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Budget impact of using the Kangaroo Method in neonatal care

ABSTRACT

OBJECTIVE: To estimate the budget impact of using the Kangaroo Method in a municipal health care network.

METHODS: An analytical decision model was developed to simulate the costs of the Kangaroo Method and Neonatal Intermediate Care Unit in Rio de Janeiro, RJ, in 2011. The reference population was clinically stable newborns, who may receive either of the two types of care. The budget impact for a hypothetical cohort of 1,000 eligible newborns was estimated for one year. The proportion of eligible infants receiving the two type of care was obtained through data collection in hospitals included in the study. The probabilities of events and resource consumption of health care in the period were incorporated into the model. A scenario analysis was developed to reflect the adoption of the Kangaroo Method on a greater or smaller scale.

RESULTS: The use of the second and third stage of Kangaroo Method means a cost reduction of R$ 1,085,379.64 (16.0%) in a year if all eligible infants were assisted in Kangaroo Method.

CONCLUSIONS: The Kangaroo Method options costs less than the Neonatal Intermediate Care Unit. The analysis of the budget impact of this method on the public health care system showed significant savings in the year long period analyzed.

DESCRIPTORS: Infant, Newborn. Kangaroo-Mother Care Method, economics. Humanization Assistance. Maternal and Child Health. Health Care Costs. Unified Health System.

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INTRODUCTION

The high number of newborns (NB) with low birth weight (LBW) is a significant health care problem and represents a high percentage of neonatal morbidity and mortality. The greatest challenge in reducing infant mortality in the different regions of Brazil is in the neonatal component, which accounts for 70.0% of mortality in children under one year of age.[a] Investment in the organization and qualification of neonatal care is prioritized as it has been included as one of the priority care strands of the Brazilian Ministry of Health since the end of the 1990s, with the aim of changing the situation.

The Kangaroo Method (KM) runs parallel to Brazilian Ministry of Health efforts to increase humanized care for NB with LBW and possesses clinical and psycho-affective advantages for the NB and their family. In addition to safety, efficacy and effectiveness, incorporating, disseminating and excluding technologies from the Brazilian Unified Health System (SUS) requires the assessment of other attributes, such as economic aspects.[b,c] Health economic evaluation of technologies are essential decision making tools in the health care sector. The KM costs less than the neonatal intermediate care unit (IU),[3,8,10] as well as increasing bed turnover in this unit and in the Neonatal Intensive Care Unit (NICU).

Such health economic evaluations are not enough to predict whether a specific intervention can be incorporated within the health care system. The policy-maker also needs to consider the resources needed to establish the intervention and compare those with the available budget. Thus, budget analyses are necessary.[1,11]

The aim of this study was to estimate the budget impact of using the KM in a municipal health care network.

METHODS

A cost study[d] was carried out from the perspective of the SUS service provider in the municipal health care network in Rio de Janeiro, in 2011. The six maternity wards administered by the Rio de Janeiro Municipal Health Secretariat (SMSDC/RJ) which care for at risk NBs were included. These maternity wards are responsible for 60% of deliveries with LBW in the municipality.[5]

The KM consists of three stages: the first is identifying high risk mothers and families before the baby is born. This guidance continues after the birth and the need for hospitalization in the NICU or IU. Visits from the parents and stimulation of their touch are increasingly encouraged. The second stage of the KM concerns the hospitalization of mother and baby in the Kangaroo Unit, if the NB is clinically stable and the mother able and willing to participate. The third stage of the KM begins after discharge form hospital. The NB visits the maternity ward where they were born regularly until they reach a weight of 2,500 g.[e]

The reference population of the study was defined as those NB who could be cared for using either type of care – second stage of KM and IU –, who met the following criteria for participating in the second KM stage: clinical stability, weighing > 1,250 g, full enteral feeds and staying in an environment without occurrence of apneas requiring resuscitation with oxygen and positive pressure in the past five days.[e]

A decision-analytic model was constructed to simulate the costs of a hypothetical cohort of 1,000 NB (Figure 1). The decision model considered the costs associated with the main health event that may affect a NB during hospitalization and that could impact on the cost (sepsis, necrotizing enterocolitis and apnea).

The time horizon included the duration of the NB hospitalization from clinical stability until discharge from the neonatal IU, discharge from the third stage of the KM or death. The study included the second and third stages of the KM, which together represent an alternative to the neonatal IU care for eligible NB. The first[a] stage of the KM was not included in the analysis as it takes place within the NICU or neonatal IU.

The decision model was based on data from the literature and on consultation with a panel of specialists (six specialists in the neonatal area, three of whom had medical training and three from a nursing background) in order to identify the outcome measures and the probabilities, due to the limited national data available on the effectiveness of the method. Specialists were consulted due to the scarcity of national studies describing the effectiveness of the KM in the context in which it is applied in Brazil. The panel of specialists also identified and quantified health care resources. The

[a] Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise de Situação em Saúde. Saúde Brasil 2008: 20 anos de Sistema Único no Brasil. Brasília (DF); 2009.
[b] Brasil. Lei 12.401, de 28 de abril de 2011. Altera a Lei no 8.080, de 19 de setembro de 1990, para dispor sobre a assistência terapêutica e a incorporação de tecnologia em saúde no âmbito do Sistema Único de Saúde - SUS. *Diario Oficial Uniao*. 29 abr 2011:1 [cited 2013 Jun 15]. Available from: http://www.planalto.gov.br/ccivil_03/_Ato2011-2014/2011/Lei/L12401.htm
[c] Ministério da Saúde. Secretaria de ciência, tecnologia e insumos estratégicos. Departamento de Ciência e Tecnologia. Coordenação Geral de Avaliação de Tecnologias em Saúde. Política Nacional de Gestão de Tecnologias em Saúde. Brasília (DF); 2009.
[d] Entringer AP. Perspectiva econômica do Método Canguru na rede municipal de saúde do Rio de Janeiro [dissertação de mestrado]. Rio de Janeiro: Instituto Fernandes Figueira/FIOCRUZ; 2012.
[e] Ministério da Saúde. Secretaria de Políticas Públicas de Saúde. Atenção humanizada ao recém nascido de baixo peso: Método Mãe-Canguru: Manual do curso. 2ª ed. Brasília (DF); 2009.

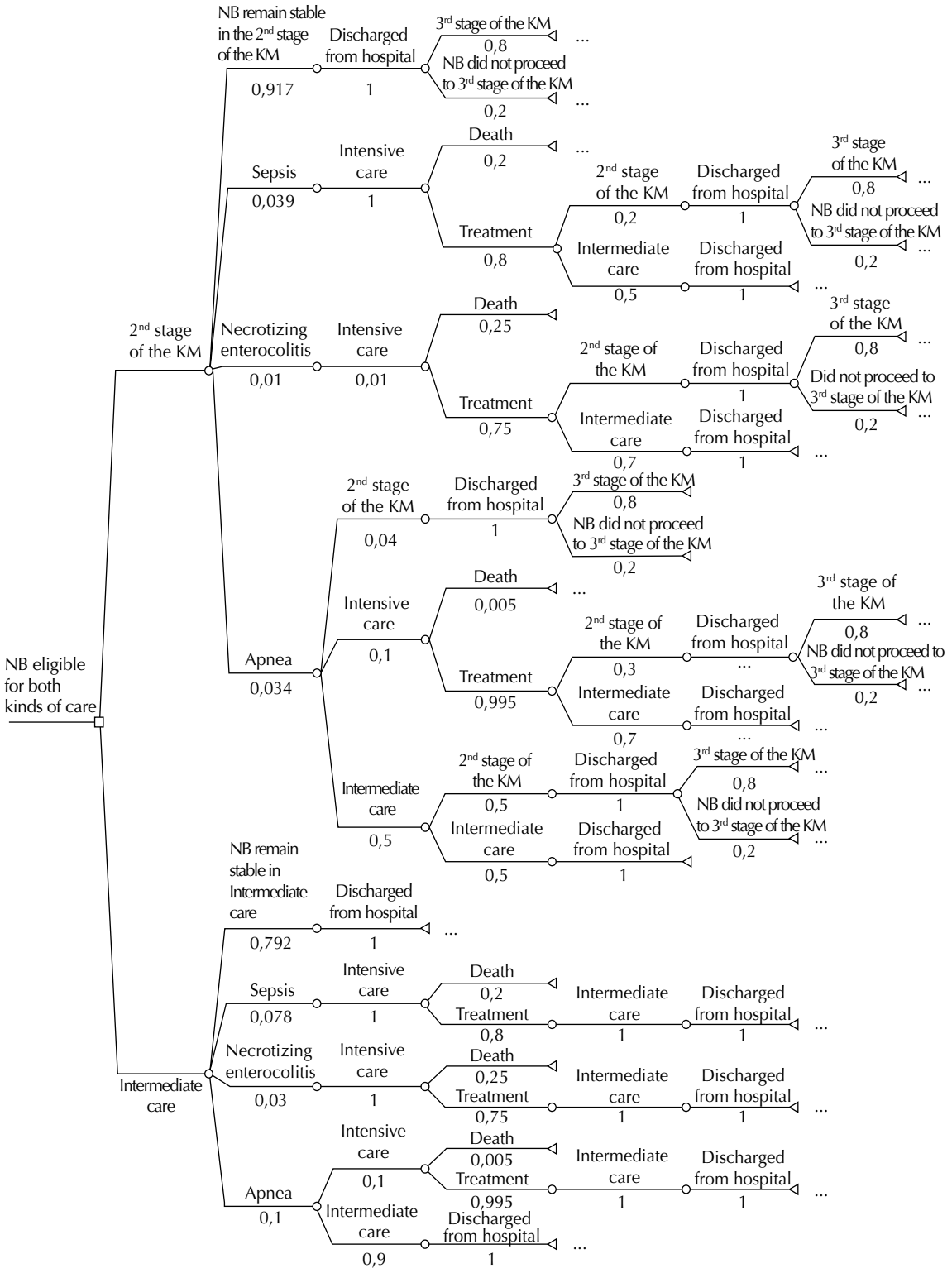


Figure 1. Schematic representation of the decision making tree. Rio de Janeiro, RJ, Southeastern Brazil, 2011.

specialists held master's or doctorate degrees and experience of the private and/or public health care networks in Rio de Janeiro. Some worked in hospitals in which the KM was used and in other health care institutions.

The direct costs of the NB's care were estimated. The items included were: human resources, consultations, inputs (medication, lab tests, mother and babies' food, gases foe medicinal use and hospital materials) and

administrative costs (cleaning and upkeep of the units, water, electricity and monitoring).

These items were valued using the *Banco de Preços em Saúde*[f] (BPS – Health Care Prices Database) of the Brazilian Ministry of Health and from information provided by the SMSDC/RJ.

Human resources necessary to KM and IU and capital costs were based on the *Política Nacional de Atenção ao Paciente Crítico* (National Policy for Care of Critical Patients) (Ordinance MS 1,071 July 4, 2005)[g] for NICU and neonatal IU and on the guidance for implementing the KM,[h] for the second stage of KM.

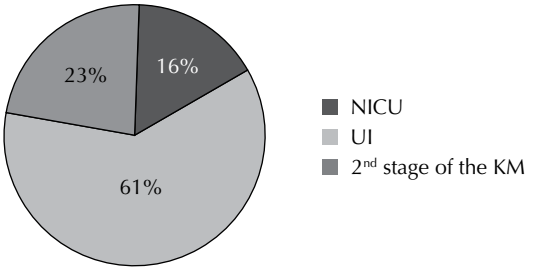
Human resources costs considered data on SMSDC/RJ employees' mean salary. The capital costs were valued based on the *Sistema de Apoio à Elaboração de Projetos de Investimentos em Saúde*[i] (SomaSUS – Support System for Developing Health Care Investment Projects) and on Comprasnet.[j] A discount of 5% was used in calculating depreciation of equipment. Maintenance costs were estimated at 10% of the purchase price of the equipment. Costs involved in building space were considered "sunk costs" and, therefore, excluded from the analysis.

The administrative costs were the cleaning and upkeep of the units, water, electricity and monitoring. It was calculated using the maternity wards' contracts allocated to each square meter, taking into consideration a higher proportion of spending on electricity and cleaning in the critical areas (NICU and neonatal IU).

The estimate of KM budget impact was based on statistical modelling that took into account estimates of epidemiological parameters and of costs and multiply the population that will benefit from the technology by the expected value, obtained from the decision-analytic model.

The base-case for the budget analysis for the SUS in the municipality of RJ refers to the proportion of NB cared for in the second stage of KM and in the neonatal IU, obtained using estimates from the SMSDC/RJ maternity wards.

A daily census was conducted to estimate how many NB met the criteria for eligibility for the KM. The eligible NB were counted in the census, irrespective of the unit in which they were. The data were collected by professionals from the local area using an instrument designed for the research. Supervision and data control were carried out by the principal researcher, responsible for training the professionals designated to collect data. The data were collected over a three-month period (September, October and November 2011) and the mean of patient eligible for the study/day in the SMSDC/RJ maternity wards was estimated.



NICU: Neonatal Intermediate Care Unit; UI: Neonatal Unit
KM: Kangoroo Method

Figure 2. Distribution (%) of the mean eligible patient/day for the 2nd stage of the Kangaroo method in Rio de Janeiro Municipal Health Secretariat maternity wards, according to the hospitalization sector of the neonatal unit. Rio de Janeiro, RJ, Southeastern Brazil, September to November 2011.

The six maternity wards had a mean of 31 patients eligible for the second stage of KM/day (Figure 2).

The budget impact study was estimated considering a hypothetical cohort of 1,000 eligible NB and a proportion of 23% of hospitalized NBs cared for in the second stage of the KM with the remaining 77.0% cared for in neonatal IU. The eligible NB who were cared for in the NICU were included in figures for the neonatal IU, as a NICU for purposes of comparison was not included in this study.

Bivariate sensitivity analysis was carried out through different scenarios[4] of adoption of the strategies being compared. Since KM is a substitute technology for the neonatal IU for those NB who are eligible,[7,a] usual clinical practice may change between one and the other.[1,11] Rates of substituting the IU with the KM were used in four scenarios: incorporating the KM for 50.0% of eligible NBs; incorporating the KM for 80.0% of eligible NBs, incorporating the KM for all eligible NBs; and using solely the neonatal IU.

[f] Ministério da Saúde. Banco de preço em saúde. Brasília (DF); 1999 [cited 2012 Jan 6]. Available from: http://portal.saude.gov.br/portal/saude/Gestor/area.cfm?id_area = 939

[g] Ministério da Saúde. Portaria MS 1.071 de 4 de julho de 2005. Determina que a Secretaria de Atenção à Saúde submeta à Consulta Pública a minuta da Política Nacional de Atenção ao Paciente Crítico. *Diario Oficial Uniao*. 17 ago 1998 [cited 2012 Feb 05]. Available from: http://www.sobrati.com.br/ms-politica-critico.htm

[h] Ministério da Saúde. Gabinete do Ministro. Portaria nº 1.683, de 12 de julho de 2007. Aprova, na forma do Anexo, a Normas de Orientação para a Implantação do Método Canguru. *Diario Oficial Uniao*. 12 jul 2007. Available from: http://bvsms.saude.gov.br/bvs/saudelegis/gm/2007/prt1683_12_07_2007.html

[i] Ministério da Saúde. Sistema de Apoio à Elaboração de Projetos de investimentos em Saúde (SOMASUS). Brasília (DF); 2004 [cited 2011 Oct 20]. Available from: http://portal.saude.gov.br/portal/saude/profissional/area.cfm?id_area=1258

[j] Ministério do Planejamento, Orçamento e Gestão. COMPRASNET: Portal de compras do Governo Federal. Brasília (DF); 1998 [cited 2012 Jan 6]. Available from: http://www.comprasnet.gov.br

Table 1. Daily cost of hospital for eligible newborns, according to type of care and cost item. Rio de Janeiro, RJ, Southeastern Brazil, 2011.

Cost item (R$)	Second stage of KM[a]	Neonatal IU[a]	NICU apnea[a]	NICU NEC[a]	NICU sepsis[a]
Hospital supplies[b]	55.14	64.82	52.15	276.99	203.75
Human resources	266.75	305.01	567.91	567.91	567.91
Administration costs	15.86	10.16	16.67	16.67	16.67
Equipment depreciation	5.77	14.24	35.49	35.49	35.49
Total daily cost of hospital	343.53	394.22	672.22	897.06	823.82

KM: Kangaroo method; IU: Neonatal Intermediate Care Unit; NICU: Neonatal Intensive Care Unit; NEC: Necrotizing enterocolitis

[a] Conversion to dollar: US$ 1.00 = R$ 1.70

[b] Hospital supplies include hospital materials, medication and solutions, laboratory tests, medical gauze and diet of the mother and NB

The decision-analytic model was performed using TreeAge Pro 2011 software. The internal values[k] incorporated into the model were tested to identify errors and ensure that the calculations were carried out accurately and to guarantee the model's internal validity.

The study was approved by the Research Ethics Committee of the Rio de Janeiro Municipal Health Secretariat (Protocol 0013.0.314.008-11) in May 2011 and by the *Instituto Fernandes Figueira*/FIOCRUZ (Protocol 0028.0.008.314-11) in April 2011.

RESULTS

The daily costs of the second stage of the KM and the neonatal IU were R$ 343.53 and R$ 394.22, respectively, which was 13.0% lower than that of the neonatal IU. Administrative costs were higher for the second stage of the KM, due to the need for big units allowing the mother to be included in the NB's care (Table 1).

The budget impact of the KM for 1,000 NB was R$ 6,795,661.30. The variation in costs in the scenarios shown was directly related to the level of adoption of the KM. The higher the proportion of eligible NB included in the second and third stages of the KM, the lower the care costs. Scenarios 1, 2 and 3 were cost-saving for the health care system, whereas keeping all NB in the neonatal IU (scenario 4) increased costs (Table 2).

Adopting scenario 3 (all eligible NB cared for using the KM) generated the biggest saving in caring for these NB, R$ 1,085,379.64 (US$ 638,458.61), which corresponds to a 16.0% reduction in costs.

DISCUSSION

Using the second and third stage of the KM as an alternative to care in the neonatal IU for the eligible NB is a cost-saving strategy. Scenario 3, which includes all clinically eligible NB in the KM, showed costs 16% lower than the base-case.

The study considered the eligibility criteria of the NB. However, other criteria affect staying in the KM, such as the mother's ability and willingness to remain with the NB, her capacity to recognize the NB's situation of risk, changes in hospital routines, health care professionals' trust in keeping the NB in the second stage of the KM and having sufficient human resources, among others. All of these issues make it difficult to include NB in the second stage of the KM. In scenario 2, in which 80.0% of eligible NB were included in the KM, there was a 12.0% reduction in costs compared with the base-case.

Most of the NB eligible for inclusion in the SMSDC/RJ study were taken care of in the neonatal IU (61.0%), 16.0% were treated in a NICU and 23.0% were taken care of in the second stage of the KM. This situation, in addition to being costly for the municipality, decreases the turnover of neonatal beds. Further investigation into the criteria that could influence the transfer of these NB to the second stage of the KM should be done.

This study had some limitations that should be considered. An appropriate estimate of the reference population for the intervention is essential when analyzing budget impact.[9] The information on the number of NB eligible for the second stage of the KM was not obtainable from public databases and SMSDC/RJ data. Thus, the hypothetical cohort of eligible NB was estimated, and the proportion of NB in each type of care was obtained using a census in the maternity wards in order to calculate budget impact.

The main limitation of the model used to estimate budget impact was in its capacity to model the dynamic aspects of disease.[l] However, the choice to use a deterministic model was based on the need to highlight the

[k] The values are presented in reais (R$) of 2011. The foreign exchange used to convert reais into US dollar was US$ 1,00 = R$ 1.70 (http://imfstatext.imf.org).

[l] Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos. Departamento de Ciência e Tecnologia. Diretrizes metodológicas: análise de impacto orçamentário: manual para o sistema de Saúde do Brasil. Brasília (DF); 2012.

Table 2. Budget impact of using the Neonatal Intermediate Care Unit and the Kangaroo Method for 1,000 eligible newborns according to the analytical decision model. Rio de Janeiro, RJ, Southeastern Brazil, 2011.

Budget impact	Baseline[a]	Scenario 1	Scenario 2	Scenario 3	Scenario 4
NB in the second[a] and third stage of the KM (%)	23	50	80	100	–
NB in the neonatal IU (%)	77	50	20	–	100
Total (R$)	6,795,661.30	6,415,073.63	5,992,198.45	5,710,281.66	7,119,865.61
Difference between scenarios and the baseline	x	-380,587.67	-803,462.85	-1,085,379.64	324,204.31

Sources: SOMASUS: Support System for Developing Health Care Investment Projects – *Sistema de Apoio à Elaboração de Projetos de Investimentos em Saúde*; COMPRASNET: Federal Government Purchasing portal – *Portal de compras do Governo Federal*, Health Care Prices Bank – *Banco de Preços em Saúde*, Ordinance MS 1,071 4th July 2005,[g] Ordinance nº 1,683 12 July 2007;[h] SMSDC/RJ: Rio de Janeiro Municipal Health Secretariat – *Sistema Municipal de Saúde e Defesa Civil, Rio de Janeiro*.
Conversion to dollar: US$ 1.00 = R$ 1.70.
NB: newborn; KM: Kangaroo Method; IU: Neonatal Intermediate Care Unit
[a] Proportion of eligible NBs according to the data collected in the SMSDC/RJ maternity wards.

financial resources required for the SMSDC/RJ to increase use of the KM in Rio de Janeiro.

Dimensioning human resources, apportioning administrative costs and calculating the depreciation of equipment was carried out considering the number of available beds for each type of care. It was not possible to apportion administrative costs per square meter of the weighted area, as information on the hospitals' other cost centers was not available.

No other studies presenting the budget impact of the KM were found, which made it difficult to compare the results of this budget impact analysis with previous studies. However, three studies[3,8,10] compared the cost of the KM and the neonatal IU and showed the Neonatal IU to be more costly than the KM. Two of these studies were conducted in countries in which the KM is used in a different context to that of Brazil, and all three studies use different methods of measuring costs than that used in this study.

The perspective of the study considered the SUS as a service provider of the SMSDC/RJ. The costs were based on data provided by the SMSDC/RJ when available and the effectiveness parameters were based on the opinions of experts in this area. Thus, caution should be used when making generalizations concerning locations with different parameters from those used in this study.

The rapid increase of new technology adoption in the health care sector has meant that health economic evaluation for their incorporation have become fundamental in contributing to the decision-making process among alternatives that are recognized to add values to the health care system. Budget impact analyses should be seen as an integral part of the process of evaluating health care technologies in Brazil.

The results of this study may contribute to the decision-making process concerning different types of neonatal care units. Difficulties in disseminating the KM include a lack of budgetary resources to expand and evaluate the method, and a lack of human resources.[2,6] From the perspective of the SUS as a service provider in the municipal health care network in Rio de Janeiro, disseminating the KM reduces SUS costs compared with the neonatal IU.

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The authors declare that there are no conflicts of interests.