered through the public health care sector is governed by guidelines of the Prenatal and Birth Humanization Program (*Programa de Humanizacao no Pre-Natal e Nascimento,* PHPN)

[31]. The PHPN recommends that women receive their first prenatal care visit within 120 days of their pregnancy. The initial visit should be followed by at least 6 subsequent visits: one visit during the first trimester, two visits during the second trimester, and three visits during the third trimester. Additional visits are recommended for women with prolonged gestation and high-risk pregnancies. Further, the PHPN specifies a set of laboratory tests that should be performed at the first visit and at the 30th week of gestation [2]. Tetanus immunization, educational activities, assessment of gestational risk, and when appropriate, referrals for high-risk pregnancies are additional requirements for care established by the PHPN.

Global and National Recommended Prenatal Care Procedures

In addition to specifications for the frequency and timing of prenatal care visits, the WHO and country health ministries recommend procedures to be performed during the course of prenatal care.

The WHO advises care providers to begin each prenatal care visit with a Rapid Assessment and Management (RAM) [28]. The RAM intends to screen women for necessary urgent care, which is demonstrated by signs such as convulsion, severe vomiting, bleeding, or visual disturbances. When it is confirmed that a woman does not exhibit any of the emergency or priority signs, she is classified as non-urgent, and the medical provider can proceed with routine care. Routine care includes checking all women for pre-eclampsia, anemia, syphilis, and HIV. If the provider detects a ruptured membrane, lack of fetal movement, HIV infection or discovers that the woman is experiencing fever, burning on urination, vaginal discharge, breathing difficulties, or alcohol or drug abuse, then treatment should be provided accordingly. Preventative

measures include administering tetanus toxoid immunization, prescribing multivitamins (i.e. folate and iron), giving a dose of mebendazole in the second or third trimester, and antimalarial drugs, if applicable, in the second or third trimester. Counseling on self-care, nutrition, exclusive breastfeeding, alcohol and drug use, and safe sex practices is recommended. Additionally, the WHO recommends that all care providers prepare a birth and emergency plan for women during their first visit. This plan serves as a reference throughout the woman's care and is modified in the event of any complications.

In the U.S., the AHRQ separates prenatal care procedures and services into three broad categories of care: 1) screening maneuvers, 2) counseling, education and interventions, and 3) immunization and chemoprophylaxis [30]. Screening maneuvers include risk profiles, documentation of height, weight, blood pressure, urine analysis, a cervical assessment, cholesterol tests, screening for gestational diabetes, cervical cancer, hepatitis B, blood lead, syphilis, rubella, varicella, depression and domestic violence, and ultrasound for fetal heart tones, position, and fundal height. Counseling and education-based interventions include preterm labor education and prevention, inventory of medications, herbal supplements and vitamins, accurate recording of menstrual dates, counseling on risks and benefits of vaginal birth after cesarean, and prenatal and lifestyle education. Vaccination against diseases including varicella, rubella, hepatitis B, tetanus-diphtheria, and influenza are recommended, and administration of folic acid and other nutritional supplements are also advised.

In Brazil, the Brazilian Ministry of Health (MoH) established parameters for the level of care pregnant women require based on international studies and WHO recommendations [32]. From these international studies and recommendations, the MoH

listed eleven essential procedures: 1) measurement of uterine height, 2) measurement of blood pressure, 3) gynecological exam, 4) breast exam, 5) pap smear (cervical cancer), 6) administration of tetanus toxoid, 7) prescription of iron, 8) prescription of multivitamins, 9) breastfeeding counseling, 10) blood analysis, and 11) urine analysis. While these procedures are prescribed, protocols vary across Brazil because states and municipalities hold discretion over the recommended procedures.

Women in Vespasiano, Brazil, the study site of this thesis, receive care based on guidelines established by the state of Minas Gerais. Minas Gerais identified a comprehensive set of exams that should be performed during a woman's first prenatal care visit [33]. During this initial visit, a set of measurements, physical examinations and laboratory tests should be conducted. The measurements include blood pressure and uterine height. A vaginal examination should be performed as part of a physical examination. Blood and urine analyses serve to detect blood group, Rh disease, gestational diabetes, toxoplasmosis, hepatitis B, and sexually transmitted diseases. Fetal heartbeat measurement is also recommended at the first visit [34]. Women exhibiting signs or risk for a high-risk pregnancy are to be referred for specialized care at a maternity center. Women not demonstrating characteristics of a high-risk pregnancy should return for subsequent visits for routine blood pressure, uterine height, and fetal heartbeat measurement. Lastly, during the first visit, providers should refer women to other providers for a tetanus vaccination. Women with syphilis, gestational diabetes, and urinary tract infections should receive additional assessments at 30 weeks [33].

Evaluating Prenatal Care

Measuring the Adequacy of Care through Composite Indices

The adequacy of prenatal care is largely measured using two points of information: the initiation of care and timing of subsequent visits. In the U.S. and other Western countries, the most widely used indices for measuring the adequacy of prenatal care are the Kessner Index, the Revised Graduated Index (R-GINDEX), and Kotelchuck's Adequacy of Prenatal Care Utilization Index (APNCU) [35]. The Kessner Index was developed in 1973 based on three factors: the sector of health service delivery (private or public), the onset of prenatal care (month), and the number of visits adjusted for gestational age at delivery [36]. The GINDEX, introduced in 1987, further characterized the adequacy of prenatal care by including more categories to classify care, including definitions for inadequate, intermediate, and adequate care. The GINDEX also distinguished women based on their receipt of intensive care to better account for risk. Alexander and Kotelchuck proposed R-GINDEX in 1996 to be in accord with ACOG recommendations (i.e. increasing number of visits from 9 to the minimum of 11). Most studies assessing prenatal care utilization employ Kotelchuck's APNCU Index. The APNCU introduces two components: the Adequacy of Initiation of Prenatal Care and the Adequacy of Received Services [37]. The APNCU, with its two parts, accounts for gestational age in addition to the number of visits, and adjusts for gestational age at delivery and the timing of the first visit. As a result, the timing of the first visit and subsequent utilization can be analyzed separately. These measures, however, do not account for the content or quality of care. The content or quality of prenatal care may be factors associated with pregnancy outcomes and maternal and infant morbidity and mortality [38].

Evaluating Care Beyond Adequacy Measures

Many studies have assessed the relationship between the utilization of prenatal care, indicated specifically by the number and/or frequency of visits, and birth outcomes, but a limited number of studies have examined the content of prenatal care, which may serve as a more meaningful indicator of adequacy of care. Prior studies concerning the content of care have largely focused on establishing an evidence-base for the practice. Assessing prenatal care by variables such as the content of care, perceived incentives and barriers to care, perceived quality of care, satisfaction and provider-patient interactions may better reflect the quality of care received, and as a result, better predict health outcomes [38-42]. Existing studies that evaluate the content of prenatal care fall into three broad categories: 1) studies that focus on the content of care as a means for measuring adequacy or ensuring guidelines are being met, 2) studies that assess the influence of content of care on outcomes, and 3) studies that evaluate the extent of care and seek to identify the factors that determine the content of care women receive.

Not until recently has the content of care become a focal point of evaluating prenatal care [38]. These studies, while differing in their purpose and methods, provide an alternative crude measure for the quality of care [39, 43-45]. Studies of this nature can be difficult, given the variation in the content of prenatal care prescriptions. As demonstrated by international and country-specific guidelines, prenatal care programs and packages contain a lengthy list of recommended procedures, but lack uniformity. Beeckman and colleagues developed a new scale, the Content and Timing of care in Pregnancy (CTP), to account for the content of care in measuring the adequacy of prenatal care [42]. Petitti and colleagues created an index containing eight procedures commonly performed during prenatal care [43]. The eight procedures included a risk

assessment, urine culture, question on smoking habits and referral for cessation, question on drinking habits and referral for cessation, question on other drug use, weight measurement, BMI measure, and total attendance of prenatal care visits. Several items (i.e. cigarette, alcohol, drug) asked about a referral for cessation or further counseling, if applicable. The items included in the index by Petitti and colleagues were considered to mediate the relationship between routine prenatal care and birth weight by a professional panel. Other studies rely on national guidelines, specifications by the ministries of health, or evidence-based practices. There is no consensus, at this time, of what procedures should be included in the development of content indices or measures of adequacy, despite guidelines at the national or organizational level.

Extensions of studies that focus on the content of care are those that evaluate the influence of having specific components of care birth outcomes. Kogan and colleagues evaluated the relationship between content of care and negative birth outcomes, specifically low birth weight [46]. In this study, Kogan and colleagues asked women to report the procedures received during their first and second prenatal care visits. The list included blood pressure, urine test, blood work, weight measurement, physical or pelvic exam, health history, consultation on multivitamin use, consultation on proper nutrition, consultation on breastfeeding, alcohol cessation, smoking cessation, illicit drug use cessation, and consultation on proper weight gain. Women who reported receiving advice on multivitamin use, breastfeeding, proper weight gain, and alcohol cessation had significantly lower percentages of low birth weight [46]. Ensuring that women receive evidence-based procedures and interventions are likely to result in more favorable health outcomes than ensuring that women receive an appropriate number of visits (without a

standard for content). By emphasizing the content of visits, rather than the number of visits, more effective prenatal care programs can be developed.

Other studies on the content of care seek to evaluate the extent of care and further, identify factors that impact what components of care women actually receive. In another study by Kogan and colleagues, the extent to which women were receiving care based on recommendations established by national guidelines for care was examined [47]. Kogan and colleagues found that while many (>75%) women reported receiving the prenatal care procedures during the first or second visit, only about half of the study population reported receiving all of the procedures recommended. Disparities varied depending on the procedure. For example, site of care was associated with the likelihood of having blood work and health history taken. Demographic characteristics were associated with blood pressure, urine test, pelvic exam, and weight and height measurements. Kotelchuck and colleagues assessed the influence of care site (e.g. private site, publicly funded site, HMO, hospital clinic) on the comprehensiveness of prenatal care [45]. In both studies, women were asked to indicate which procedures were performed during their first and second visits. Procedures included: pregnancy test, blood pressure, pap smear, urine test, blood test, weight and height, physical or pelvic examine, health history, and ultrasound examination. Studies demonstrated that factors such as the site of care [45, 47], timing of first visit [44, 47], and demographic characteristics such as age, education, and socioeconomic status [47] were associated with the procedures women received.

A study conducted by Victora and colleagues is in some ways, a hybrid of the broad types of studies in the literature that consider the content of care. Victora and colleagues assessed the quality of prenatal by measuring how many of the 11

recommended procedures were performed among women giving birth in Pelotas, Brazil in 2004 [39]. The procedures were grouped into three categories of services: physical examinations and counseling (breast examination, gynecological examination, pap test, and breast feeding counseling), measurements (uterine height, blood pressure, urine analysis, and blood analysis), and prescriptions (referral for tetanus vaccine, iron supplementation, and multivitamin supplementation). A score ranging from 0-11 determined the adequacy of prenatal care; one point was assigned for each procedure performed. This approach sought to fill a gap concerning the quality of prenatal care according to the content of care as well as characteristics of the mother and provider.

The process indicators of PHPN allow for quantitative (and indirect qualitative) evaluations of prenatal care, and while these reflect the proportion of pregnant women who received the minimum PHPN care recommendations, these parameters do not fully demonstrate the quality of care [32]. Other important indicators of quality of care include patient satisfaction and women's experiences, shaped by her perceptions of incentives and barriers to care and provider-patient interactions.

The socio-demographic determinants of perceived quality of prenatal care at the primary level has been assessed [10]. Overall satisfaction of care is a component of a validated questionnaire developed by the WHO to evaluate perceptions of antenatal care services in select developing countries [48]. Two indirect questions and one direct question reflect the level of satisfaction. The indirect questions ask, "If you were pregnant again, would you come back to this clinic," and "would you recommend this clinic to a relative or a friend for their antenatal check ups?" The direct question was, "In general, how satisfied are you with antenatal care you have received from this clinic?"

Parity, having more than two living children, and employment status was associated with an increased likelihood of overall satisfaction with care [10]. The association between overall satisfaction and parity and having more than two children suggests that former experiences with care may have a role in continuous and future health seeking behaviors.

Women's experiences, indicated by perceived incentives and barriers, and provider-patient interactions provide another opportunity to assess the quality of care received by women during the course of prenatal care. Incentives and barriers to care are a key component of many health behavior theories. Incentives to care include perceived benefits and favorable health outcomes. Barriers to care include the cost of care, lack of transportation, distance to access care, long wait times at clinics, and language or cultural barriers. The experiences of women directly impact their health-seeking behaviors (reviewed in [40]). Positive experiences may encourage women to seek care, while negative experiences may deter women from attending subsequent visits, or following recommended schedules. By assessing behaviors and perceptions, inferences may be drawn concerning quality of care.

Disparities in Coverage and Quality of MCH Care in Brazil

Brazil has the largest economy in Latin America. Despite its aggregate wealth, Brazil is a country with considerable income disparities. These disparities are not only reflected in wealth, but also in population health. In 2005, Brazil's staggering number of child deaths placed the country on a priority list for achieving the MDGs by 2015 [49]. Suboptimal health outcomes for mothers and children are associated with pregnancy during adolescence, insufficient education, limited employment or unemployment, and high parity (reviewed in [50]). Health care coverage and quality in Brazil largely reflects

a pro-rich pattern. Identified barriers to care include geographic and social inequalities in health service supply (reviewed in [51]). Other determinants of health, including race and ethnicity, and differences in public versus private care, hinder the ability to access care [39].

Inequities in maternal and child health and care are pervasive in Brazil. Studies of differential access to and coverage have shown that while the initiation of prenatal care is high, the proportion of women receiving recommended care is insufficient, and too often, low [2, 52]. Fewer studies review how the quality of maternal and child health care services vary depending on socio-demographic characteristics [39].

Maternal and Child Health Programs in Brazil

The Brazilian Ministry of Health introduced the Prenatal and Birth Humanization Program (Programa de Humanização no Pré-Natal e Nascimento, PHPN) in 2000 as an effort to reduce maternal and perinatal morbidity and mortality rates. The program is an extension of the universal health care scheme (Sistema Único de Saúde, SUS) introduced in 1988 to establish heath care as a fundamental right. SUS provides health services free of charge at the point of delivery. In 2010, SUS maintained 41,000 health posts and centers, 30,000 specialized outpatient services, 2,000 hospitals, and 236,000 community health agents (reviewed in [51]). Expanding upon the foundations of SUS, PHPN aims to assure universal access to quality care during pregnancy, delivery, and the postnatal and prenatal periods [32]. The PHPN describes the minimum requirements for prenatal care, but leaves it to state governments and municipalities to develop specific implementation protocols that reflect resource levels [33, 34]. Regional differences are reflected in the low coverage of program requirements, which is projected at a rate of 20% [32].

Despite high coverage levels in Brazil, the quality of prenatal health services is not consistently high [53]. A study conducted in Pelotas, Brazil found that half of the women did not receive a breast examination and a quarter of women did not have a pelvic examination during prenatal care (reviewed in [53]). A national study found that only 62% of women received results from a routine HIV test, with variations reflected by demographic characteristics such as educational level and ethnicity (reviewed in [53]).

Information Sources for Receipt of Care in Brazil

The various sources of gathering information on prenatal care visits in Brazil include: SISPRENATAL, Live Birth Information System (SINASC), patient records, pregnancy booklet (prenatal care cards), or interviews with mothers. Brazil utilizes the prenatal health information system (SISPRENATAL) to monitor the implementation of PHPN. SISPRENATAL is considered an unreliable documentation method for tracking the number of visits and procedures performed during care [32]. SISPRENATAL can have failures in documentation as a result of the details involved in the worksheet, sending the worksheet, and in subsequent typing into the system. Additionally, the person registering information into the SISPRENATAL system does not participate in the visits, and therefore does not have the ability to validate that the procedure being registered was actually performed. A separate information system, SINASC, provides detailed information on prenatal care visits in Brazil. Although detailed information is provided by SINASC, the system is limited by its questioned reliability and its inability to evaluate performance based on MoH recommendations. A pregnancy booklet is filled out during each visit and SISPRENATAL relies on worksheets by the health unit after each visit.

The prenatal booklet is more reliable than SISPRENATAL since it is less subject to recording errors.

One study found that prenatal booklets offered more accurate documentation of performance measures when compared to SISPRENATAL [32]. The discrepancy was attributed to recording errors. Prenatal booklets showed greater reporting of procedures compared to SISPRENATAL in all regions. Discrepancies may result in reporting since the prenatal care package is not delivered by one medical professional. Separate physicians, disconnected from prenatal care service delivery, administer vaccines (i.e. tetanus), and these are typically administered on a different day. The lack of integration between the multiple professionals/teams/sectors in delivering prenatal care requirements directly impacts the reporting and documentation of procedures performed [53]. The lack of coordination in service delivery results in substantial differences in reporting and the lack of a single, reliable source for information on prenatal care visits.

CHAPTER #3: METHODS

Study Population

A cross-sectional household survey was conducted in June 2011 with women over the age of 18 that were pregnant and enrolled for prenatal care services at a Family Health Unit in the Vespasiano municipality between October 2009 and September 2010. The project was approved by the Institutional Review Board of Emory University in the United States (IRB00020524) and the Ethics Research Committee of the *Faculdade de Saúde e Ecologia Humana* in Brazil (No. 403/2011).

Sampling Strategy, Recruitment, and Consent

The Brazilian Information System of the Prenatal and Birth Humanization Program (SISPRENATAL) was used to identify women eligible to participate in the study. The Vespasiano municipal epidemiology department provided a complete list of addresses for the eligible study population. This list included a total of 649 women that were enrolled in the 10 operational Family Health Units between October 2009 and September 2010. One unit was excluded from the study as a result of security concerns identified by the community health workers (CHWs) and study team. Sampling was stratified by Family Health Units. The number of participants selected from each unit was proportional to the total number of women in the health unit. Women were selected randomly from each stratum using a random number calculator. CHWs acted as liaisons between the study staff and household members in the beginning of the study. Households were visited at least two times, during different times of the day, for recruitment. Study staff obtained voluntary informed consent from each participant by reciting an oral script.

A total of 423 women were sampled, and 252 interviews were completed for a response rate of 59.6%. Among non-responders, 83 (19.6%) were not home during a minimum of two visits, and 68 (16.1%) moved outside of the municipality or to an unknown location. Ten women (2.4%) were not visited because of logistical barriers. The remainder of women (2.4%) could only meet outside of study work hours (n=5), refused participation (n=2), reported not being pregnant (n=1), or lived in houses that were considered unsafe to visit by CHW (n=2). Of the 252 women interviewed, 238 women were included in the analyses. Reasons for exclusion included fetal death (n=9), reported menstruation date after the date of childbirth (n=1), and an extreme gestational age (n=1).

Study Instrument and Data Collection

A household survey was created for data collection. The questionnaire included questions on demographic characteristics (e.g. age, marital status, skin color, education), past and current pregnancies (including complications, family planning, and pregnancy outcome), and prenatal care received. Household wealth was assessed using 12 questions on household possessions and educational attainment of the head of household [54]. Socioeconomic status was also reflected by enrollment in Bolsa Família, a social welfare program supporting Brazilian families. Women also were asked if they attended prenatal care, the month of the first prenatal care visit, and how many prenatal care visits they made during the pregnancy. Women were asked about the specific procedures during prenatal care in a woman's most recent pregnancy recommended by the Brazilian MoH [31, 33, 34]: uterine height measurement, blood pressure measurement, gynecological exam, breast exam, pap smear, tetanus vaccine, iron supplementation prescription, multivitamin prescription, breastfeeding counseling, blood draw for analyses, and urine

examination. Women were asked if they perceived any of the following as barriers to seeking medical care or treatment: knowing where to go, having permission to go, having money for care, distance to health services, transportation, having to go alone, fear of not receiving care, concerns of not having a female provider, quality of available services, and wait time at clinic.

Reliability of Prenatal Care Recall

Prenatal care cards are used to record information on a woman's prenatal care visits and procedures performed. A subsample of women (n=52) was asked if they had prenatal care cards. If available (n=28), study staff reviewed the prenatal care cards to document procedures reported on the prenatal care cards. Because the prenatal care cards did not appear to include all 11 procedures recommended by the MoH, only data on the performance of a urine analysis, blood analysis, uterine height, blood pressure, iron supplementation, and multivitamin supplementation was gathered. An older version of the prenatal care card did not include information on vitamin and iron supplementation. Thus, urine analysis, blood analysis, uterine height, and blood pressure were the procedures that could be compared, in the subsample of 28 women, between the prenatal care card and their recall on the survey.

Data Quality

Survey data was entered into Microsoft Excel 2010 (Microsoft Corporation, Washington) spreadsheets using double data entry. All discrepancies identified between the two were recorded through an error log, compared to original questionnaires, and resolved by manual corrections in a third spreadsheet. Approximately 5% of the

questionnaires were randomly selected for comparison to the data in the database and no errors were found.

Outcome Variables

Self-reported receipt of each of the 11 procedures prescribed by the MoH was an individual outcome variable. Completion of all 11 procedures indicated receipt of adequate care. Satisfaction with care serves as an additional proxy for assessing quality of care. Satisfaction of care was dichotomized as very satisfied/satisfied or indifferent/unsatisfied/very unsatisfied.

Exposure Variables and Covariates

Skin color was dichotomized as black/mixed and not black/mixed as well as black and not black, but only black and not black was used in the full models. Education attainment was categorized as: ≤7 grades (fundamental education incomplete), 8-10 grades (fundamental education complete), or 11+ grades (intermediate education and beyond). A validated wealth index, based on questions from the 2000 Census, was constructed as an indicator of household wealth. Socioeconomic status was also reflected by participation in Bolsa. Initiation of prenatal care was considered timely if the first visit was completed by the time a woman was 4 months pregnant. The number of visits attended by a woman reflected adherence to prenatal care. MoH recommends a minimum of 6 prenatal care visits. In accordance with this recommendation, women were categorized into two groups, those having less than 6 visits and those with 6 or more visits. Prenatal care type was dichotomized as public or private care. Lastly, a monthly visit from a CHW was treated as an exposure in analyses.

An additional independent variable was included in the analyses to capture the effect of perceived barriers on a woman's satisfaction with care. Specifically, identification of the quality of available services being a barrier to care was treated as a covariate to predict a woman's satisfaction with care.

Data Analysis

Data analysis was performed with the SAS 9.3 software package (SAS Institute Inc., North Carolina).

Recall Reliability

An aim of this study was to evaluate the content of care women received based on the 11 procedures recommended by the MoH, but in the absence of a "gold standard" for recalling procedures women received, our study asked women if they received any of the 11 procedures during care. Recall reliability was assessed by comparing procedures documented on prenatal patient cards and self-reported receipt of procedures in the survey using the kappa statistic [55]. Because the contingency tables comparing the performance and reported receipt of urine analysis, blood analysis, uterine height, and blood pressure were unbalanced as a result of absent responses in at least one category, a coefficient could not be calculated and only percentage agreement was determined.

Analysis of predictors linked to the 11 specific procedures

Bivariate analyses were performed using chi-square test to examine the association between demographic variables and the content of care received. A multivariate logistic regression model was analyzed to identify the relationship between self-reported receipt of all 11 procedures recommended by the MoH (outcome) and socioeconomic status, race, type of care, frequency of visits from CHW, and initiation

and adherence to care (exposures). The same exposure variables were then entered into separate multivariate logistic regression models to identify the association between self-reported receipt of separate prenatal procedures (outcome) and socioeconomic status, race, type of care, frequency of visits from CHW, and initiation and adherence to care (exposures). Women who did not recall receipt of a specific procedure were excluded from the particular analysis. Because uterine height, blood pressure, urine analyses, and blood analyses were performed for almost all women, analyses were not performed for these outcomes.

Analysis of predictors linked to a women's satisfaction with care

To predict a woman's satisfaction with prenatal care (outcome), Bolsa participation, skin color, use of private care, wealth, and perceived barriers to care (exposures) were entered into a logistic regression model. Multivariate logistic regression models were not reduced in these analyses. All tests were conducted at the 95% confidence interval (alpha = .05).

CHAPTER #4: RESULTS

Characteristics of the Population

Women surveyed ranged from 18 to 45 years of age at the time of delivery (Table 1). Approximately three-quarters were between 20 and 34 years of age. Most women self-identified as being mixed (51%), followed by black (24%) and then white (13%). Approximately one quarter of the women did not complete fundamental education, 29% completed fundamental education, and 45% received education at the intermediate level or above. More than half of the participants were unemployed, of whom the majority was not looking for work (data not shown). Relatively few women participated in Bolsa (16%), a social welfare program which provides conditional cash transfers to women of low-income households. In conclusion, women were racially diverse, of lower educational status, and most often in their prime reproductive years.

Pregnancy and Prenatal Care

For the majority of women (62%), this was not the first childbirth (data not shown). A majority of the women (56%) had one to three children (data not shown). To determine initiation and adherence to prenatal care, women were asked when they initiated prenatal care and the total number of visits attended (Table 2). In accordance with standards of prenatal care utilization, the majority of women initiated prenatal care by month 4. On average, prenatal care was initiated by month 3, as compared to the recommended standard of initiating care by month 4. Women attended an average of 6 prenatal care visits, as compared to the minimum standard of 7 visits. Most women used the public health sector versus the private sector for prenatal care services (Table 1). The majority of women in the study reported being satisfied with the care received during

prenatal care (Table 2). Overall, women surveyed initiated care in a timely manner, as recommended by the MoH, but did not attend the minimum number of recommended visits.

Recall Reliability

Comparison of Prenatal Care Procedures between Prenatal Care Cards and Self-Report

To determine the reliability of self-reported receipt of prenatal care procedures, those reported by the woman were compared to those documented on prenatal patient cards, which included blood pressure, blood analysis, uterine height, and urine analysis (Methods). Agreement was high across categories (i.e. blood pressure, blood analysis, uterine height, urine analysis) within the eligible subsample of 27 possessing prenatal care cards (Table 3). The high agreement found between self-report data and information recorded on prenatal care cards suggests that maternal recall is a reliable source in the absence of a gold standard for recording procedures performed during care.

Receipt of Prenatal Care Procedures

Only 15 of the 238 women in the study reported receiving all 11 procedures, as recommended by the MoH (Table 4). Approximately three quarters of women reported receiving counseling on breastfeeding and gynecological exams during prenatal care (Table 4). Only 35% of women reported receiving a mammogram, and merely 17% reported receiving a pap smear during their pregnancy (Table 4). Overall, women commonly reported receiving prescriptions, including iron supplementation (92%), tetanus vaccination (75%), and multivitamin supplementation (92%). Approximately three-quarters of women received the tetanus vaccine and multivitamin supplementation.

Factors Associated with Receipt of all 11 Procedures

An adjusted logistic regression analysis suggested that women who were enrolled in Bolsa had higher odds of receiving all 11 procedures during prenatal care (Table 5). The odds of receiving all 11 procedures during prenatal care were lower among women with fundamental education or less.

Factors Associated with Receipt of Physical Examinations and Counseling

A woman's odds of receiving a gynecological exam was higher if she used private care, but also if she received at least one monthly visit from a CHW (Table 6). Women who did not complete fundamental education had decreased odds of receiving a gynecological exam. Several factors were significantly associated with receipt of a mammogram during prenatal care. The odds receiving a mammogram were higher for women enrolled versus not enrolled in Bolsa. Odds also were higher for women who reported having at least one CHW visit a month compared to those who reported having CHW visits less often than once a month. Compared to their counterparts, black women as well as women with less than fundamental education had lower odds of receiving a mammogram. Lastly, compared to women who initiated prenatal care in the first four months of pregnancy, those who initiated prenatal care during or after the fifth month had lower odds of receiving a mammogram. The odds of receiving a pap smear were higher for women enrolled in Bolsa than for those who were not. Women with less than fundamental education had lower odds of receiving a pap smear than their counterparts. Women who utilized the private sector had higher odds of receiving counseling on breastfeeding practices.

Factors Associated with Reported Receipt of Prescriptions

None of the factors included in the model were positively associated with reported receipt of the tetanus vaccine. The odds of receiving a tetanus vaccine were lower among women with less than fundamental education and women who self identified as black. The odds of being prescribed iron supplements were higher among women who received at least one CHW visit a month. Multivitamin supplementation was not as universal as iron. Women who initiated prenatal care late, or after month 4, were less likely to be prescribed iron supplements. However, no factors were significantly associated with multivitamin prescription in the adjusted analysis.

Satisfaction with Prenatal Care

Factors Associated with Satisfaction with Prenatal Care

The odds of a woman reporting satisfaction with care were higher among those who received at least one CHW visit a month (Table 8). Women who identified the quality of available services as barriers to care or utilized private care were more likely to be dissatisfied with their prenatal care. The frequency of CHW visits, the identification of barriers to care, and utilization of private care were associated with a woman's satisfaction with prenatal care services.

CHAPTER #5: DISCUSSION

Findings

The goal of this study was to assess the quality of prenatal care received by women in Vespasiano, Brazil between September 2009 and October 2010. In summary, the receipt of procedures varied; nearly all women reported receiving measurements during prenatal care, but fewer women reported receiving physical examinations, counseling, and prescriptions. Factors significantly associated with reporting the receipt of prenatal care procedures also varied. Enrollment in Bolsa and receiving at least one CHW visit a month were positively associated with self-reported receipt of care. Low education attainment was a risk factor for self-reported non-receipt of specific prenatal care procedures. Women within the study population who identified barriers to care and women who used private care were less likely to be satisfied with prenatal care received; whereas, women who received at least one CHW a month were more likely to be satisfied with prenatal care.

Variability of Procedures

Our findings regarding the variability of procedures performed, based on type, are consistent with other studies that examined the content of prenatal care in Brazil and the U.S. [39, 47]. Nearly all women in our study reported receipt of procedures classified as measurements, but fewer women reported receipt of physical examinations and prescriptions. One explanation for this finding is that a nurse or physician's assistant, regardless of the reason for the visit, usually performs procedures such as blood pressure measurement and urine collection at the entry point of care [39]. It is likely that without an evidence-base or reporting requirements for procedures performed during prenatal

care, physicians may be less inclined to deliver all recommended procedures, or only deliver based on their assessments of need [56]. Further, the procedures within the measurement category require less skill and steps to perform, and therefore can be carried out by health professionals without specialized training. Only 71% of women recalled receiving a prescription for multivitamin supplementation, while 92% of women recalled receiving a prescription for iron supplementation. A study by Wehby and colleagues also found that counseling on iron supplementation is provided more often than multivitamin supplementation, suggesting that counseling women on the benefits of multivitamins is not standard practice in Brazil for prenatal care services [57]. The discrepancy between multivitamin supplementation and iron supplementation can be explained by associated costs. In Brazil, iron supplements are subsidized and often freely available at public clinics, but multivitamin supplements are not provided free to pregnant women [39].

The discrepancy between the performance of specific procedures also may reflect the growth both in the health sector and in the use of health services in Brazil, specifically within the use of prenatal care services [58]. The existing healthcare infrastructure, characterized by high turnover rates, inadequate professional training, deficient infrastructure and insufficient resources, has been cited as a reason why completion rates for prenatal care, according to MoH guidelines, have been low [2]. Although health system reforms have improved access to care in Brazil and increased utilization rates, challenges remain in terms of ensuring equity and sustainability [53, 58, 59].

Protective and Risk Factors for Reported Receipt of Care

Interestingly, we found participation in Bolsa, Brazil's social welfare program, to be positively associated with self-reported receipt of specific prenatal care procedures. Brazil's Bolsa Família Program is a social welfare program that aims to reduce poverty by targeting low-income families and providing conditional cash transfers to women of households [60]. Specifically, families with per capita income between 60 and 120 Brazilian Reals (less than $61.00) are eligible to enroll in Bolsa [61]. Bolsa provides cash transfers to women contingent upon family behaviors such as the use of health cards and other social services, in which prenatal care falls [60]. These cash transfers enable women to attend prenatal care visits by increasing access to care. Cash transfer programs in Malawi, Mexico, Honduras, and Nicaragua have been associated with increased use of health services [62]. In addition to promoting care-seeking behaviors, these programs have been associated with increased immunization coverage, and improved immunization coverage and health status. However, the same improvements in health service utilization and care-seeking behaviors have not been observed as an outcome of Bolsa in Brazil [63].

One of Bolsa's primary goals is to improve maternal and child health outcomes by promoting health care utilization [64, 65]. Conditional cash transfers, then, are expected to increase a woman's likelihood of receiving services that socially and economically disadvantaged populations usually do not have access to or utilize. Although an evaluation of Bolsa found that enrollment had no effect on child immunization or acute malnutrition and chronic stunting, the study cited heighted awareness of the importance of accessing preventive health services. Because awareness was increased, Soares and colleagues cited the lack of available health services as a

possible explanation for the absence of a relationship between Bolsa and immunization and nutrition outcomes. Bolsa has proven to be effective in improving outcomes in other areas such as poverty alleviation and education [63]. Additionally, conditional cash transfer programs in other Latin American countries (i.e. Mexico and Colombia) were shown to be effective in improving health conditions [63]. Our findings may support Soares' hypothesis of supply-side factors as a prohibitive factor for improvements in health. Over the last three decades, Brazil has worked to improve the infrastructure of prenatal care service delivery. Access to prenatal care has increased tremendously as a result of the FHP and regionalized health teams, eliminating the barrier cited by Soares and colleagues [2]. The effect on prenatal care utilization was not assessed in the evaluation of Bolsa [63]. Studies assessing the relationship between Bolsa enrollment and prenatal care access, utilization, and delivery are necessary to better understand the affect of conditional cash transfers on care-seeking behaviors.

Several studies have identified socio-economic and ethnic differences in the content of care received by women in the U.S. and Latin America [39, 47, 66]. Our study only found skin color to be negatively associated with receipt of a mammogram. However, low educational attainment, another indicator of socio-economic status, was a risk factor for reported non-receipt of many prenatal care procedures in our study. Consistent with other studies, women with low educational attainment were less likely to receive all 11 procedures, gynecological exams, mammograms, pap smears, and vaccination against tetanus [47]. It is possible that women with less education, compared to those with more education, may not be able to distinguish between the various procedures performed during prenatal care, such as differentiating between a

gynecological exam versus pap smear, resulting in differences in recall. Further, women with lower education attainment may not have the appropriate knowledge of standard prenatal care procedure or why procedures are important. Without this health literacy, women are not engaged in their care and do not have authority or empowerment to demand care [67, 68]. The lack of education and understanding of prenatal care procedures may also enable providers to treat women with lower educational attainment less equitably than women with higher levels of education.

A similar study in Brazil, assessing the content of care, found socio-economic status characteristics, such as skin color and income, to be associated with the non-receipt of prenatal care procedures [39]. However, these differences diminished after adjusting for attendance patterns, specifically number of visits. In our models, the number of visits a woman received, however, did not predict a woman's likelihood of receiving procedures during prenatal care in our study population. In our models, only late initiation (≥5 months) was statistically significant with decreased odds of receiving a mammogram or iron supplementation.

Reported Satisfaction with Care

Overall, we found that the majority of Vespasiano women receiving prenatal care services between September 2009 and October 2010 were satisfied with care. Generally, operational definitions of satisfaction involve an individual's expectations for care and that individual's perceived reality of the delivery or receipt of care [69-71]. Factors commonly associated with lowered satisfaction in other studies include exclusive use of public sector and continuity of care [72-75]. Our findings revealed that women who identified the quality of available services as a barrier to care and women who utilized

private care were less likely to be satisfied with the prenatal care they received. In other studies, barriers associated with lowered satisfaction include language and cultural barriers, lack of transportation, cost of care, and wait time [75, 76]. Generally, exclusive use of the public sector for care is associated with lower levels of satisfaction which is counter to our findings that women who reported utilizing private care were more likely to be dissatisfied with care received [73]. A possible explanation for this relationship is that women switched to private services as a result of their dissatisfaction with the public sector. Our study does not investigate why women reported being dissatisfied with care, but lower costs for care have been associated with higher satisfaction in other studies, which may further explain why women in our study who utilized private care were more likely to be dissatisfied with care [77].

Further, women who received at least one CHW visit a month were more likely to report satisfaction with care. Guidelines of the Family Health Program require CHWs to visit households at least once a month to monitor household health and provide referrals to family health units when necessary [78]. The expectation of care is established through guidelines and the structure of the FHP in Brazil. Further, having at least one CHW visit per month is consistent with other studies that found continuity of care and patient-provider interactions as factors of patient satisfaction [79-81].

Strengths and Limitations

This study was characterized by multiple strengths. The primary strength of this study was the ability to evaluate the quality, or content of care received during prenatal care. Adequacy of prenatal care is often assessed using variables such as initiation of care, number of visits, and gestational age. However, because the goal of prenatal care is

to improve outcomes for mothers and children, the content of care is a critical component to evaluate. A second strength is that our analyses included the 11 procedures recommended by the MoH for performance during prenatal care. A third strength is that we were able to validate the receipt of prenatal care procedures through self-report in a subset of women.

This study had several limitations. With cross-sectional design of the study is limiting because causality cannot be determined. Although the survey asked women if they experienced complications during pregnancy, the type of complication or its timeframe (i.e. recent or past pregnancies) was not specified. Guidelines for the administration of prenatal care services, in terms of number of visits and content of care, are usually dependent upon classified risk of the pregnancy [29, 30, 82]. Additionally, women were only asked if they received procedures at least once during prenatal care visits, limiting our ability to determine when women received procedures. PHPN guidelines specify that all procedures should be performed during the first visit, but lab tests should be repeated at 30 gestational weeks [31]. In summary, the inability to assess pregnancy risk in relation to the content of care received and the timing of receipt limited our study.

Implications, Recommendations, and Conclusions

Brazil has taken tremendous steps toward ensuring health access to women and children. Various strategies can be employed to ensure that women not only have access to care, but access to quality care. In our study, women enrolled in Bolsa, Brazil's social welfare program, were more likely to receive quality care, suggesting Bolsa is achieving its intended goals in terms of prenatal care. Other Latin American social welfare

programs should model Bolsa and adopt key tenants such as behavior change and the empowerment of women. Additionally, our study showed that those procedures listed on the prenatal care cards (blood pressure, blood analysis, urine analysis, uterine height) were performed almost universally among women. Prenatal care cards should be updated to include all 11 procedures women are recommended to receive so that knowledge, transparency, and women's empowerment to demand these procedures can be increased. Additionally, attendance patterns, specifically the number of prenatal care visits attended, did not predict a woman's likelihood of receiving prenatal care procedures. Rather than specifying that all women should have a total of seven visits during care, efforts should be targeted at ensuring women receive evidence-based procedures during care, or at the very least, recommended procedures. Attendance patterns are potentially meaningless unless quality services are rendered.

Interventions and programs with goals of improving conditions in maternal and child health should focus on educating women on the purpose and benefits of prenatal care. The Health Belief Model (HBM) framework is helpful for understanding why individuals take action to prevent, screen for, and control illnesses. The constructs include perceived susceptibility, perceived benefits, perceived barriers, cues to action, and self-efficacy. Many of these constructs, however, require women to have an understanding of the complications and risks that could occur during a pregnancy. Women also require an understanding of how prenatal care serves to improve the outcomes of a pregnancy. In addition to educating providers, increasing knowledge among women is critical. Many of the procedures performed during prenatal care are difficult to distinguish. Providers should communicate to women during care—explaining

the procedures and reasons for their use. This transparency, according to the HBM, would encourage women to seek care and overtime, develop self-efficacy to demand care. Prenatal care is widespread in Brazil. It remains a priority to ensure that the quality of care is high in order to achieve the goals of improving maternal and child health overall.

In conclusion, an evaluation of the content of care is necessary to promote the delivery of quality care. This study demonstrated that although utilization of prenatal care is high, the content of care varied. Merely 15 women in the study reported receipt of all 11 procedures recommended by the MoH. Gaps in delivery were reflected in the low performance of specific procedures and identified risk factors for reported non-receipt of procedures. Additionally, women in Vespasiano, Brazil were generally satisfied with the care received, but perceptions of barriers to care existed among this population. Assessments of prenatal care delivery in Brazil should shift to focus on barriers to care and the quality of care. This will guide reforms necessary to improve conditions in maternal and child health.

REFERENCES

1. Foundation, B.a.M.G. *Maternal, Neonatal and Child Health: Strategy Overview*. 2013; Available from: http://www.gatesfoundation.org/What-We-Do/Global-Development/Maternal-Neonatal-and-Child-Health.
2. Passos, A.A. and E.R.F. Moura, *Process indicators in the Program for Humanization of Prenatal Care and Childbirth in Ceará State, Brazil: analysis of a historical series (2001-2006).* Cadernos de Saúde Pública, 2008. **24**(7): p. 1572-1580.
3. Glanz, K.R., Barbara K.; Viswanath, K., *Health Behavior and Health Education: Theory, Researrch, and Practice*. Fourth Edition ed2008, San Francisco, CA: Jossey-Bass.
4. Rogers, E.M., *Diffusion of preventive innovations.* Addict Behav, 2002. **27**: p. 989-993.
5. Haider, M. and G.L. Kreps, *Forty years of diffusion of innovations: utility and value in public health.* Journal of health communication, 2004. **9**(S1): p. 3-11.
6. Statistics, B.I.o.G.a. *Demographic Census*. 2010 November 11, 2012]; Available from: http://tabnet.datasus.gov.br/.
7. Statistics, B.I.o.G.a. *Household Income Survey*. 2003.
8. Health, B.M.o. *Live Birth Information System (SINASC)*. 2009; Available from: http://tabnet.datasus.gov.
9. Carroli, G., C. Rooney, and J. Villar, *How effective is antenatal care in preventing maternal mortality and serious morbidity? An overview of the evidence.* Paediatr Perinat Epidemiol, 2001. **15 Suppl 1**: p. 1-42.
10. Oladapo, O.T. and M.O. Osiberu, *Do sociodemographic characteristics of pregnant women determine their perception of antenatal care quality?* Matern Child Health J, 2009. **13**(4): p. 505-11.
11. Organization, W.H., *Maternal mortality.* 2012.
12. Organization, W.H., *Children: reducing mortality.* 2012.
13. Organization, W.H., *Newborns: reducing mortality.* 2012.
14. Oestergaard, M.Z., et al., *Neonatal mortality levels for 193 countries in 2009 with trends since 1990: a systematic analysis of progress, projections, and priorities.* PLoS Med, 2011. **8**(8): p. e1001080.
15. McCormick, M.C., *The contribution of low birth weight to infant mortality and childhood morbidity.* The New England Journal of Medicine, 1985.
16. Villar, J. and P. Bergsjo, *Scientific basis for the content of routine antenatal care. I. Philosophy, recent studies, and power to eliminate or alleviate adverse maternal outcomes.* Acta Obstet Gynecol Scand, 1997. **76**(1): p. 1-14.
17. Moos, M.K., *Prenatal care: limitations and opportunities.* J Obstet Gynecol Neonatal Nurs, 2006. **35**(2): p. 278-85.
18. Alexander, G.R. and M. Kotelchuck, *Assessing the role and effectiveness of prenatal care: history, challenges, and directions for future research.* Public Health Rep, 2001. **116**(4): p. 306-16.
19. Campbell, O.M. and W.J. Graham, *Strategies for reducing maternal mortality: getting on with what works.* Lancet, 2006. **368**(9543): p. 1284-99.

20. AbouZahr, C. and T. Wardlaw, *Maternal mortality at the end of a decade: signs of progress?* Bulletin-World Health Organization, 2001. **79**(6): p. 561-568.
21. Kitzman, H., et al., *Effect of prenatal and infancy home visitation by nurses on pregnancy outcomes, childhood injuries, and repeated childbearing. A randomized controlled trial.* JAMA, 1997. **278**(8): p. 644-52.
22. Olds, D.L., et al., *Improving the delivery of prenatal care and outcomes of pregnancy: a randomized trial of nurse home visitation.* Pediatrics, 1986. **77**(1): p. 16-28.
23. Fiscella, K., *Does prenatal care improve birth outcomes? A critical review.* Obstetrics & Gynecology, 1995. **85**(3): p. 468-479.
24. Birthweight, C.S.P.L. and D.H.P.D. Prevention, *Preventing Low Birthweight: Summary*1985: National Academies Press.
25. Gortmaker, S.L., *The effects of prenatal care upon the health of the newborn.* Am J Public Health, 1979. **69**(7): p. 653-660.
26. Mustard, C.A. and N.P. Roos, *The relationship of prenatal care and pregnancy complications to birthweight in Winnipeg, Canada.* Am J Public Health, 1994. **84**(9): p. 1450-1457.
27. Raine, T., S. Powell, and M.A. Krohn, *The risk of repeating low birth weight and the role of prenatal care.* Obstetrics and Gynecology, 1994. **84**: p. 485-485.
28. Health, W.H.O.R., *Pregnancy, Childbirth, Postpartum, and Newborn Care: A Guide for Essential Practice*2003: WHO.
29. Freeman, R. and R. Poland, *Guidelines for perinatal care.* Washington: American Academy of Pediatrics and American College of Obstetricians and Gynecologists, 1992.
30. Quality, A.f.H.R.a., *Routine prenatal care*, U.S.D.o.H.a.H. Services, Editor 2010, The National Guideline Clearinghouse: Bloomington, MN.
31. Ministério da Saúde, D.d.A.P.E., *Secretaria de Atenção à Saúde: Pré-natal e puerpério: atenção qualificada e humanizada – manual técnico*, M.d. Saúde, Editor 2005: Brasília.
32. Andreucci, C.B., et al., *SISPRENATAL as a tool for evaluating quality of prenatal care.* Revista de Saúde Pública, 2011. **45**(5): p. 854-864.
33. Health, M.G.S.S.o., *Prenatal, birth and puerparal care: the Live Life protocol*, SAS/SES, Editor 2006: Prenatal, birth and puerparal care: the Live Life protocol.
34. Secretaria Municipal de Saúde, P.M.d.V., *Protocolo de Assistência à Mulher no Período do Pré-Natal no Município de Vespasiano* P.M.d. Vespasiano, Editor 2009: Vespasiano, Minas Gerais.
35. Alexander, G.R. and M. Kotelchuck, *Quantifying the adequacy of prenatal care: a comparison of indices.* Public health reports, 1996. **111**(5): p. 408.
36. Research, I.o.M.P.o.H.S. and D.M. Kessner, *Infant death: an analysis by maternal risk and health care*. Vol. 1. 1973: Institute of Medicine Washington^ eDC DC.
37. Kotelchuck, M., *An evaluation of the Kessner adequacy of prenatal care index and a proposed adequacy of prenatal care utilization index.* Am J Public Health, 1994. **84**(9): p. 1414-1420.
38. Beeckman, K., et al., *The relationship between antenatal care and preterm birth: the importance of content of care.* Eur J Public Health, 2012.

39. Victora, C., et al., *Socio-economic and ethnic group inequities in antenatal care quality in the public and private sector in Brazil.* Health Policy and Planning, 2010. **25**(4): p. 253-261.
40. Novick, G., *Women's experience of prenatal care: an integrative review.* J Midwifery Womens Health, 2009. **54**(3): p. 226-37.
41. Vause, S. and M. Maresh, *Indicators of quality of antenatal care: a pilot study.* Br J Obstet Gynaecol, 1999. **106**(3): p. 197-205.
42. Beeckman, K., et al., *The development and application of a new tool to assess the adequacy of the content and timing of antenatal care.* BMC Health Serv Res, 2011. **11**: p. 213.
43. Petitti, D.B., et al., *An outcome evaluation of the content and quality of prenatal care.* Birth, 1991. **18**(1): p. 21-25.
44. Peoples-Sheps, M.D., V.K. Hogan, and N. Ng'andu, *Content of prenatal care during the initial workup.* American journal of obstetrics and gynecology, 1996. **174**(1): p. 220-226.
45. Kotelchuck, M., et al., *The influence of site of care on the content of prenatal care for low-income women.* Matern Child Health J, 1997. **1**(1): p. 25-34.
46. Kogan, M.D., et al., *Relation of the content of prenatal care to the risk of low birth weight.* JAMA: The Journal of the American Medical Association, 1994. **271**(17): p. 1340-1345.
47. Kogan, M.D., et al., *Comparing mothers' reports on the content of prenatal care received with recommended national guidelines for care.* Public health reports, 1994. **109**(5): p. 637.
48. Langer, A., et al., *Conceptual bases and methodology for the evaluation of women's and providers' perception of the quality of antenatal care in the WHO Antenatal Care Randomised Controlled Trial.* Paediatr Perinat Epidemiol, 1998. **12**: p. 98-115.
49. Barros, F.C., et al., *Recent trends in maternal, newborn, and child health in Brazil: progress toward Millennium Development Goals 4 and 5.* Am J Public Health, 2010. **100**(10): p. 1877-89.
50. Machado, C.J. and K. Hill, *Maternal, neonatal and community factors influencing neonatal mortality in Brazil.* J Biosoc Sci, 2005. **37**(2): p. 193-208.
51. Macinko, J. and M. Lima-Costa, *Horizontal equity in health care utilization in Brazil, 1998–2008.* International Journal for Equity in Health, 2012. **11**(1): p. 33.
52. Barros, F.C., et al., *The challenge of reducing neonatal mortality in middle-income countries: findings from three Brazilian birth cohorts in 1982, 1993, and 2004.* Lancet, 2005. **365**(9462): p. 847-854.
53. Victora, C.G., et al., *Maternal and child health in Brazil: progress and challenges.* Lancet, 2011. **377**(9780): p. 1863-76.
54. Barros, A.J. and C.G. Victora, *A nationwide wealth score based on the 2000 Brazilian demographic census.* Revista de Saúde Pública, 2005. **39**(4): p. 523-529.
55. Crewson, P.E., *A Correction for Unbalanced Kappa Tables.* SAS 6.12, 2001. **Paper 194-26**.

56. Glei, D.A., N. Goldman, and G. Rodríguez, *Utilization of care during pregnancy in rural Guatemala: does obstetrical need matter?* Social science & medicine, 2003. **57**(12): p. 2447-2463.
57. Wehby, G.L., et al., *Predictors of multivitamin use during pregnancy in Brazil.* International journal of public health, 2009. **54**(2): p. 78-87.
58. Paim, J., et al., *The Brazilian health system: history, advances, and challenges.* The Lancet, 2011. **377**(9779): p. 1778-1797.
59. Victora, C.G., et al., *Applying an equity lens to child health and mortality: more of the same is not enough.* The Lancet, 2003. **362**(9379): p. 233-241.
60. e Silva, M.O.d.S., *The Bolsa Família and Social Protection in Brazil.*
61. Soares, S., R.P. Ribas, and F.V. Soares, *Targeting and Coverage of the Bolsa Família Programme: Why Knowing What You Measure is Important in Choosing the Numbers*, 2010.
62. Lagarde, M., A. Haines, and N. Palmer, *Conditional cash transfers for improving uptake of health interventions in low-and middle-income countries.* JAMA: The Journal of the American Medical Association, 2007. **298**(16): p. 1900-1910.
63. Soares, F.V., R.P. Ribas, and R.G. Osório, *Evaluating the Impact of Brazil's Bolsa Família: Cash Transfer Programs in Comparative Perspective.* Latin American Research Review, 2010. **45**(2): p. 173-190.
64. Sambamoorthi, U. and D.D. McAlpine, *Racial, ethnic, socioeconomic, and access disparities in the use of preventive services among women.* Preventive Medicine: An International Journal Devoted to Practice and Theory, 2003.
65. Segnan, N., *Socioeconomic status and cancer screening.* IARC scientific publications, 1997(138): p. 369.
66. Couture, M.-C., et al., *Inequalities in breast and cervical cancer screening among urban Mexican women.* Preventive medicine, 2008. **47**(5): p. 471-476.
67. Bennett, I., et al., *'Breaking It Down': Patient-Clinician Communication and Prenatal Care Among African American Women of Low and Higher Literacy.* The Annals of Family Medicine, 2006. **4**(4): p. 334-340.
68. Samantha Garbers, M. and M.A. Chiasson, *Inadequate functional health literacy in Spanish as a barrier to cervical cancer screening among immigrant Latinas in New York City.* Preventing Chronic Disease, 2004: p. 03_0038.
69. Linder-Pelz, S., *Toward a theory of patient satisfaction.* Social science & medicine, 1982. **16**(5): p. 577-582.
70. Williams, B., *Patient satisfaction: a valid concept?* Social science & medicine, 1994. **38**(4): p. 509-516.
71. Hekkert, K.D., et al., *Patient satisfaction revisited: a multilevel approach.* Social science & medicine, 2009. **69**(1): p. 68-75.
72. Probst, J.C., D.L. Greenhouse, and A.W. Selassie, *Patient and physician satisfaction with an outpatient care visit.* The Journal of family practice, 1997. **45**(5): p. 418.
73. Gouveia, G.C., et al., *Health care users' satisfaction in Brazil, 2003.* Cadernos de Saúde Pública, 2005. **21**: p. S109-S118.
74. Omar, M.A. and R.F. Schiffman, *Pregnant women's perceptions of prenatal care.* Maternal-child nursing journal, 1995. **23**(4): p. 132.

75. Handler, A., et al., *Women's satisfaction with prenatal care settings: A focus group study.* Birth, 1996. **23**(1): p. 31-37.
76. Anderson, R.T., F.T. Camacho, and R. Balkrishnan, *Willing to wait?: The influence of patient wait time on satisfaction with primary care.* BMC Health Serv Res, 2007. **7**(1): p. 31.
77. Andaleeb, S.S., N. Siddiqui, and S. Khandakar, *Patient satisfaction with health services in Bangladesh.* Health Policy and Planning, 2007. **22**(4): p. 263-273.
78. Svitone, E.C., et al., *Primary health care lessons from the Northeast of Brazil: the Agentes de Saúde Program.* Revista Panamericana de Salud Pública, 2000. **7**(5): p. 293-301.
79. Hjortdahl, P. and E. Laerum, *Continuity of care in general practice: effect on patient satisfaction.* BMJ: British Medical Journal, 1992. **304**(6837): p. 1287.
80. Saultz, J.W. and W. Albedaiwi, *Interpersonal continuity of care and patient satisfaction: a critical review.* The Annals of Family Medicine, 2004. **2**(5): p. 445-451.
81. Fan, V.S., et al., *Continuity of care and other determinants of patient satisfaction with primary care.* Journal of general internal medicine, 2005. **20**(3): p. 226-233.
82. Chalmers, B., V. Mangiaterra, and R. Porter, *WHO principles of perinatal care: the essential antenatal, perinatal, and postpartum care course.* Birth, 2001. **28**(3): p. 202-207.

TABLES

Table 1. Demographic characteristics of women having live births. Vespasiano, Minas Gerais State, Brazil, 2011. (N=238)

Characteristic	%
Age at childbirth, in years	
18-20 years	13
20-34 years	73
35-45 years	14
Marital Status	
Single	19
Single, but living with partner	35
Married	45
Separated	2
Divorced	<1
Skin Color	
Mixed	51
Black	24
White	13
Yellow	9
Amerindian	3
Mother's education	
Less than fundamental	26
Fundamental	29
Intermediate or higher	45
Bolsa* Enrollment	16

*Bolsa: Brazil's social welfare program

Table 2. Characteristics of pregnancy and prenatal care received by women in Vespasiano, Brazil, 2011 (N=238)

Characteristic	%
Planned Pregnancy	47
Timing of Prenatal Care, in months	
0 to 4	88
5 to 8	12
Number of Prenatal Care Visits	
1 to 6	84
7	16
Utilization of Private Care	16
Satisfied with Prenatal Care	82

Table 3. Recall Reliability. Percentage agreement between self-report and prenatal care card data of procedures performed (N=27).

Procedure Performed	Agree	Disagree	Agreement (%)
Urine Analysis	24	3	90
Uterine Height	26	1	96
Blood Analysis	26	1	96
Blood Pressure	27	0	100

Table 4. Self-reported receipt of recommended prenatal care procedures performed between October 2009 and September 2010 in Vespasiano, Brazil. (N=238)

Procedure	Yes (%)
Measurements	
Blood pressure	100
Blood analysis	99.6
Uterine height	97
Urine analysis	97
Physical Exam and Counseling	
Counseling about breastfeeding	78
Gynecological exam	71
Mammogram	35
Pap smear	17
Prescriptions	
Iron supplementation	92
Tetanus toxoid vaccine	75
Multivitamin supplementation	71
Reported receipt of all 11 Procedures	6

Table 5. Adjusted odds for self-reported receipt of all 11 recommended procedures during prenatal care by women between October 2009 and September 2010 in Vespasiano, Brazil (N=238)

Characteristic	OR (95% CI)
Bolsa Enrollment	
Yes	5.16 (1.29-24.48)**
No	ref
Utilization of Private Care	
Yes	1.73 (0.48-6.26)
No	ref
Educational Attainment	
Less than fundamental	0.25 (0.05-1.24)†
Fundamental	0.17 (0.03-0.98)**
Intermediate or higher	ref
Skin Color	
Black	0.49 (0.12-2.02)
Not Black	ref
Timing of Prenatal Care, in months	
0 to 4	ref
5 to 8	0.52 (0.06-4.73)
Number of Visits	
1 to 6	1.46 (0.39-5.43)
7	ref
Frequency of CHW_a Visits	
At least once a month	1.76 (0.57-5.45)
Less than once a month	ref

$_a$CHW: Community Health Worker, ** $p<0.05$, † $p<0.10$

Table 6. Adjusted odds for self-reported receipt of physical examinations and counseling during prenatal care by women in Vespasiano, Brazil between October 2009 and September 2010[a].

	Gynecological Exam	Mammogram	Pap Smear	Breastfeeding Counseling
Characteristic	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Bolsa Enrollment				
Yes	1.76 (0.72-4.26)	2.32 (1.03-5.18)**	3.26 (1.30-8.18)**	1.40 (0.55-3.55)
No	ref	ref	ref	ref
Utilization of Private Care				
Yes	3.40 (1.11-10.46)**	1.69 (0.80-3.57)	1.87 (0.81-4.35)	3.13 (1.03-9.52)**
No	ref	ref	ref	ref
Educational Attainment				
Less than fundamental	0.38 (0.18-0.81)**	0.33 (0.15-0.75)**	0.43 (0.17-1.14)†	0.99 (0.45-2.19)
Fundamental	1.33 (0.61-2.89)	0.82 (0.42-1.60)	0.59 (0.25-1.38)	1.21 (0.56-2.63)
Intermediate or higher	ref	ref	ref	ref
Skin Color				
Black	0.58 (0.28-1.18)	0.54 (0.27-1.06)†	0.95 (0.43-2.12)	1.16 (0.54-2.53)
Not Black	ref	ref	ref	ref
Timing of Prenatal Care, in months				
0 to 4	ref	ref	ref	ref
5 to 8	0.55 (0.21-1.45)	0.39 (0.14-1.09)†	1.24 (0.40-3.90)	1.01 (0.31-3.27)
Number of Visits				
1 to 6	1.14 (0.53-2.42)	1.34 (0.67-2.65)	0.59 (0.25-1.42)	1.51 (0.51-4.47)
7	ref	ref	ref	ref
Frequency of CHW[b] Visits				
At least once a month	1.96 (1.03-3.73)**	1.72 (.96-3.08)†	1.21 (.60-2.43)	1.36 (0.71-2.61)
Less than once a month	ref	ref	ref	ref

[a]Sample sizes varied according to procedure: gynecological exam (n=229), mammogram (n=231), pap smear (n=230), breastfeeding counseling (n=231), [b]CHW: Community Health Worker, ** $p<0.05$, † $p<0.10$

Table 7. Adjusted odds for self-reported receipt of prescriptions during prenatal care by women in Vespasiano, Brazil between October 2009 and September 2010[a].

	Tetanus Vaccination	Iron Supplementation	Multivitamin Supplementation
Characteristic	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Bolsa Enrollment			
Yes	1.24 (0.50-3.06)	1.19 (0.23-6.04)	1.18 (0.51-2.75)
No	ref	ref	
Utilization of Private Care			
Yes	1.30 (0.48-3.50)	0.60 (0.17-2.12)	0.60 (0.28-1.27)
No	ref	ref	ref
Educational Attainment			
Less than fundamental	0.36 (0.16-0.81)**	1.44 (0.39-5.40)	0.60 (0.28-1.27)
Fundamental	1.26 (0.54-2.93)	1.52 (0.42-5.48)	0.64 (0.32-1.28)
Intermediate or higher	ref	ref	ref
Skin Color			
Black	0.44 (0.21-0.92)**	1.25 (0.33-4.81)	0.88 (0.45-1.75)
Not Black	ref	ref	ref
Timing of Prenatal Care, in months			
0 to 4	ref	ref	ref
5 to 8	1.08 (.038-3.12)	0.23 (0.06-0.94)**	0.77 (0.31-1.90)
Number of Visits			
1 to 6	0.82 (0.38-1.80)	1.48 (0.39-5.56)	0.88 (0.44-1.75)
7	ref	ref	ref
Frequency of CHW[b] Visits			
At least once a month	1.28 (0.65-2.52)	2.95 (0.89-9.77)†	1.56 (0.86-2.84)
Less than once a month	ref	ref	ref

[a]Sample sizes varied according to procedure: tetanus vaccination (n=224), iron supplementation (n=230),multivitamin supplementation (n=230) [b]CHW: Community Health Worker, ** p<0.05, †p<0.10

Table 8. Adjusted odds for self-reported satisfaction with prenatal care received by women in Vespasiano, Brazil between October 2009 and September 2010 (N=233).

Characteristic	OR (95% CI)
Bolsa Enrollment	
Yes	1.15 (0.33-3.96)
No	ref
Utilization of Private Care	
Yes	0.27 (0.10-0.70)**
No	ref
Educational Attainment	
Less than fundamental	0.58 (0.21-1.64)
Fundamental	1.04 (0.40-2.72)
Intermediate or higher	ref
Skin Color	
Black	1.21 (0.46-3.17)
Not Black	ref
Perceiving quality of available services as a barrier to care	
Yes	0.14 (0.06-0.32)**
No	ref
Receipt of all 11 Procedures	
Yes	ref
No	1.69 (0.34-8.34)
Frequency of CHW_a Visits	
At least once a month	2.02 (0.87-4.68)†
Less than once a month	ref

$_a$CHW: Community Health Worker, ** $p<0.05$, $^{\dagger}p<0.10$