Nurse case management in reducing neonatal complications: a quasi-experimental study

Gestão de casos por enfermeiro na redução de complicações neonatais: estudo quase-experimental

Gestión de casos por enfermeros en la reducción de complicaciones neonatales: estudio cuasi experimental

Flávia Teixeira Ribeiro da Silva[1] https://orcid.org/0000-0001-7656-955X
Ricardo Castanho Moreira[2] https://orcid.org/0000-0003-4014-3201
Carlos Alexandre Molena Fernandes[1] https://orcid.org/0000-0002-4019-8379

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Corresponding author
Flávia Teixeira Ribeiro da Silva
E-mail: flavia@uenp.edu.br

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https://orcid.org/0000-0002-7091-9691
Escola Paulista de Enfermagem, Universidade Federal de São Paulo, SP, Brazil

Abstract

Objective: To analyze the impact of nurse-mediated case management on prematurity, low birth weight, and neonatal mortality.

Methods: A pragmatic, quasi-experimental, single-arm, clinical trial, conducted in a city in the south of Brazil, with implementation of the nurse-mediated case management model as an intervention during ten months, in a sample of 91 pregnant women. The intervention consisted of nursing and multi-professional appointments, educational actions, home visits, and a telephone call. The data of the intervention group were compared to the data of births from 2016 to 2018 in the city, with calculation of the relative risk, the absolute risk reduction and the number needed to treat.

Results: Premature births accounted for 4.4% (95% CI 0.18%; 8.61%). Case management effectiveness in prematurity was 62%; for every 14 pregnant women in the intervention group, one premature birth was avoided. An absolute risk reduction of 7.3% was identified compared to previous city numbers. Newborns with low birth weight (<2500g) (p=0.975) were 8.9% of the total of neonates born, and neonatal mortality in the intervention group was not identified (p=0,850).

Conclusion: Nurse-mediated case management during pregnancy proved to be a strategy for prevention of prematurity and demonstrated the magnitude in neonatal mortality. However, regarding the birth weight, this model had no effectiveness. The regular presence of nurses is fundamental to improve the care during pregnancy.

Resumo

Objetivo: Analisar o efeito da gestão de casos mediada por enfermeiro na prematuridade, baixo peso ao nascer e mortalidade neonatal.

Métodos: Pesquisa clínica pragmática, de caráter quase-experimental, com braço único, realizada em um município no sul do Brasil, com aplicação interventiva do modelo de gestão de casos mediada por enfermeiro durante dez meses, em amostra composta por 91 gestantes; a intervenção incluiu: consulta de enfermagem e multiprofissional, ações educativas, visita domiciliar e abordagem telefônica. Os dados do grupo intervenção foram comparados aos dados dos nascimentos ocorridos no período de 2016 a 2018 no município do estudo com cálculo do Risco Relativo, Redução do Risco Absoluto e Número Necessário para Tratar.

Resultados: Identificaram-se 4,4% (IC 95% 0,18%; 8,61%) de partos prematuros. A eficácia da gestão de casos na prematuridade foi de 62%; a cada 14 gestantes do grupo intervenção, um parto prematuro foi evitado. Elas apresentaram uma Redução do Risco Absoluto de 7,3% comparadas aos números anteriores do município. Nasceram com baixo peso (<2500g) 8,9% dos neonatos (p=0,975) e não houve mortalidade neonatal no grupo intervenção (p=0,850).

[1]Universidade Estadual de Maringá, Maringá, PR, Brazil.
[2]Universidade Estadual do Norte da Paraná, Bandeirantes, PR, Brazil.
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Conclusão: A gestão de casos mediada por enfermeiro durante a gestação apresentou-se como estratégia de prevenção da prematuridade e evidenciou a magnitude na mortalidade neonatal. Sobre o peso ao nascer, este modelo não causou efetividade. É fundamental a presença regular do enfermeiro para a melhoria do cuidado durante a gestação.

Resumen

Objetivo: Analizar el efecto de la gestión de casos mediada por enfermeros en la prematuridad, bajo peso al nacer y mortalidad neonatal.

Métodos: Estudio clínico pragmático, de carácter cuasi experimental, de un solo brazo, realizado en un municipio del sur de Brasil, con aplicación de intervención del modelo de gestión de casos mediada por enfermeros durante diez meses, con una muestra compuesta por 91 mujeres embarazadas. La intervención incluyó: consulta de enfermería y multiprofesional, acciones educativas, visita domiciliaria y contacto telefónico. Los datos del grupo experimental fueron comparados con los datos de los nacimientos ocurridos en el período de 2016 a 2018 en el municipio del estudio con cálculo del riesgo relativo, reducción del riesgo absoluto y número necesario para tratar.

Resultados: Se identificaron 4,4 % (IC 95 % 0,18 %; 8,61 %) de partos prematuros. La eficacia de la gestión de casos en la prematuridad fue del 62 %; de cada 14 mujeres embarazadas del grupo experimental, un parto prematuro fue evitado. Presentaron una reducción del riesgo absoluto del 7,3 % comparado con los números anteriores del municipio. El 8,9 % de los neonatos (p=0,975) nacieron con bajo peso (<2500 g) y no hubo mortalidad neonatal en el grupo experimental (p=0,850).

Conclusión: La gestión de casos mediada por enfermeros durante la gestación demostró ser una estrategia de prevención de prematuridad y evidenció la magnitud en la mortalidad neonatal. Respecto al peso al nacer, este modelo no causó efectividad. La presencia regular de los enfermeros es fundamental para mejorar los cuidados durante la gestación.

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Introduction

Infant mortality is still considered a major public health problem, even with the evolution of the reduction from 37 deaths per 1,000 live births in 1990 to 18 in 2017. Approximately 6.3 million children died in 2017 from preventable causes. About 40% of these deaths occurred in the neonatal period, most of them in the first week of life, and mostly due to premature births, in particular, those under 32 weeks of gestation, therefore, with a low birth weight.[1]

The neonatal mortality in Brazil is more representative, accounting for 70% of infant deaths.[2] A study conducted in the Southern region, with 688 women in the postpartum period, reported 13 neonatal deaths, 12 of which were premature; meaning that neonates born to women with premature labor were 11 times more likely to die in the neonatal period.[3]

Children who die in the first 27 days of life suffer from diseases and conditions associated with the quality of care in the gestational period.[4] Reductions in neonatal deaths depend on the quality of health services, which must provide specialized and skilled care for all births, including hospital care in case of emergency. Low-cost interventions, such as health education, surveillance, and a planned follow-up according to the reality of the pregnant woman during prenatal care, birth, and the first week of the newborn's life, are fundamental strategies for neonatal health.[5]

Therefore, the case management (CM) model, based on scientific evidence and on systematic care procedures, has been used as a strategy to reduce complications and mortality, as a tool that combines nursing administration and care, focused on care management performed by nurses. The planning, organization, motivation and control of care delivery are determined in a timely, safe and integral manner, based on clinical evaluation, in coordination with the care delivered by other professionals, as appropriate.[6]

The CM performed by nurses in obstetric and neonatal care contributes to optimize and equalize the nursing care by promoting the protagonism of women.[7,8] The empowerment of women/couples with relevant and useful information, based on the best available evidence to enable humane, longitudinal, safe and timely care, is a differential aspect that uses appropriate technologies, such as best practices, educational and integrative actions, and others, according to the need.[7]

However, publications of Brazilian experiences on this model of care are still incipient and represent a knowledge gap. Due to the lack of studies on CM performed by nurses for pregnant women, and because it represents a new model of care, this study

aimed to analyze the effect of the nurse-mediated CM model on the outcomes of prematurity, birth weight, and neonatal mortality.

Methods

This was a quasi-experimental, single-arm, pragmatic clinical trial conducted at the women and children's health center of the city of Bandeirantes - Paraná, located in the southern region of Brazil. This setting was considered eligible because the strategy proposed as an intervention, i.e., nurse-mediated CM during pregnancy, is not offered in the public health network.

The study population was composed of pregnant women. The sample size calculation assumed the proportion of premature births in the city (10%), an alpha risk of 0.05 and a beta risk of 0.2 in bilateral contrast. from a total of 432 pregnant women who used the Brazilian National Health System (SUS), 106 were considered eligible who were enrolled in the Prenatal Information System (SIS PRE-NATAL) at the beginning of the study.

The inclusion criteria were pregnancy, gestational age under 20 weeks, living in the city where the study was conducted, and enrolled in the SIS PRE-NATAL. Pregnant women who were interested in moving or planned to give birth in another city, or those who presented discontinuation criteria were excluded - maternal or fetal death, abortion, and/or declared no interest to participate in the study.

The convenience sample was non-probabilistic. Those who met the inclusion criteria were formally invited by reading the Informed Consent Form (ICF), as well as the description of the steps so that they could freely choose to participate or not in the research later.

The pregnant women who agreed to participate in the study received usual care in the basic health units and the interventional actions of the nurse-mediated CM model, which subsidizes the study, were incorporated.

A data collection occurred from May 2019 to August 2020, in agreement with the phases described in the flow chart of the Consolidated Standards of Reporting Trials (CONSORT)[9] (Figure 1).The follow-up of each pregnant woman was conducted over a 10-month period, to include the gestational and neonatal periods. The strategies selected to compose the nurse-mediated CM included nursing and multiprofessional appointments, group and individual educational actions, home visits, and telephone calls, which were organized according to the proposed actions of the *Rede Mãe Paranaense* (Paraná's Mother Network Guideline)[10]

The CM was mediated by a nurse specialized in Public Health, with a Master's degree in Health Sciences and experience in primary health care, who was also the principal investigator of this study.

The appointments occurred in the reference health unit for maternal and child care, and included anamnesis, physical examination, diagnosis of care needs, planning of care, including the prescription and jointly developed care plan, implementation of care, and evaluation of the care process. A continuous and collaborative evaluation with the pregnant woman and family members was also conducted throughout the care process. All the information was documented in a semi-structured instrument.

After identifying the needs of each pregnant woman, they were referred to the professionals of the Family Health Strategy (FHS) to receive physical evaluations and instructions: pharmacist, psychologist, dentist, and nutritionist. The mean time of each appointment was 30 minutes. The educational actions were accomplished every month, during the nursing appointment, home visit, or phone call, and the following topics were addressed: the importance of prenatal care, explanations and interpretations of physical, laboratory, and imaging tests, body care, healthy eating and habits, prevention of health conditions, immunization, and care of the newborn.

The home visits intended to understand the family living situation to provide a plan of care that was achievable; and the telephone call was used to establish a bond, through a more humanized approach, monitoring, and full support.. A telephone number was provided for contact, whenever the participant considered it necessary.

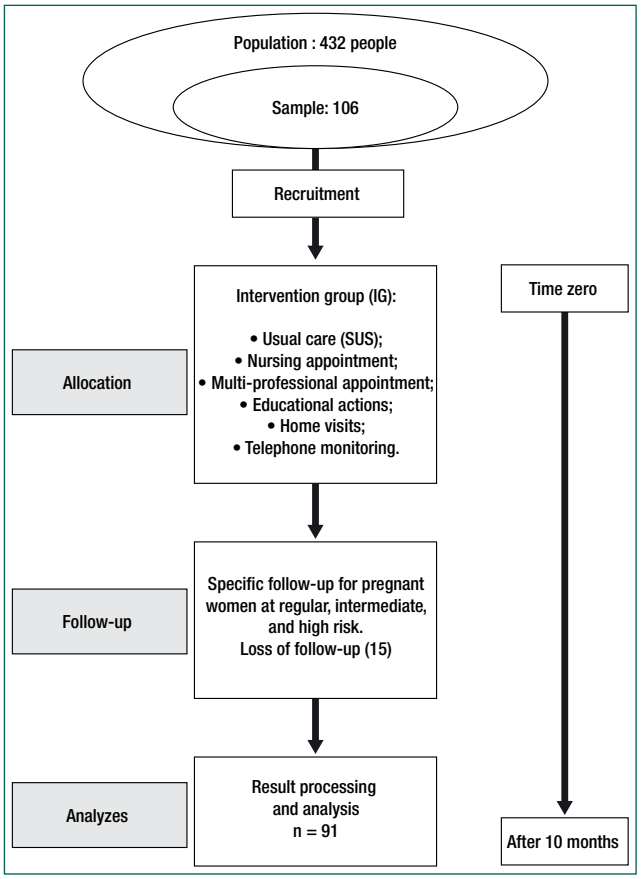

Figure 1. Methodological diagram of the study, according to the CONSORT follow-up diagram model

The outcome variables analyzed were prematurity (gestational age less than 37 weeks), birth weight (up to 2,499g; from 2,500g to 3,999g; 4,000g or more), and neonatal mortality (deaths between 0 and 27 days).. The potential predictive variables were, age, skin color, height, marital status, number of children, level of education, occupation, family income, lifestyle (physical activity, smoking, alcohol consumption, use of illicit drugs), and nutritional status.

The results of the intervention group were compared to the data of births that occurred in the city where the study was conducted, from 2016 to 2018. In the period from the historical series analysis to the beginning of the research data collection, there were no alterations in the structure of the maternal and childcare network or in its work process.

Fifteen discontinuations occurred during data collection, due to moving to another city (seven), abortions (seven), and fetal death (one). Therefore, 91 pregnant women completed the program.

The nominal or categorical variables were described in absolute and relative numbers, and the mean values were calculated for numerical variables.

Microsoft Excel® was used for data organization, and the analyses were performed in the SPSS® software, version 18.0. A significance level of $p<0.05$ and a confidence interval of 95% were adopted.

The Chi-square test was used to analyze the associations of interest that compared the proportion of preterm births, birth weight, and neonatal mortality of participants followed by nurse-mediated CM using retrospective data from the city. To analyze the effect of the CM model, the relative risk and absolute risk reduction calculation were used; and to estimate the impact of the intervention, the number needed to treat (NNT) calculation was performed.

The study was approved under protocol number 3.230.699 (Ethics Review Submission Certificate: 09617219.4.0000.8123).

Results

The mean age was 25.5 years, with a minimum of 14 years and a maximum of 44 years. The white skin color (59.3%) was prevalent, married (84.6%), with two children (42.9%), education time from 9 to 12 years (62.6%), active occupation (50.5%) and per capita income higher than R$141.00 (92.3). Most were taller than 1.51m (97.8%), and the nutritional status assessment showed that 20.9% were overweight and 29.7% obese, in the beginning of pregnancy.

Smokers represented 20.9% of the sample, and 4.4% had been smoking during pregnancy; 2.2% and 4.4% reported using licit and illicit drugs, respectively; and 92.3% did not perform light physical activity, such as walking.

The study identified a proportion of premature births of 4.4% (95%CI 0.18%; 8.61%). In turn, a rate of 11.7% was found (table 1) compared to the historical series recorded in DATASUS in the previous three years for the city of Bandeirantes-PR (2016 to 2018).

The pregnant women in the intervention group presented a risk for premature birth of 38% (95%

CI 0.14%; 0.99%) of the risk calculated for pregnant women in the city. The proportion of preterm births was lower than that recorded in Bandeirantes, with a reduction in absolute risk of 7.3%. As for the NNT, for every 13.7 pregnant women in the intervention group, one premature birth was expected to be avoided compared to the city data, as shown in table 1.

Table 1. Relative risk for preterm births in the intervention group versus the city' s history

Parameters	Intervention Group	Bandeirantes*
Live Births	91	1328
Premature births	4	155
Percentage of prematurity †	4.40%	11,70%
Relative Risk (RR) (Intervention vs Bandeirantes)	0.38 (0.14 a 0.99)	1
Absolute Risk Reduction (ARR)	7.30%	
Number Needed to Treat (NNT)	13.7 (7.16 a 170.21)	

*Cumulative data for the period from 2016 to 2018; †Chi-square test (p-value: 0.033) Number Needed to Treat (NNT)

A comparison was performed between the birth weight of children born in the city, retrospective data from 2016 to 2018, and the weight of children born to mothers monitored by the nurse-mediated CM (intervention group); no statistical significance was found between the groups (p=0.975), as described in table 2. The neonatal mortality rate (NMR) of the city in the historical series from 2016 to 2018 was compared with the NMR of the intervention group, and no statistical significance was identified between the groups (p=0.85) (table 2).

Table 2. Comparison of birth weight and neonatal mortality of children born in Bandeirantes, from 2016 to 2018, versus the weight and mortality of children of intervention group

Variables	Intervention group (2019-2020) n(%)	Bandeirantes (2016 a 2018) n(%)	p-value*
Weight (in grams)			0.975
Up to 2.499	8 (8.8)	114 (8.6)	
2.500 to 3.999	80 (87.9)	1164 (87.7)	
4.000 or more	3 (3.3)	50 (3.7)	
Live births (LB)	91	1328	
Neonatal mortality	0	6	0.850
NMR† / 1.000 LB	0.0	4.5	

*Chi-square test; † NMR - Newborn Mortality Rate

Discussion

The importance of implementing strategies to reduce prematurity, low birth weight, and neonatal mortality was the reason for this study, which aimed to analyze the nurse-mediated CM model, when integrated into the standard care of the public health-care network for pregnant women.

The CM model for pregnant women was launched in 2017 in the Paraná's Mother Network Guideline.[11] It is a cooperative process between a professional case manager, a person with a health condition, the social support network to plan, monitor, and evaluate care options and health care coordination. The purpose is to provide quality, humanized care, able to increase functional capacity and preserve individual and family autonomy, according to the needs of each individual.[12]

Prematurity, low birth weight and neonatal mortality are important problems in the context of maternal and child health of Brazil, and are potentially preventable by adequate care and follow-up during pregnancy.[13]

The CM in the prenatal care at the Primary Health Care is characterized as a strategy of care that includes the singularities of the mother-child binomial and family, and aims to promote singular, multidimensional, continuous, vigilant, and organized care that prioritize the subjectivity of the woman-mother and the newborn care. This program adopts well-defined and implemented protocols, considering the social and bio psychological changes experienced by the woman and the life context of each family, transforming the puerperal woman into the protagonist of self-care and the newborn care, also involving the participation and support of the family.[6]

The prematurity rate in Brazil is 11.5%, almost twice as high as in European countries.[14] The high number of premature births that did not receive adequate prenatal care shows the importance of effective maternal health policies and their contribution to unfavorable outcomes.[4]

Data from this study showed that nurse-mediated CM was 62% effective in reducing prematurity, indicating that the model is a protective factor for preterm births. Corroborating these findings, the World Health Organization defines that most preterm births could be avoided with basic care and low-cost interventions.[15]

The study also found that for approximately every 14 pregnant women monitored by the intervention group, one premature birth was avoided in comparison to the city data. This outcome suggests that the nurse-mediated CM in obstetric and neonatal care assumes great importance and contributes considerably to qualify the nursing care and health of the newborn.

The findings demonstrate that the nurse-mediated CM interventions on prenatal and postnatal care, focusing on education, monitoring, and humanization strategies, can contribute to the prevention of premature births.

Low birth weight is also considered one of the pivotal factors for neonatal mortality, which can be minimized by quality prenatal care, such as orientations, nutrition, and maternal health.[1,16]

Although prenatal care has a strong correlation with the newborn's nutritional status, the results showed a predominance of low birth weight (<2,500 g) of 8.9%, in mothers included in the CM process of care. This predominance exceeds the Brazilian epidemiological data, which estimates 8.0% of low birth weight in the same region of the study.[17]

The newborn weight of mothers who received the nurse-mediated CM intervention compared to city data did not show statistical difference. This finding may be explained by the fact that low birth weight is a multifactorial occurrence, involving maternal, newborn, and pregnancy factors, and especially the local context.[18]

No deaths occurred during the study, and the difference in relation to the local historical series was relevant, because it shows the magnitude of the CM effect in reducing neonatal mortality. From a statistical perspective, the comparison did not show a significant p value, however, it may be attributed to the effect of the sample number for this variable. Considering that prematurity is one of the major risk factors for neonatal mortality,[1]. and that CM showed to be effective in reducing preterm births, some attenuation of the neonatal mortality can be assumed

A study conducted in southern Brazil found that CM contributed to the optimization of care, and dissolution of critical issues. This study also showed that CM is very promising as a care strategy in the high-risk prenatal care, especially when recognizing the subjectivities of each case and understanding the importance of differentiated management in these cases, achieving comprehensiveness and equity of care.[8]

Studies indicate that CM improves patient satisfaction with treatment, reduces hospitalizations and costs, improves symptom control, the velocity of appointment scheduling, and even lifestyle changes, i.e., it has proven to positively influence the health care outcomes.[19-21]

Nurses are fundamental mediators for the implementation of the new model of obstetric and neonatal care, based on humanization of care, best practices based on scientific evidence, and the protagonism of women in the process of labor and birth. [7]

Assuming that CM requires involvement of professionals, and understanding that health services are currently focused on prescriptive, bureaucratic, and technicist acts, this model allows nurses and other professionals to contribute to system configuration and design as a whole. As a result, it enables the professionals to work with independence, as long as they remain in the exercise of their activities and attributions, respecting the ethical precepts inherent to each category.[22]

The nurse-mediated CM in prenatal care in this study focused on individual and collective education, prenatal nursing appointments, home visits, and telephone monitoring. Through these actions, nursing professionals emphasize the obstetric and neonatal benefits of prenatal care. A qualitative study conducted in Angola concluded that nursing CM is effective in collaborative working relationships centered on lectures and prenatal consultations, aiming at a bonding development and a dialogic relationship with the women and their families.[23]

A Brazilian study reports that patients who receive care under the CM model report a preference for appointment with a nurse during prenatal care and stated a feeling of security, related to the bonding, affection, and care provided by nurses, combined with the promotion of empowerment and

autonomy of the pregnant couple. And nurses state that they had professional satisfaction when they noticed the positive impact provided in the lives of the patients.[24]

Case management promotes more effective contact between patients and health system, the recognition of vulnerable groups, facilitated access to elucidation of doubts by telephone, support for self-care, use of protocols for monitoring complications, guidance and support for use of available resources in the health system, providing the possibility of interventions aimed at individualized health care needs, collaborating with the institutions and health team in achieving quality of services.

Further research must be conducted on the effect of the CM model for pregnant women, as well as longitudinal studies that analyze the bond and quality of care for the binomial, whose repercussions may continue beyond the time of data collection Furthermore, studies should be conducted in other locations, to additionally evaluate other perspectives, such as cost-effectiveness, efficiency and acceptability of this modality of care for both the health professional and the pregnant woman and her family.

The contribution of this research to the SUS, to health policies and applicability in professional nursing practice, is shown in the evidence that the use of the nurse-mediated CM model for the care of pregnant women presents the prospect of reducing prematurity; that the organizational structure itself, along with the investment in the qualified nursing workforce existing in primary health care (PHC) at the municipal level, can improve the results of nursing actions. These actions that can even improve the resoluteness and professional autonomy, with positive repercussions for obstetric/neonatal care, as well as for the practice of this professional in the context of PHC.

The limitations of this study refer to the non-resolution of some actions of administrative nature, whether bureaucratic or fragmented, due to barriers of the health service. In addition, there were changes in the provision of on-site service and follow-up of these pregnant women and neonates in the period from March to August 2020, due to the social distancing imposed by the pandemic of the COVID-19 virus. Also, the limitation in the study design compromises the control of other factors that may have occurred concomitantly to the implemented intervention, and that could interfere in the outcome.

Conclusion

The implementation of the nurse-mediated CM model during pregnancy proved to be effective in reducing preterm births and demonstrated the magnitude of neonatal mortality. Regarding birth weight, this model was not effective. The regular presence of the nurse provided help to clarify doubts about care, which may have contributed to the decrease in prematurity.

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Collaborations

Silva FTR, Moreira RC and Fernandes CAM declare that they contributed to the project design, data analysis and interpretation, article writing, relevant critical review of the intellectual content, and approval of the final version to be published.

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