A Prenatal Remote Monitoring Program in Pregnancies Complicated with Gestational Hypertensive Disorders: What Are the Contributors to the Cost Savings?

Peer-reviewed author version

LANSSENS, Dorien; VONCK, Sharona; VANDENBERK, Thijs; Schraepen, Cedric; STORMS, Valerie; THIJS, Inge; GRIETEN, Lars & GYSELAERS, Wilfried (2019) A Prenatal Remote Monitoring Program in Pregnancies Complicated with Gestational Hypertensive Disorders: What Are the Contributors to the Cost Savings?. In: Telemedicine journal and e-health, 25 (8), p. 686-692.

DOI: 10.1089/tmj.2018.0147
Handle: http://hdl.handle.net/1942/27856

Original Research

A Prenatal Remote Monitoring Program in Pregnancies Complicated with Gestational Hypertensive Disorders: What Are the Contributors to the Cost Savings?

A1
A2 *Dorien Lanssens,[1,2] Sharona Vonck,[2,3] Thijs Vandenberk,[1] Cédric Schraepen,[1] Valerie Storms,[1] Inge M. Thijs,[1,4] Lars Grieten,[1] and Wilfried Gyselaers[1,2,5]*

[1]Mobile Health Unit, Faculty of Medicine and Life Sciences, Hasselt University, Hasselt, Belgium.
[2]Department of Gynaecology, Ziekenhuis Oost-Limburg, Genk, Belgium.
[3]Department of Health and Life Sciences, Hasselt University, Hasselt, Belgium.
[4]Future Health Department, Ziekenhuis Oost-Limburg, Genk, Belgium.
[5]Department of Physiology, Hasselt University, Hasselt, Belgium.

Abstract

Background: *In 2015, we performed a cost analysis of a prenatal remote monitoring (RM) program compared with conventional care (CC) for women diagnosed with gestational hypertensive disorders (GHD).*

Introduction: *We investigated where the cost savings were distributed by dividing our patient population into three subgroups, according to the gestational age (GA) at the time of delivery: (1) <34 weeks; (2) 34–37 weeks; and (3) >37 weeks of GA.*

Materials and Methods: *Healthcare costs were calculated from patient-specific hospital bills at Ziekenhuis Oost Limburg (Genk, Belgium) in 2015–2016. Cost comparisons were made from the perspectives of the Belgium national healthcare system (HCS), the National Institution for Insurance of Disease and Disability (RIZIV), and the costs to individual patients.*

Results: *A total of 256 pregnant women were included, 80 (31.25%) of whom received RM and 176 (68.75%) of whom received CC. The greatest difference in costs between RM and CC was in the group that delivered before 34 weeks of GA, followed by the group who delivered after 37 weeks of GA, and then the group of women who delivered at 34–37 weeks of GA. Most of the cost savings were in neonatal care, for both the three separate study subgroups and the total study group.*

Discussion and Conclusion: *Our data showed that RM is more cost-effective than CC for pregnant women with GHD. Further investigation of the effects of RM on the long-term economic and social costs is recommended, together with an analysis of the price that should be asked for RM services.*

Keywords: *cost analysis, remote monitoring, pregnancy-induced hypertension*

Introduction

Gestational hypertensive disorders (GHD) are one of the most common complications during pregnancy. According to the Flemish Study Center of Perinatal Epidemiology (SPE), 4.9% of all pregnancies are complicated by these disorders: of the 64,323 deliveries in 2016, 3,152 were complicated by GHD.[1] GHD is defined as a systolic blood pressure (BP) >140 mmHg and a diastolic BP >90 mmHg. It refers to any of the following four conditions: (1) preexisting hypertension; (2) gestational hypertension; (3) preeclampsia; and (4) unclassifiable hypertension.[2] GHD is a major cause of maternal, fetal, and newborn morbidity and mortality.[2,3] The assessment of women with pregnancies complicated with GHD includes a clinical follow-up, serological investigation, and fetal ultrasound evaluation. The type and frequency of follow-up depend on the kind and severity of the hypertensive disorder.[2] The goal of treatment is to prevent significant cerebrovascular and cardiovascular events in the mother, without compromising fetal well-being.[4]

Recently, new techniques for medical monitoring have been developed, such as remote monitoring (RM), which can be broadly defined as the use of telecommunication technologies to facilitate the transmission of medical information and services between healthcare providers and patients.[5] RM is a relatively new approach (dating back to the early 1990 s) that allows patient management at home.[6] As part of the Hasselt University and Limburg Clinical Research Program (LCRP), Ziekenhuis Oost-Limburg (Genk, Belgium) added RM of the blood pressure, activity level, and weight gain to its prenatal care for women with GHD in the Pregnancy Remote Monitoring (PREMOM) Study. The initial results were promising,[7,8] and other feasibility studies, within and outside pregnancy,

have also successfully tested the possibility of sending data such as BP and/or body weight from the patient's home.[9,10] However, until now, few studies have evaluated the economic impact of RM compared with that of conventional care (CC).[11–14] Our research team performed the first economic analysis to assess the costs of RM versus CC and we concluded that the RM prenatal follow-up of women with GHD is cost-effective for the global healthcare system (HCS).[15] A second cost analysis was performed in which data were collected in 2015 and 2016. In this study, in which we divided our patient population into three subgroups according to the gestational age (GA) at the time of delivery, we analyzed the cost savings made with RM and identified where these savings were made.

Materials and Methods

DATA

Data collected from the PREMOM Study, extending from January 1, 2015, to December 31, 2016, were used for this cost analysis. The PREMOM Study design and data collection method are described in detail elsewhere.[7,8] Briefly, the PREMOM Study was a 2-year retrospective study, performed at the outpatient clinic of a secondary prenatal center, where pregnant women at risk for GHD received either RM or CC. In 2015 and 2016, 320 pregnant women were diagnosed with GHD: 90 (28.13%) received RM and 230 (71.88%) received CC. Women consenting to RM underwent obstetric surveillance with a BP monitor, an activity tracker, and a weight scale. Pregnant women in the prenatal remote follow-up program were asked to make one BP measurement in the morning and one in the evening, to make one weight measurement once a week, and to wear an activity tracker day and night until delivery or hospital admission. The data from the monitoring devices were transmitted to a Web-based dashboard developed by the Mobile Health Unit of Hasselt University. Predetermined alarm signals were set: based on international guidelines, was decided to generate an alarm signal when the diastolic blood pressure was greater than or equal to 90 mmHg and/or the systolic blood pressure was greater than or equal to 140 mmHg.[16,17] When appropriate, individual alarm signals were set (e.g., when they started with an antihypertensive therapy and on demand of the obstetrician). All alarm events were communicated to the obstetrician in charge to discuss management options before the patient was contacted and instructed at home. Therapeutic interventions were in accordance with local management strategies.

This study protocol was approved by the local ethics committees responsible for the site. The study conformed to the principles outlined in the Declaration of Helsinki. All patients gave their written informed consent, and all data were treated confidentially.

STUDY DESIGN

The objective of the study was to determine where the main cost savings were distributed, or which aspect of the prenatal, perinatal, or postnatal care involved an increase in costs, when RM was used instead of CC. The study population was divided into three subgroups: (1) delivery before 34 weeks of GA (which is the cutoff value to determinate whether a pregnant women suffers from early or late preeclampsia); (2) delivery at 34–37 weeks of GA (which is the intermediate measure); and (3) delivery after 37 weeks of GA (which is the cutoff value to determinate whether a pregnant women delivers preterm or term).The data were examined from three different perspectives, based on the current organization of Belgian healthcare: (1) the Belgium global HCS, which combines the costs for the National Institution for Insurance of Disease and Disability (RIZIV) and for individual patients; (2) the RIZIV, which is the national institutional social security system in Belgium, which ensures that every insured individual, regardless of his/her financial situation, has access to necessary quality medical care, in accordance with the tariff agreements between caregivers and the government[18]; and (3) the patient, who must pay for part of their care from their own financial resources. The HCS costs were estimated from the national tariffs applied for these services. The costs to RIZIV were calculated from the Belgium national reimbursement tariffs.[18] The costs to the patients were calculated as the HCS cost minus the RIZIV cost.

The calculations were made for three major domains and the total costs, presented below. A detailed overview of the included costs is presented in *Supplementary Data S1*(Supplementary Data are available online at www.liebertpub.com/tmj).

Cost analysis: prenatal follow-up. All costs related to urgent and nonurgent in-office visits were used in the prenatal follow-up cost analysis: (1) cost of prenatal consultations; (2) cost of ultrasound examinations; and (3) cost of cardiotocographic readings.

Cost analysis: prenatal admission to the hospital. To evaluate the economic impact of RM on the three major stakeholders, the following data points were collected when a pregnant woman was admitted to the prenatal ward: (1) costs related to the laboratory tests of the mother; (2) costs of medicines; and (3) costs related to admission.

Cost analysis: maternal and neonatal care at and after delivery. For both the CC group and the RM group, the following costs were included: (1) cost of the delivery; (2) necessary costs for the care of the neonate; and (3) other costs.

Cost analysis: total costs. After analyzing these data, a cost analysis of the total costs was made. This included (1) the costs of the prenatal follow-up; (2) the costs of admission to the prenatal ward; and (3) the costs of maternal and neonatal care at and after delivery.

STATISTICAL ANALYSIS

Because the baseline characteristics were continuous data, they are summarized as mean ± SD. Categorical data are summarized as counts and percentages and were compared with the χ^2 test or Fisher's exact test, where appropriate. Costs are reported as means and standard deviations or medians and interquartile ranges, depending on if they were normally or abnormally distributed. Differences in costs were calculated with the Mann–Whitney *U* test, because the cost data were typically highly skewed,[19] in that, a few patients incurred particularly high costs. Nominal level $\alpha < 0.05$ was considered significant. All statistical analyses were performed with SPSS release 24.0 (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0; IBM Corp, Armonk, NY).

Results

PREGNANCY-RELATED OUTCOMES

The pregnancy-related outcomes of the patients are summarized in *Table 1*. Of the 90 patients who participated in the RM study, 10 (11.12%) were excluded because they received (part of) their prenatal follow-up at another prenatal center and the financial bills for those services were not available. In the CC group, 54 (23.48%) patients were excluded for the same reasons. Finally, the RM group comprised 80 patients (31.25%) and the CC group comprised 176 patients (68.75%). The pregnancy-related outcomes of the populations enrolled were almost homogeneous, with no difference between the groups, except in the prevalence of gestational hypertension (80.00% in RM vs. 50.56% in CC, $p < 0.001$) and preeclampsia (18.75% in RM vs. 41.48%, $p < 0.001$) in the total study group and in the group with GA >37 weeks (86.15% in RM vs. 56.06% in CC [$p < 0.001$] and 12.31% in RM vs. 35.61% in CC [$p = 0.001$], respectively).

T1

TOTAL COSTS

An overview of the total costs per study group is presented in *Supplementary Tables S1–S4* and in *Figure 1*. *Figure 1* presents the average costs (±SD) for the three study subgroups and the total study group. The costs are categorized according to the patient costs (not refunded by the health insurance), RIZIV costs (refunded by the Belgium national healthcare insurance), and healthcare services costs (which is the sum of the patient and the RIZIV costs). There were no significant differences in the three study subgroups (< 34 weeks of GA, 34–37 weeks of GA, and >37 weeks of GA), or when all three subgroups were combined, between RM and CC in the total costs for HCS and RIZIV, or patient costs. There was a reduction of 50.52% (€9,125.17) in the HCS costs for women who delivered before 34 weeks of GA, 1.16% (€35.94) for women who delivered after 37 weeks of GA, and 25.00% (€1293.86) for the total study group when RM was compared with CC. There was an increase in the total HCS cost of 3.90% (€227.12) for the RM group women who delivered at 34–37 weeks of GA. Among women who delivered before 34 weeks of GA, there were reductions of 56.23% (€8,929.77) in the RIZIV costs and 8.95% (€195.18) in the patient costs when the women were treated with RM rather than with CC. Women treated with RM who delivered at 34–37 weeks of GA had a reduction in RIZIV costs of 21.03% (€652.13) and an increase in the patient costs of 67.04% (€863.79) compared with the CC women. Among the women who delivered after 37 weeks of GA, the RIZIV costs were 5.09% (€102.42) lower in the RM group than in the CC group, but the patient costs were 6.08% (€66.49) higher in the RM group than in the CC group. In summary, the total cost for RIZIV was 35.17% (€1,383.72) lower in women treated with RM than in women treated with CC, but the patient costs were 7.07% (87.89) higher for the women in the RM group than for those in the CC group.

ST1–4
F1

DISTRIBUTION OF COST SAVINGS

The healthcare costs for the three major domains, according to study group, are presented in *Supplementary Tables S5–S8*. In women who gave birth before 34 weeks of GA, 91.96% of the cost savings were in maternal and neonatal care at and after delivery (they were all located in the neonatal care), and less than 10% of the costs savings were located in the prenatal follow-up (0.34%) and the prenatal admission to the hospital (7.70%) (which could be further divided in prenatal visits (0.18%), ultrasound (0.16%), prenatal admission (7.58%), and medications (0.12%)). In women who gave birth at 34–37 weeks of GA, 79.11% of the cost reductions were located in maternal and neonatal care at and after delivery (which all are located in the neonatal care), followed by the prenatal admission until to the hospital (medications (12.16%) and laboratory tests (5.44%)), and 3.29% for the prenatal follow-up (an reduction in the prenatal visits of 3.29%). In women who delivered after 37 weeks of GA, 76.27% of the cost reductions

ST5 – ST8

Table 1. Pregnancy-Related Outcomes

	RM GROUP (*N* = 80)	CC GROUP (*N* = 176)	STATISTICAL SIGNIFICANCE (TWO TAILED)
Total group			
GA at delivery	38w 1/7 (±2.65)	37w 5/7 (±3.22)	0.31
GHD			
EH	1 (1.25%)	9 (5.11%)	0.14
GH	64 (80.00%)	89 (50.56%)	≤**0.001**
PE	15 (18.75%)	73 (41.48%)	≤**0.001**
HELLP	0 (0.00%)	5 (2.84%)	0.13
	RM GROUP (*N* = 7)	**CC GROUP (*N* = 20)**	
GA <34 weeks			
GA at delivery	31w 3/7 (±2.63)	30w 1/7 (±0.59)	0.30
GHD			
EH	0 (0.00%)	0 (0.00%)	–
GH	3 (42.85%)	6 (30.00%)	0.54
PE	4 (57.14%)	13 (65.00%)	0.71
HELLP	0 (0.00%)	1 (5.00%)	0.55
	RM GROUP (*N* = 8)	**CC GROUP (*N* = 24)**	
GA 34–37 weeks			
GA at delivery	35w 4/7 (±0.94)	35w 5/7 (±0.85)	0.61
GHD			
EH	0 (0.00%)	1 (4.17%)	0.56
GH	5 (62.50%)	9 (37.50%)	0.22
PE	3 (37.50%)	13 (54.17%)	0.41
HELLP	0 (0.00%)	1 (4.17%)	0.56
	RM GROUP (*N* = 65)	**CC GROUP (*N* = 132)**	
GA >37 weeks			
GA at delivery	39w 1/7 (±0.14)	39w 1/7 (±0.10)	0.84
GHD			
EH	1 (1.54%)	8 (6.06%)	0.15
GH	56 (86.15%)	74 (56.06%)	≤**0.001**
PE	8 (12.31%)	47 (35.61%)	**0.001**
HELLP	0 (0.00%)	3 (2.27%)	0.22

Values are mean (±SD) or numbers (percentages).

RM, remote monitoring; CC, conventional care; GA, gestational age; GHD, gestational hypertensive disorder; EH, essential hypertension; GH, gestational hypertension; PE, preeclampsia; HELLP, hemolysis, elevated liver enzymes, and low platelets.

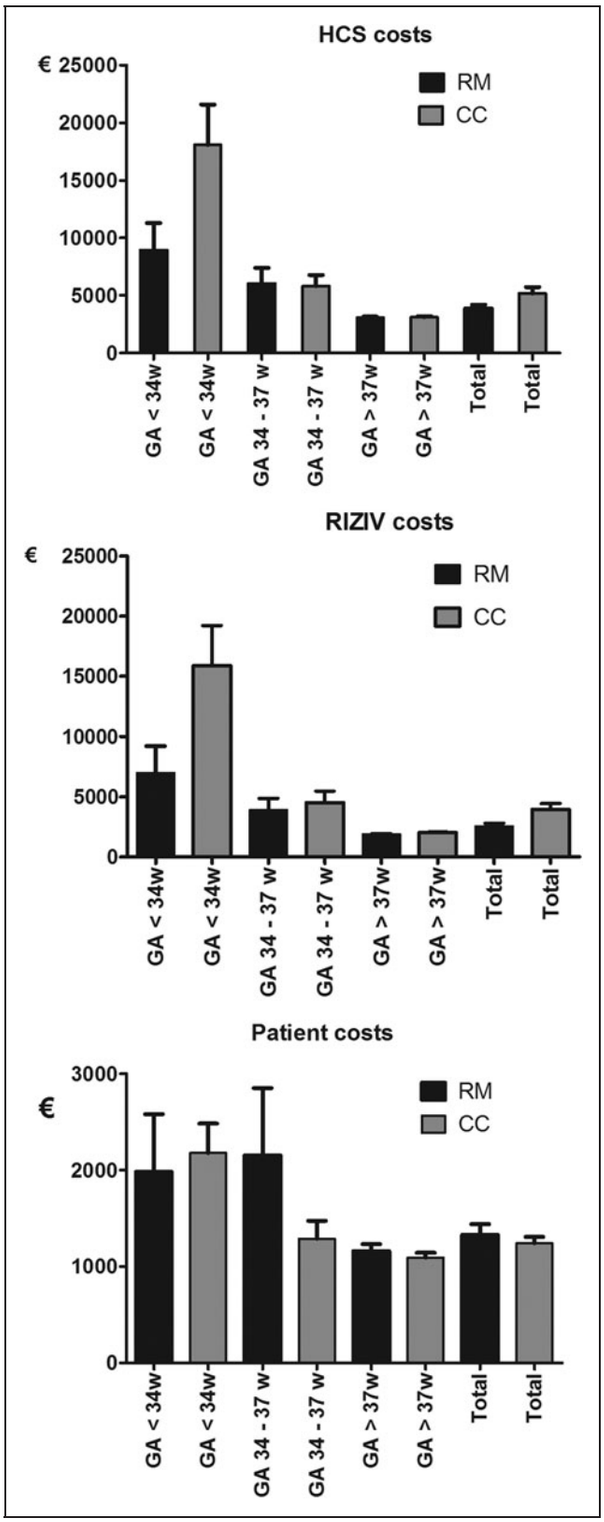

Fig. 1. Overview of total costs per study group.

Table 2. Cost Savings in Healthcare System

	STUDY POPULATION 2015–2016		FLANDERS (*N*=3,152)	
	RM (*N*=80)	CC (*N*=176)	RM	CC
<34 weeks of GA				
# pts (%)	7 (8.75%)	20 (11.36%)	285 (8.75%)	358 (11.36%)
HCS/pte	8,936.20	18,061.37	8,936.20	8,936.20
Total HCS/group	62,553.40	361,227.40	2,546,817.00	6,465,970.46
34–37 weeks of GA				
# pts (%)	8 (10.00%)	24 (13.64%)	325 (10.00%)	455 (13.64%)
HCS/pte	6,031.26	5,805.14	5,805.14	5,805.14
Total HCS/group	4,825.08	139,323.36	1,960,159.50	2,641,338.70
> 37 weeks of GA				
# pts (%)	65 (81.25%)	132 (75.00%)	2,642 (81.25%)	2,439 (75.00%)
HCS/pte	3,073.38	3,109.32	3,073.38	3,073.38
Total HCS/group	199,769.70	41,430.24	8,119,869.96	783,631.48
Total amount of costs	310,573.18	910,981.00	12,626,846.46	16,690,940.64
Cost savings (CC–RM)	600,407.82		4,064,094.18	

Costs are calculated in euros (€).

HCS, healthcare system; GA, gestational age.

were located in maternal and neonatal care at and after delivery (of which 59.60% is located in the neonatal care and 16.67% in other), 17.92% in the prenatal follow-up (14.91% in prenatal visits and 3.01% in the ultrasounds), and 5.81% in the prenatal admission to the hospital (which are located in the laboratory tests).

Discussion

PRINCIPAL FINDINGS

We investigated where the main cost savings in an RM prenatal follow-up program were distributed by dividing the patient population into three subgroups according to the GA at the time of delivery.

The findings of this study, performed on a dataset collected over 2 years, showed that the greatest differences in costs between RM and CC were in the group who delivered before 34 weeks of GA (50.52% in HCS costs, 56.23% in RIZIV costs, and 8.95% in patient costs), followed by the group who delivered after 37 weeks of GA (1.16% in HCS costs, 5.09% in RIZIV costs, and –6.08% in patient costs), and was least in the group of women who delivered at 34–37 weeks of GA (–3.90% in HCS costs, 21.03% in RIZIV costs, and –67.04% in patient costs). In the total RM group, the reductions were 25.00% in HCS costs, 35.17% in RIZIV costs, and –7.07% in patient costs.

Most of the cost savings were in neonatal care for all three study subgroups (birth <34 weeks GA, birth 34–37 weeks GA, and birth >37 weeks GA) and when all three study subgroups were analyzed together. Obviously, the higher the GA at the time of delivery, the lower the cost for neonatal care. In the RM women who delivered after 34 weeks of GA, reductions were observed in the costs of prenatal visits (3.29% with birth at 34–37 weeks of GA and 14.91% with birth at >37 weeks of GA), ultrasound (3.01% with birth at >37 weeks of GA), laboratory tests (approximately 5% in both groups), medications (12.16% with birth at 34–37 weeks of GA), and other costs (16.67% with birth at >37 weeks of GA) compared with the CC group. When the study subgroups were analyzed together, more than 95% of the cost savings with RM were in neonatal care.

STRENGTHS AND LIMITATIONS

The use of "real-life" data from hospital bills and from the SPE was the main strength of this study. By using these data, the actual situation of pregnancies complicated with GHD (in Flanders) was analyzed and the results are generalizable to settings with similar economic and social characteristics. It is

nearly impossible to give all pregnant women with GHD this type of prenatal care, but it is clear that for each woman who received this type of care, the HCS cost was reduced.

The main limitation of this study was that the patients from the PREMOM Study were not randomized. Nevertheless, the PREMOM Study and this financial analysis provide a picture of the "real-life" situation in Belgium. We obtained the data from patient files and hospital bills, although we had no information on patients' acts of hospital and medical consumption and the patients' social costs (such as transportation and travel costs and the loss of employment income during hospital stays). These results may differ in different HCSs and different economic and social settings, such as in other countries. This study was also limited to 6 weeks after delivery. It is clear that neonates who need intensive care at the moment of delivery will have higher healthcare costs than neonates who do not need this care. These costs usually arise from rehospitalizations, acute care visits, or further intensive care for the rest of the infant's life. Finally, the costs for organizing RM are not taken into account, which are as follows: the RM devices, the midwife who supervised the data, and the technical support. To obtain a complete picture of the cost of and cost savings attributable to this technology, further research is required, which takes these data into account.

COMPARISONS WITH PREVIOUS TRIALS

A cost analysis of an RM prenatal follow-up program for women with GHD, for which the data analysis was performed in 2015, was, to the best of our knowledge, the first study to report that RM is cost-effective for a global HCS, mainly through savings to the insurance institution RIZIV. Since that analysis was completed, no new studies have been published on the financial impact of an RM prenatal follow-up program for women with GHD.

POSSIBLE EXPLANATIONS

This study demonstrated that neonatal care is one of the largest costs in the care of mothers and babies. However, this is not new information. Neonatal care is characterized by its intensive character and is known as one of the most expensive services in hospitals.[20] It is recognized that most neonatal morbidity associated with GHD is attributable to the complications of prematurity and the cost of neonatal care correlates with the severity of prematurity.[21] Our research team has shown that the neonates in the RM group, who were born before 34 weeks of GA, were approximately 10 days older than the corresponding neonates in the CC group. RM makes it possible for caregivers to see abnormal events in pregnant women and offer an intervention when necessary to prevent the worsening of the disease. It may not always be possible to prevent a premature delivery, but RM makes it possible to delay a premature delivery by up to 10 days. These 10 days will have a significant impact on the health of the neonate and reduce the costs to the HCS and RIZIV by more than 50%. The lower prevalence of premature births in the RM group compared with the CC group can be similarly explained. The literature indicates that a premature birth at 28–36 weeks of GA is 2.30 times more expensive than a birth after 36 weeks of GA, and that births before 28 weeks of GA are 12.47 times more expensive.[21] Because fewer premature neonates were born in the RM group than in the CC group, the cost savings will increase when RM is extended to all pregnant women in Flanders. This can explain the cost savings that will be reached when we extrapolate this over a large number of women with GHD.

The increase in patient costs for the study group who delivered at 34–37 weeks of GA mainly occurred in the categories "prenatal admission," "neonatal admission," and "delivery" (39.88%, 41.20%, and 14.98%, respectively). Further analysis of these data showed that pregnant women in the RM group were more likely to choose a single room for their hospitalization than a room shared with other patients. Therefore, the patient costs were higher in the RM group. Moreover, more insurance was reimbursed to the women in the CC group, whose child was hospitalized after delivery, than to the corresponding women in the RM group. This may explain the large difference in the costs incurred by the two groups.

To conclude, of the women who gave birth at >37 weeks GA, significantly more patients were diagnosed with preeclampsia and fewer with gestational hypertension in the CC group than in the RM group. Although these diseases require different treatments, which entail different costs, the GA at which these women gave birth partly explains the slight discrepancy in costs. Women who gave birth at >37 weeks of GA, who were considered at risk for or had preeclampsia, were less likely to be hospitalized due to the GA, but had more frequent prenatal visits and laboratory tests to monitor their vital parameters. This difference in costs is clear in this study, but it did not affect the total costs as strongly as the difference in the cost of neonatal care in the group who gave birth at <34 weeks of GA.

RECOMMENDATIONS FOR FURTHER RESEARCH

This study was restricted to a postnatal follow-up period of 6 weeks after delivery. It would be interesting to monitor the neonates in both the RM and CC groups for more than 6 weeks

postpartum to allow a long-term cost–benefit analysis. Because the social costs (such as transportation and travel costs and the cost of lost employment income for the time spent in hospital) were not taken into account in this study, it would be interesting to include this type of cost in a future study. It is possible that the differences in costs will be even greater when these factors are also considered. It would also be interesting to know how much pregnant women are prepared to pay each month to fund the RM service. In this way, it would be possible to fund RM through both RIZIV and patient contributions. The costs required to provide RM were not taken into account in this analysis, but should be included in follow-up studies. To conclude, for future RM programs, it would be interesting to implement screening tools toward the identification of pregnancies at high risk for hypertensive and/or fetal growth. Some screening programs already exist (e.g., for preeclampsia and gestational diabetes mellitus), but most of them are troubled with poor performance both in terms of sensitivity and/or specificity, particularly for late preeclampsia, gestational hypertension, or isolated fetal growth restriction. A prenatal screening tool with a high sensitivity and specificity rate would allow including only high-risk pregnancies in RM programs. This is necessary to prevent an unwanted rise of costs of RM offered to all pregnant women.

Conclusions

When an RM program was included in the prenatal care of women at risk of GHD, the greatest differences in costs between RM and CC were observed in the women who gave birth before 34 weeks of GA, followed by the group who delivered after 37 weeks of GA, and were least in the group of women who delivered at 34–37 weeks GA. In the total study group, saving in both the HCS and RIZIV costs were observed. Most of the cost savings were in neonatal care, both in the three individual RM study subgroups and in the combined RM group. Our data show that RM is more cost-effective than standard care for pregnant women with GHD. We recommend further investigation into the effect of RM on long-term and social costs, and into the price that can be asked for the provision of RM services.

Acknowledgments

We thank the obstetricians and midwives of the Department of Gynecology at the Ziekenhuis Oost-Limburg and the other hospitals participating in the PREMOM project (JESSA Ziekenhuis, Hasselt; Sint-Franciskusziekenhuis, Heusden-Zolder; Ziekenhuis Maas en Kempen, Bree; Mariaziekenhuis Noord-Limburg, Overpelt; Sint Trudo, Sint Truiden; and AZ Vesalius, Tongeren). We also like to thank the financial department of the Ziekenhuis Oost-Limburg (Genk, Belgium) for their assistance and support during this study.

This study is part of the Limburg Clinical Research Program (LCRP) UHasselt-–ZOL–Jessa, supported by the Foundation Limburg Sterk Merk, the province of Limburg, the Flemish Government, Hasselt University, Ziekenhuis Oost-Limburg, and Jessa Hospital. This work was supported by Foundation Mustela (Laureate 2016).

Disclosure Statement

None of the authors have financial interests or other conflicts of interests to report.

REFERENCES

1. Devlieger RME, Martens G, Van Mol C, Cammu H. *Perinatale activiteiten in vlaanderen 2016*. Brussel: SPE, **2017**.
2. Kintiraki E, Papakatsika S, Kotronis G, Goulis DG, Kotsis V. Pregnancy-induced hypertension. *Hormones* **2015;**14:12.
3. Ayala DE, Hermida RC. Ambulatory Blood Pressure Monitoring for the Early Identification of Hypertension in Pregnancy. *Chronobiol Int* **2012;**30:223–259.
4. Kattah AG, Garovic VD. The management of hypertension in pregnancy. *Adv Chronic Kidney Dis* **2013;**20:229–239.
5. Odibo IN, Wendel PJ, Magann EF. Telemedicine in obstetrics. *Clin Obstet Gynecol* **2013;**56:422–433.
6. Cruz J, Brooks D, Marques A. A Home Telemonitoring in COPD: A systematic review of methodologies and patients' adherence. *Int J Med Inform* **2014;**83: 249–263.
7. Lanssens D, Vandenberk T, Smeets CJ, De Cannière H, Molenberghs G, Van Moerbeke A, van den Hoogen A, Roibjns T, Vonck S, Staelens A, Storms V, Thijs IM, Grieten L, Gyselaers, W. Remote Monitoring of Hypertension Diseases in Pregnancy: A Pilot Study. *JMIR Mhealth Uhealth* **2017;**5:10.
8. Lanssens D, Vonck S, Storms V, Thijs IM, Grieten L, Gyselaers W. The impact of a remote monitoring program on the prenatal follow-up of women with gestational hypertensive disorders. *J Med Internet Res* **2018;**223:72–78.
9. Ganapathy R, Grewal A, Castleman JS. Remote monitoring of blood pressure to reduce the risk of preeclampsia related complications with an innovative use of mobile technology. *Pregnancy Hypertens* **2016;**6:263–265.
10. Rhoads SJ, Serrano CI, Lynch CE, Ounpraseuth ST, Gauss CH, Payakachat N, et al. Exploring Implementation of m-Health Monitoring in Postpartum Women with Hypertension. *Telemed J E Health* **2017;**23:833–841.
11. Morrison JBN, Jacques D, Coleman SK, Tanziano GJ. Telemedicine: Cost-effective Management of High Risk Pregnancy. *Manag Care* **2001;**10:42–46, 48–49.
12. Buysse H, De Moor G, Van Maele G, Baert E, Thienpont G, Temmerman M. Cost-effectiveness of telemonitoring for high-risk pregnant women. *Int J Med Inf* **2008;**77:470–476.
13. Rosner BI, Gottleib MGM, Anderson WN. Effectiveness of an Automated Digital Remote Guidance and Telemonitoring Platform on Costs, Readmissions, and Complications After Hip and Knee Arthroplasties. *J Arthroplasty* **2017;**33:988–996.
14. Clarke M, Fursse J, Connolly N, Sharma U, Jones R. Evaluation of the National Health Service (NHS) Direct Pilot Telehealth Program: Cost-Effectiveness Analysis. *Telemed J E Health* **2018;**24:67–76.
15. Lanssens DVT, Smeets C, De Cannière H, Vonck S, Claessens J, Heyrman Y, Vandijck D, Storms V, Thijs I, Grieten L, Gyselaers W. Prenatal remote

monitoring of women with gestational hypertensive diseases: Cost analysis. *J Med Internet Res* **2018;**20:e102.

16. Duffy JM, van 't Hooft J, Gale C, Brown M, Grobman W, Fitzpatrick R, et al. A protocol for developing, disseminating, and implementing a core outcome set for pre-eclampsia. *Pregnancy Hypertens* **2016;**6:274–288.
17. Gyselaers W, Spaanderman M, et al. Assessment of venous hemodynamics and volume homeostasis during pregnancy: Recommendations of the International Working Group on Maternal Hemodynamics. *Ultrasound Obstet Gynecol* ePub Nov 9, 2017
18. RIZIV. *Rijksinstituut voor ziekte- en invaliditeitsverzekering*. Brussel, RIZIV, **2017**.
19. Malehi A, Pourmotahari F, Angali KA. Statistical Models for the Analysis of Skewed Healthcare Cost Data: A simulation study. *Health Econ Rev* **2015;**5:11.
20. Imershein AW, Turner C, Wells JG, Pearman A. Covering the Costs of Care in Neonatal Intensive Care Units. *Pediatrics* **1992;**89:56–61.
21. Pourat NMA, Jones JM, Gregory KD, Korst L, Kominski GF. Costs of Gestational Hypertensive Disorders in California: Hypertension, Preeclampsia, and Eclampsia. Los Angles: UCLA Center for Health Policy Research, **2013**.

Address correspondence to:
Dorien Lanssens
Mobile Health Unit
Faculty of Medicine and Life Sciences
Hasselt University
Martelarenlaan 42
Hasselt 3500
Belgium

E-mail: dorien.lanssens@uhasselt.be

Received: May 30, 2018
Revised: June 27, 2018
Accepted: July 29, 2018

AU1: Please identify (highlight or circle) all authors' surnames for accurate indexing citations.
AU2: Please mention the authors' degree abbreviations (e.g., MS, MD, and PhD).
AU3: Kindly check the sentence for clarity, "Predetermined alarm signals were set: based on international guidelines, was decided to generate an alarm signal when the diastolic blood pressure was greater than or equal to 90 mmHg and/or the systolic blood pressure was greater than or equal to 140 mmHg."
AU4: Please provide Ref. 18 in English.
AU5: Please mention the degree abbreviation (e.g., MS, MD, and PhD) of the corresponding author.
AU6: Please mention the significance of bold and underlined values in Table 1.
AU7: Please cite Table 2 in the text.
AU8: Kindly check for clarity, "Blood derives patients' costs for the admission to the intensive care"
AU9: Please mention the significance of bold and underlined values in Supplementary Tables S5–S8.

Supplementary Data

Supplementary Data S1. A detailed overview of the included costs

1. Prenatal follow-up
- Cardiotocographics
- Prenatal visits
- Ultrasounds

2. Prenatal admission to the hospital

Costs related to the labs of the mother:
- Activated partial thromboplastin time
- Aerobic culture of sanies
- Counting of erythrocytes and/or hematocrit
- Counting of leukocytes
- Counting of thrombocytes
- Dosing of albumin in microamount by an immunological method
- Dosing of albumin
- Dosing of aspartate aminotransferase and alanine aminotransferase
- Dosing of calcium
- Dosing of chloride
- Dosing of creatinine
- Dosing of CRP with an immunological method
- Dosing of fibrinogen
- Dosing of glucose
- Dosing of glucose or other reducing sugars
- Dosing of hemoglobin by electrometric method
- Dosing of lactic dehydrogenases
- Dosing of magnesium
- Dosing of phosphates
- Dosing of potassium
- Dosing of sodium
- Dosing of total bilirubin and its fractions
- Dosing of total protein
- Dosing of total proteins
- Dosing of urea
- Dosing of uric acid
- Microscopic examination of urine sediment, after double staining
- Thromboplastin time

Costs of the medications:
- Pharmaceutical costs:
  - Aldomet® 250 mg
  - Amlor® 5 mg
  - Amlor 10 mg
  - Atropine sulfate aguettant injection 0.5 mg/mL
  - Boostrix Polio® vaccine 0.5 mL
  - Bridion® injection 2 mL/100 mg
  - Buscopan® injection 1 mL/20 mg
  - Cabergoline Teva® 0.5 mg
  - Cedium Chlorhexidini® 0.0%
  - Cedium Chlorhexidini 0.5%
  - Cafazoline Mylan® injection 2 g
  - Celestone® injection 4 mg/mL
  - Chloramphenicol® 5 mg/mL
  - Clexane® SC injection 0.4 mg
  - Clexane SC injection 0.6 mg
  - Clindamycine Fresenius Kabi® 150 mg/mL
  - Contramal®injection 100 mg/mL
  - Cytotec® 200 mcg
  - Dafalgan® 500 mg
  - Daktarin® Spray 100 g
  - Diclofenac® suppo 100 mg
  - Diprivan® injection 200 mg/20 mL
  - Edium Chlorhexidini® 0.05%
  - Ephedrine® injection 50 mg/1 mL
  - Esmeron® injection 5 mL/50 mg
  - Fentanyl® injection 2 mL
  - Fortal® 50 mg
  - Glucose injection 10 mL
  - Glucose 5% infusion 100 mL
  - Glucose 5% infusion 500 mL
  - Glucose 5% infusion 1,000 mL
  - Hacdil - S® dilution 15 mL
  - Hirudoid® gel
  - Injectafer® 100 mg/2 mL
  - Instillagel®
  - Iso-Betadine® derm. 125 mL
  - Iso-Betadine gyn. 500 mL
  - Iso-Betadine hydro-alkohol 500 mL
  - Iso-Betadine unigyn. 500 mL
  - Linisol® 1% injection 10 mL
  - Linisol 2% injection 10 mL
  - Litican® injection 50 mg/2 mL
  - Magnesium sulphate 1 g/10 mL
  - Marcaine® injection 0.5%
  - Movical Neutral®
  - NaCl 0.9% 20 mL
  - NaCl 0.9% perfusion Viaflo
  - NaCl 0.9% perfusion 100 mL
  - NaCl 0.9% perfusion 250 mL
  - NaCl 0.9% perfusion 500 mL
  - NaCl 0.9% perfusion 1,000 mL

Naropin® injection 20 mL 10 mg/mL
Neobacitracine® Pro instant
Nepresol® 25 mg
Norgalax® 120 mg
Ondansetron Mylan® injection 2 mg
Otrivine anti-rhinitis®
Pabal® injection 1 mL/100 mcg
Paracetamol Actavis® perfusion 500 mg
Paracetamol Fresenius Kabi® perfusion 10 mg/mL
Paraffine 10 mL
Penicilline 2.000.000E perfusion
Phenylephrine® injection 50 mcg/1 mL
Plasma Lyte® 148 + Glucose 5%
Plasmalyte® a viaflo 1,000 mL
Prepidil gel® 0.5 mg/3 mL
Primperan® injection 10 mg/2 mL
Prostin E2 comprime 0.5 mg
Reparil® 1% gel
Rhogam® injection 300 mcg
Riopan® gel 10 mL
Robinul + Neostigmine® injection 0.5 mg/mL
Ropivacaine Fresenius Kabi® injection 7.5 mg/mL
Scandicaïne® injection 1% 20 mL
Sufenta® injection 0.01 mg
Sufenta injection 0.05 mg
Syntocinon® injection 10E/2 mL
Taradyl® injection 10 mg
Tardyferon® 80 mg
Trandate® 100 mg
Ultiva® injection 5 mg
Ultraproct® ointment 30 g
Vaseline® ointment 20 g
Volulyte® 6% perfusion 500 mL
Xylocaine® + Adrenaline 10 mg/mL +5 μg/mL
Zantac® 150 mg

Patients' costs for pharmaceutical products

Costs related to the admission:

Cardiotocographics before the delivery
Hospital care per admission
Hospital care per day
Medical imaging radiology
Patients' costs for clinical biology per day
Personal share
Supplement single room
X-ray diagnosis

3. Maternal and neonatal care at and after delivery

Costs of the delivery:

Additional fee for benefits with relative value
Anesthesia
Anesthesia for obstetric benefits
Assistance provided by a physician in a hospital environment
Delivery by cesarean section
Delivery done by the midwife
Monitoring and registration of fetal heart rate
Normal or complicated delivery

Costs necessary for the care of the neonate:

Activated partial thromboplastin time
Aerobic culture of sanies
Aortic puncture for decrease (s), injections, catheter insertion, etc.
Biodimensional ultrasound
Clinical examination of the newborn on the maternity
Complicated dermatological correlation for extensive lesions, during hospitalization
Counting of erythrocytes and/or hematocrit
Counting of the leukocytes
Counting of thrombocytes
Delivery margin of implants
Determine antierythrocyte antibodies
Determine blood groups
Determine RH phenotype
Dosing of albumin in microamount by an immunological method
Dosing of ionized calcium outside each calculation method
Dosing of sodium, potassium, chlorides, and bicarbonates in plasma or serum
Dosing of albumin
Dosing of aspartate aminotransferase and alanine aminotransferase
Dosing of calcium
Dosing of chloride
Dosing of creatinine
Dosing of CRP with an immunological method
Dosing of fibrinogen
Dosing of glucose
Dosing of glucose or other reducing sugars
Dosing of hemoglobin by electrometric method
Dosing of lactic dehydrogenases
Dosing of magnesium
Dosing of phosphates
Dosing of potassium

Dosing of sodium
Dosing of total bilirubin and its fractions
Dosing of total protein
Dosing of total proteins
Dosing of urea
Dosing of uric acid
Full blood and labile blood products - Fresh frozen human plasma virus inactivated
Full transthoracic echographic bilan of the heart
Hemoculture with identification of isolated germs
Hospital care per admission to the neonatal intensive care
Hospital care per day at the neonatal intensive care
Individual kinesiotherapy session where the personal involvement of the physiotherapist per beneficiary has a global average duration of 15 minutes
Installation and monitoring of positive pressure ventilation by nasal route using probe or mask and artificial respiratory equipment
Installation and supervision of controlled or assisted continuous ventilation
Installation and supervision on the continuous monitoring of the heart function of the neonate older than 33 weeks
Intravenous perfusion to child younger than seven years
Larynx intubation
Medical imaging radiology
Microscopic examination of urine sediment, after double staining
Patients' costs for clinical biology per day
Patients' costs for admission to the intensive care
Peripherally inserted central venous catheter (PICC) for long-term use
Personal share for admission to the neonatal intensive care
pH determination and CO_2 and O_2 pressures in the blood (acid-base equilibrium)
Placement of an umbilical catheter in the newborn outside the anesthesia
Stomach catheterization in children younger than seven years
Surveillance from day 6 until day 12 after the delivery on the maternity
Take charge of newborns by at-risk pregnancies
Thromboplastin time
Total abdominal investigation with at least eight incisions
X-ray diagnosis

Other costs:

Admission to the emergency room
Admission to the intensive care
Blood derives patients' costs for the admission to the intensive care

Supplementary Table S1. Total Costs for Women Delivered Before 34 Weeks of Gestational Age

	STUDY GROUP		COST SAVING IN THE RM GROUP		STATISTICAL SIGNIFICANCE (TWO–TAILED)
	TM GROUP (*N* = 7)	CC GROU (*N* = 20)	€	%	
Total amount of costs					
HCS costs (€)					
Mean	8,936.20 ± 6,260.39	18,061.37 ± 15,729.19	9,125.17	50.52	0.22
Median	6,484.32 (4,403.54–15,533.20)	15,434.23 (4,907.05–26,333.46)			
RIZIV costs (€)					
Mean	6,951.59 ± 5,894.59	15,881.69 ± 14,972.48	8,930.10	56.23	0.17
Median	4,398.12 (1,945.38–12,880.87)	13,671.19 (2,973.18–23,186.25)			
Patients' costs (€)					
Mean	1,984.60 ± 1,580.54	2,179.68 ± 1,369.47	195.18	8.95	0.74
Median	1,867.63 (629.84–3,064.74)	13,671.19 (2,973.18–23,186.25)			

Values are mean ± SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).

TM, telemonitoring; CC, conventional care; HCS, healthcare system; RIZIV, national healthcare insurances.

Supplementary Table S2. Total Costs for Women Delivered Between 34 and 37 Weeks of Gestational Age

	STUDY GROUP		COST SAVING IN THE RM GROUP		STATISTICAL SIGNIFICANCE (TWO–TAILED)
	TM GROUP (*N*=8)	CC GROUP (*N*=24)	€	%	
Total amount of costs					
HCS costs (€)					
Mean	6,031.26±3,856.05	5,805.14±4,718.45	–227.12	–3.90	0.79
Median	5,152.59 (2,859.38–8,956.75)	4,569.32 (2,822.91–7,068.35)			
RIZIV costs (€)					
Mean	3,878.95±2,828.58	4,531.08 (4,720.36)	652.13	21.03	0.57
Median	2,495.53 (1,705.37–7,103.22)	3,160.03 (2,132.61–4,452.85)			
Patients' costs (€)					
Mean	2,152.31±1,984.03	1,288.52±908.59	–863.79	–67.04	0.34
Median	1,235.04 (843.29–4,349.09)	1,189.52 (512.26–1,671.66)			

Values are mean±SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).

Supplementary Table S3. Total Costs for Women Delivered After 37 Weeks of Gestational Age

	STUDY GROUP		COST SAVING IN THE RM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N* = 65)	CC GROUP (*N* = 132)	€	%	
Total amount of costs					
HCS costs (€)					
Mean	3,073.38 ± 793.20	3,109.32 ± 981.73	35.94	1.16	0.65
Median	2,909.15 (2,663.50–3,615.32)	2,908.78 (2,442.36–3,601.08)			
RIZIV costs (€)					
Mean	1,912.77 ± 381.50	2,015.19 ± 626.51	102.42	5.09	0.97
Median	1,873.83 (1,633.17–2,070.34)	1,821.36 (1,591.14 (2,309.80)			
Patients' costs (€)					
Mean	1,160.62 ± 579.16	1,094.13 ± 595.63	−66.49	−6.08	0.35
Median	1,247.02 (799.04–1,527.11)	1,142.75 (602.49–1,431.84)			

Values are mean ± SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).

Supplementary Table S4. Total Costs for All the Gestational Hypertensive Disorder Groups

	STUDY GROUP		COST SAVING IN THE RM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N* = 80)	CC GROUP (*N* = 176)	€	%	
Total amount of costs					
HCS costs (€)					
Mean	3,882.17 (2,841.32)	5,176.03 (7,263.62)	1,293.86	25.00	0.92
Median	3,099.13 (2,710.20–3,884.69)	3,069.00 (2,578.65–4,228.32)			
RIZIV costs (€)	2,550.28 (2,386.51)	3,934.00 (6,833.84)			
Mean	1,900.11 (1,652.01–2,336.05)	2,020.87 (1,646.35–2,711.11)	1,383.72		0.24
Median	1,331.89 (969.69)	1,244.00 (833.65)		35.17	
Patients' costs (€)					
Mean			–87.89		0.57
Median	1,270.21 (790.48–1,604.38)	1,193.40 (623.09–1,631.48)		–7.07	

Values are mean ± SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).

Supplementary Table S5. Healthcare Costs of Women Delivered Before 34 Weeks of Gestational Age

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP ($N=7$)	CC GROUP ($N=20$)	€	%	
Prenatal follow-up					
Prenatal visits					
HCS costs (€)					
Mean	94.08 ± 42.60	111.13 ± 58.36	17.05	15.34	0.56
Median	82.32 (61.74–144.06)	113.19 (66.89–138.92)			
RIZIV costs (€)					
Mean	56.46 ± 25.57	66.69 ± 35.02	10.23	15.34	0.56
Median	49.40 (37.05–86.45)	67.93 (40.14–83.36)			
Patients' costs (€)					
Mean	37.62 ± 17.04	44.44 ± 23.34	6.82	15.34	0.56
Median	32.92 (24.69–57.61)	45.27 (26.75–55.55)			
Ultrasounds					
HCS costs (€)					
Mean	64.58 ± 64.13	79.77 ± 59.14	15.19	19.04	0.63
Median	53.18 (0.00–106.36)	79.77 (53.18–79.77)			
RIZIV costs (€)					
Mean	58.55 ± 55.43	72.33 ± 53.63	13.78	19.04	0.63
Median	48.22 (0.00–96.44)	72.33 (48.22–72.33)			
Patients' costs (€)					
Mean	6.02 ± 5.70	7.44 ± 5.52	1.42	19.04	0.63
Median	4.96 (0.00–9.92)	7.44 (4.96–7.44)			
Cardiotocographics					
HCS costs (€)					
Mean	62.34 ± 50.90	46.76 ± 98.82	−15.58	−33.32	0.11
Median	62.34 (0.00–124.68)	0.00 (0.00–62.34)			
RIZIV costs (€)					
Mean	31.17 ± 25.45	23.38 ± 49.41	−7.79	−33.32	0.11
Median	31.17 (0.00–62.34)	0.00 (0.00–31.17)			
Patients' costs (€)					
Mean	31.17 ± 25.45	23.38 ± 49.41	−7.79	−33.32	0.11
Median	31.17 (0.00–62.34)	0.00 (0.00–31.17)			
Prenatal admission					
Labs					
HCS costs (€)					
Mean	71.00 ± 47.47	65.14 ± 43.56	−5.86	−9.00	0.96
Median	61.65 (51.13–111.70)	61.93 (49.08–74.03)			

continued →

Supplementary Table S5. Healthcare Costs of Women Delivered Before 34 Weeks of Gestational Age *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N*=7)	CC GROUP (*N*=20)	€	%	
RIZIV costs (€)					
Mean	58.52±29.70	64.06±43.07	5.54	8.65	0.31
Median	61.65 (51.13–84.68)	59.97 (48.92–74.03)			
Patients' costs (€)					
Mean	12.48±24.19	1.08±3.79	−11.40	−1,055.56	0.31
Median	0.00 (0.00–23.84)	0.00 (0.00–0.00)			
Prenatal admission					
HCS costs (€)					
Mean	972.32±172.01	1,696.51±881.95	724.19	42.69	**0.04**
Median	943.84 (844.92–1,003.03)	1,517.36 (1,023.99–2,271.09)			
RIZIV costs (€)					
Mean	550.58±109.62	1,072.05±748.33	521.47	62.20	**0.02**
Median	478.20 (471.34–650.15)	925.09 (657.11–1,420.69)			
Patients' costs (€)					
Mean	421.74±124.92	624.47±444.00	232.73	32.46	0.41
Median	400.05 (344.07–530.68)	573.17 (260.12–989.45)			
Medicaments					
HCS costs (€)					
Mean	192.61±34.81	204.13±46.14	11.52	5.64	0.58
Median	190.14 (156.49–215.01)	203.47 (180–227.50)			
RIZIV costs (€)					
Mean	113.09±14.38	121.26±36.61	8.17	6.74	0.09
Median	111.50 (105.61–113.60)	121.45 (112.39–140.91)			
Patients' costs (€)					
Mean	79.52±31.27	82.87±31.54	3.35	4.04	0.66
Median	78.64 (47.01–91.30)	79.95 (57.96–98.14)			
Maternal and neonatal care					
Delivery					
HCS costs (€)					
Mean	1,528.34±634.20	1,128.42±516.33	−399.92	−35.44	0.08
Median	1,524.78 (785.84–2,210.34)	987.12 (685.98–1,418.87)			
RIZIV costs (€)					
Mean	911.53±197.88	792.12±182.35	−119.41	−15.07	0.05
Median	882.62 (778.84–1,126.46)	749.73 (677.16–778.84)			
Patients' costs (€)					
Mean	616.80±456.30	348.03±406.80	−268.77	−77.23	0.13
Median	642.16 (7.00–1,083.88)	39.79 (0.00–640.03)			

continued →

Supplementary Table S5. Healthcare Costs of Women Delivered Before 34 Weeks of Gestational Age *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N* = 7)	CC GROUP (*N* = 20)	€	%	
Neonatal care					
HCS costs (€)					
Mean	5,884.18 ± 6,079.33	14,670.42 ± 15,303.49	8,786.24	59.89	0.22
Median	3,530.13 (438.40–11,858.92)	12,810.15 (739.50–22,772.07)			
RIZIV costs (€)					
Mean	5,115.46 ± 5,894.93	13,614.81 ± 1,448,401	8,499.35	62.43	0.17
Median	2,598.36 (249.34–10,839.98)	11,740.99 (686.21–21,184.29)			
Patients' costs (€)					
Mean	946.88 ± 1,153.60	1,058.66 ± 1,040.70	111.78	10.56	0.62
Median	619.66 (42.86–1,418.76)	983.91 (141.54–1,445.06)			
Other					
HCS costs (€)					
Mean	66.75 ± 54.72	59.09 ± 43.45	−7.66	−12.96	0.82
Median	26.39 (25.73–109.25)	25.73 (25.73–112.30)			
RIZIV costs (€)					
Mean	56.22 ± 44.81	59.99 ± 39.23	3.77	6.28	0.84
Median	25.73 (21.10–25.73)	25.73 (25.73–104.08)			
Patients' costs (€)					
Mean	10.53 ± 18.10	4.10 ± 5.65	−6.43	−156.83	0.69
Median	0.00 (0.00–16.70)	0.00 (0.00–8.22)			

Values are mean ± SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).
GA, gestational age.

Supplementary Table S6. Healthcare Costs of Women Delivered Between 34 and 37 Weeks of Gestational Age

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP ($N=8$)	CC GROUP ($N=24$)	€	%	
Prenatal follow-up					
Prenatal visits					
HCS costs (€)					
Mean	126.05 ± 81.16	146.63 ± 59.87	20.58	14.29	0.50
Median	123.48 (46.31 + 205.80)	144.06 (102.90–180.08)			
RIZIV costs (€)					
Mean	75.64 ± 48.71	98.99 ± 35.93	23.35	14.29	0.50
Median	74.10 (27.79–123.50)	86.45 (61.75–108.06)			
Patients' costs (€)					
Mean	50.41 ± 32.46	58.64 ± 23.94	8.23	14.29	0.50
Median	49.38 (18.52–82.30)	57.61 (41.15–72.01)			
Ultrasounds					
HCS costs (€)					
Mean	152.89 ± 70.71	128.52 ± 64.50	−24.37	−18.96	0.35
Median	132.95 (93.07–199.43)	106.36 (79.77–186.13)			
RIZIV costs (€)					
Mean	138.63 ± 64.11	116.53 ± 58.48	−22.10	−18.96	0.35
Median	120.55 (84.39–180.83)	96.44 (72.33–168.77)			
Patients' costs (€)					
Mean	14.26 ± 6.59	11.99 ± 6.02	−2.27	−18.96	0.35
Median	12.40 (8.68–18.60)	9.92 (7.44–17.36)			
Cardiotocographics					
HCS costs (€)					
Mean	101.30 ± 188.31	28.57 ± 44.95	−72.73	−254.57	0.20
Median	62.34 (0.00–62.34)	0.00 (0.00–62.34)			
RIZIV costs (€)					
Mean	50.65 ± 94.16	14.29 ± 22.48	−36.36	−254.57	0.20
Median	31.17 (0.00–31.17)	0.00 (0.00–31.17)			
Patients' costs (€)					
Mean	50.65 ± 94.16	14.29 ± 22.48	−36.36	254.57	0.20
Median	31.17 (0.00–31.17)	0.00 (0.00–31.70)			
Prenatal admission					
Labs					
HCS costs (€)					
Mean	31.16 ± 49.30	65.16 ± 54.83	34.00	52.18	**0.03**
Median	15.22 (2.11–33.68)	52.55 (20.01–81.75)	34.05	52.77	**0.02**

continued →

Supplementary Table S6. Healthcare Costs of Women Delivered Between 34 and 37 Weeks of Gestational Age *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N* = 8)	CC GROUP (*N* = 24)	€	%	
RIZIV costs (€)					
Mean	28.68 ± 48.55	60.73 ± 49.72			
Median	12.34 (2.11–31.02)	52.55 (20.01–81.75)			
Patients' costs (€)					
Mean	2.48 ± 5.75	4.43 ± 15.26	1.95	44.02	0.29
Median	0.00 (0.00–2.57)	0.00 (0.00–0.00)			
Prenatal admission					
HCS costs (€)					
Mean	2,186.94 ± 2,551.14	1,468.46 ± 945.79	−718.48	−48.93	0.60
Median	1,305.99 (955.64–2,196.96)	1,197.40 (892.40–1,871.93)			
RIZIV costs (€)					
Mean	1,179.81 ± 1,239.36	851.82 ± 451.27	−327.99	−38.50	0.76
Median	839.65 (622.12–1,001.03)	724.44 (512.34–998.86)			
Patients' costs (€)					
Mean	1,007.13 (1,327.91)	616.64 ± 568.14	−390.49	−63.33	0.51
Median	472.18 (294.83–1,221.25)	462.36 (265.40–933.06)			
Medicaments					
HCS costs (€)					
Mean	162.32 (77.18)	238.31 ± 61.69	75.99	31.89	**0.03**
Median	161.11 (127.25–231.85)	227.26 (±203.88–284.25)			
RIZIV costs (€)					
Mean	90.78 ± 54.42	133.62 ± 35.06	42.84	32.06	0.05
Median	104.52 (34.80–136.23)	123.68 (112.18–141.43)			
Patients' costs (€)					
Mean	71.54 ± 36.66	104.69 ± 48.39	33.15	31.66	0.09
Median	78.39 (43.84–102.36)	104.40 (71.43–140.26)			
Maternal and neonatal care					
Delivery					
HCS costs (€)					
Mean	1,017.85 ± 504.38	984.01 ± 441.80	−33.84	3.44	0.37
Median	1,142.62 (727.38–1,396.50)	783.05 (670.34–1,315.38)			
RIZIV costs (€)					
Mean	641.67 ± 282.89	754.45 ± 170.63	112.78	14.95	0.66
Median	685.98 (586.98–816.05)	729.55 (670.34–772.59)			
Patients' costs (€)					
Mean	376.18 ± 321.12	229.56 ± 354.97	−146.62	−63.87	0.32
Median	518.17 (0.00–642.56)	3.10 (0.00–624.39)			

continued →

Supplementary Table S6. Healthcare Costs of Women Delivered Between 34 and 37 Weeks of Gestational Age *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N*=8)	CC GROUP (*N*=24)	€	%	
Neonatal care					
HCS costs (€)					
Mean	2,197.09 ± 2,467.97	2,691.51 ± 4,777.13	494.42	18.37	0.97
Median	1,616.10 (193.41–3,413.18)	761.13 (381.97–2,428.82)			
RIZIV costs (€)					
Mean	1,604.83 ± 2,251.01	2,461.13 ± 4,664.14	856.30	34.79	0.60
Median	412.39 (154.64–2,692.99)	652.39 (652.39–2,166.13)			
Patients' costs (€)					
Mean	592.19 ± 1,082.89	188.71 ± 219.01	−403.48	−148.28	0.76
Median	188.42 (1.86–612.03)	75.89 (14.31–278.32)			
Other					
HCS costs (€)	80.83 ± 49.08	53.97 ± 43.56			
Mean	25.93 (25.73–113.29)	25.73 (25.73–108.32)	−26.86	−49.77	0.63
Median	68.24 ± 54.30	50.52 ± 38.62			
RIZIV costs (€)					
Mean	65.39 (25.73–112.76)	25.73 (25.73–101.19)	−17.72	−35.08	0.31
Median					
Patients' costs (€)					
Mean	12.59 ± 42.43	3.45 ± 6.43	−9.14	−264.93	0.52
Median	0.00 (0.00–6.17)	0.00 (0.00–8.22)			

Values are mean ± SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).

Supplementary Table S7. Healthcare Costs for Women Delivered After 37 Weeks of Gestational Age

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N* = 65)	CC GROUP (*N* = 132)	€	%	
Prenatal follow-up					
Prenatal visits					
HCS costs (€)					
Mean	149.44 ± 80.14	164.02 ± 70.70	14.58	8.89	0.17
Median	114.06 (82.32–226.38)	164.64 (123.48–205.80)			
RIZIV costs (€)					
Mean	89.68 ± 48.09	98.43 ± 42.42	8.75	8.89	0.17
Median	86.45 (49.40–135.82)	98.80 (74.10–123.50)			
Patients' costs (€)					
Mean	59.76 ± 32.05	65.59 ± 28.27	5.83	8.89	0.17
Median	57.61 (32.92–90.53)	65.84 (49.38–82.30)			
Ultrasounds					
HCS costs (€)					
Mean	85.09 ± 42.36	88.03 ± 38.61	2.94	3.34	0.99
Median	79.77 (79.77–106.36)	79.77 (79.77–106.36)			
RIZIV costs (€)					
Mean	77.15 ± 38.41	79.82 ± 35.01	2.67	3.34	0.99
Median	72.33 (72.33–96.44)	72.33 (72.33–96.44)			
Patients' costs (€)					
Mean	7.94 ± 3.95	8.21 ± 3.60	0.27	3.34	0.99
Median	7.44 (7.44–9.92)	7.44 (7.44 9.92)			
Cardiotocographics					
HCS costs (€)					
Mean	138.11 ± 113.72	113.35 ± 102.14	−24.76	−21.84	0.15
Median	124.68 (62.34–187.02)	62.34 (62.34–187.02)			
RIZIV costs (€)					
Mean	69.05 ± 56.86	56.67 ± 51.07	−12.38	−21.84	0.15
Median	62.34 (31.17–93.51)	31.17 (31.17–93.51)			
Patients' costs (€)					
Mean	69.05 ± 56.86	56.67 ± 51.07	−12.38	−21.84	0.15
Median	62.34 (31.17–93.51)	31.17 (31.17–93.51)			
Prenatal admission					
Labs					
HCS costs (€)					
Mean	15.57 ± 41.92	21.25 ± 25.91	5.68	6.73	**≤0.001**
Median	0.65 (0.00–13.76)	14.54 (1.74–31.08)			

continued →

Supplementary Table S7. Healthcare Costs for Women Delivered After 37 Weeks of Gestational Age *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP ($N=65$)	CC GROUP ($N=132$)	€	%	
RIZIV costs (€)					
Mean	14.59 ± 38.67	20.68 ± 25.17	6.09	29.45	≤**0.001**
Median	0.65 (0.00–13.76)	14.96 (1.74–30.34)			
Patients' costs (€)					
Mean	0.98 ± 7.94	0.57 ± 3.57	−0.41	−71.93	0.47
Median	0.00 (0.00–0.00)	0.00 (0.00–0.00)			
Prenatal admission					
HCS costs (€)					
Mean	1,018.78 ± 524.80	1,004.25 ± 511.78	–	−1.45	0.68
Median	1,023.63 (666.15–1,258.43)	943.16 (684.05–1,203.33)	14.53		
RIZIV costs (€)					
Mean	575.79 ± 297.40	573.99 ± 329.75		−0.31	0.92
Median	598.61 (331.87–684.29)	466.55 (347.74–739.63)	−1.80		
Patients' costs (€)					
Mean	442.99 ± 284.11	430.27 ± 273.57		2.96	0.63
Median	598.61 (225.32–581.42)	392.57 (276.13–548.74)	−12.72		
Medicaments					
HCS costs (€)					
Mean	205.94 ± 117.41	202.02 ± 63.66	−3.92	1.94	0.13
Median	169.44 (155.70–212.19)	187.15 (157.37–227.80)			
RIZIV costs (€)					
Mean	118.67 ± 73.60	114.36 ± 19.48	−4.31	9.47	≤**0.01**
Median	105.34 (99.41–110.17)	110.69 (103.66–122.09)			
Patients' costs (€)					
Mean	87.26 ± 57.24	87.66 ± 54.17	0.40	0.06	0.58
Median	70.47 (53.85–98.53)	77.11 (53.80–101.86)			
Maternal and neonatal care					
Delivery					
HCS costs (€)					
Mean	1,085.14 ± 348.15	1,069.51 ± 421.62	–	−1.46	0.64
Median	1,291.36 (671.16–1,313.87)	998.94 (685.98–1,321.63)	15.63		
RIZIV costs (€)					
Mean	693.13 ± 84.88	692.26 ± 158.15		−0.13	0.47
Median	670.34 (666.97–753.49)	670.34 (648.71–765.90)	−0.87		
Patients' costs (€)					
Mean	392.01 ± 317.99	377.15 ± 365.61		−3.94	0.59
Median	624.39 (0.00–627.76)	438.72 (0.00–629.45)	−14.86		

continued →

Supplementary Table S7. Healthcare Costs for Women Delivered After 37 Weeks of Gestational Age *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N* = 65)	CC GROUP (*N* = 132)	€	%	
Neonatal care					
HCS costs (€)					
Mean	293.27 ± 397.62	351.54 ± 358.45	58.27	16.58	**0.02**
Median	239.53 (136.63–318.18)	270.39 (180.02–368.65)			
RIZIV costs (€)					
Mean	201.53 ± 173.70	286.07 ± 311.49	84.54	29.56	**0.02**
Median	187.18 (85.49–261.23)	215.69 (135.06–296.96)			
Patients' costs (€)					
Mean	94.72 ± 336.78	65.47 ± 81.38	–	–29.40	0.20
Median	48.22 (18.76–65.77)	57.43 (16.16–72.90)	29.15		
Other					
HCS costs (€)					
Mean	79.05 ± 88.74	95.35 ± 141.04	16.30	17.10	0.20
Median	57.98 (25.73–105.04)	78.10 (25.73–109.41)			
RIZIV costs (€)					
Mean	73.17 ± 78.02	92.81 ± 140.48	19.64	21.17	0.26
Median	39.91 (25.73–105.04)	76.81 (25.73–105.04)			
Patients' costs (€)					
Mean	5.88 ± 20.16	2.55 ± 4.48	–3.33	–	0.74
Median	0.00 (0.00–8.14)	0.00 (0.00–8.06)		130.59	

Values are mean ± SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).

Supplementary Table S8. Healthcare Costs for All the Gestational Hypertensive Disorder Groups

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP ($N=80$)	CC GROUP ($N=176$)	€	%	
Prenatal follow-up					
Prenatal visits					
HCS costs (€)					
Mean	142.26 ± 78.74	155.64 ± 69.80	13.38	8.60	0.14
Median	144.06 (82.32–205.80)	144.06 (102.90–205.80)			
RIZIV costs (€)					
Mean	85.37 ± 47.25	93.40 ± 41.89	8.03	8.60	0.14
Median	86.45 (49.40–123.50)	86.45 (61.75–123.50)	5.35	8.60	0.14
Patients' costs (€)					
Mean	56.89 ± 31.49	62.24 ± 27.91			
Median	57.61 (32.92–82.30)	57.61 (41.15–82.30)			
Ultrasounds					
HCS costs (€)					
Mean	90.07 ± 51.56	92.61 ± 47.48	2.54	2.73	0.76
Median	79.77 (79.77–106.36)	79.77 (79.77–106.36)			
RIZIV costs (€)					
Mean	81.67 ± 46.75	83.97 ± 43.05	2.30	2.73	0.76
Median	72.33 (72.33–96.44)	72.33 (72.33–96.44)			
Patients' costs (€)					
Mean	8.40 ± 4.81	8.64 ± 4.43	0.24	2.73	0.76
Median	7.44 (7.44–9.92)	7.44 (7.44–9.92)			
Cardiotocographics					
HCS costs (€)					
Mean	127.80 ± 119.81	94.22 ± 101.29	−33.58	−20.41	**0.03**
Median	124.68 (62.34–187.02)	62.34 (0.00–124.68)			
RIZIV costs (€)					
Mean	63.90 ± 59.91	47.11 ± 50.64	−16.79	−20.41	**0.03**
Median	62.34 (31.17–93.51)	31.17 (0.00–62.34)			
Patients' costs (€)					
Mean	63.90 ± 59.91	47.11 ± 50.64	−16.79	−20.41	**0.03**
Median	62.34 (31.17–93.51)	31.17 (0.00–62.34)			
Prenatal admission					
Labs					
HCS costs (€)					
Mean	21.98 ± 45.45	32.22 ± 38.30	10.24	31.78	**≤0.001**
Median	1.46 (0.00–20.22)	20.53 (6.09–41.30)			

continued →

Supplementary Table S8. Healthcare Costs for All the Gestational Hypertensive Disorder Groups *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N*=80)	CC GROUP (*N*=176)	€	%	
RIZIV costs (€)					
Mean	19.84±40.62	31.07±36.43	11.23	36.14	≤**0.001**
Median	1.46 (0.00–19.45)	20.53 (6.09–41.30)	–0.99	–86.09	0.84
Patients' costs (€)					
Mean	2.14±10.44	1.15±6.59			
Median	0.00 (0.00–0.00)	0.00 (0.00–0.00)			
Prenatal admission					
HCS costs (€)					
Mean	1,131.53±963.10	1,146.22±679.80	14.69	1.29	0.74
Median	1,013.69 (720.89–1,277.38)	970.51 (716.71–1,371.32)			
RIZIV costs (€)					
Mean	633.99±492.18	668.47±446.00	34.48	5.16	0.47
Median	609.92 (355.07–709.59)	572.67 (373.97–814.54)	–19.79	–4.14	0.84
Patients' costs (€)					
Mean	497.54±502.08	477.75±355.89			
Median	427.31 (263.00–582.36)	404.31 (272.13–610.27)			
Medicaments					
HCS costs (€)					
Mean	200.41±109.38	207.21±62.60	6.80	3.28	**0.013**
Median	171.26 (155.70–212.73)	193.97 (162.56–233.77)			
RIZIV costs (€)					
Mean	115.39±68.83	117.77±25.22	2.38	2.03	≤**0.001**
Median	105.63 (99.36–111.70)	11,305 (104.52–127.28)	4.42	4.94	0.22
Patients' costs (€)					
Mean	85.01±53.60	89.43±51.50			
Median	71.25 (53.60–98.45)	79.19 (54.91–109.41)			
Maternal and neonatal care					
Delivery					
HCS costs (€)					
Mean	1,117.19±409.68	1,064.55±434.79	–52.64	–4.94	0.26
Median	1,291.36 (683.99 1,332.58)	990.40 (685.98–1,329.38)			
RIZIV costs (€)					
Mean	707.10±142.12	712.16±164.62	5.06	0.72	0.71
Median	670.34 (666.97–767.68)	670.4 (666.97–778.84)	–56.38		0.18
Patients' costs (€)					
Mean	410.09±333.23	353.71±369.56			
Median	624.39 (0.00–640.03)	424.11 (0.00–631.04)		15.94	

continued →

Supplementary Table S8. Healthcare Costs for All the Gestational Hypertensive Disorder Groups *continued*

	STUDY GROUP		COST SAVING IN THE TM GROUP		STATISTICAL SIGNIFICANCE (TWO-TAILED)
	TM GROUP (*N* = 80)	CC GROUP (*N* = 176)	€	%	
Neonatal care					
HCS costs (€)					
Mean	975.29 ± 2,478.00	2,297.77 ± 6,992.57	1,322.48	57.55	**0.009**
Median	248.10 (138.67–382.13)	296.38 (202.65–536.97)			
RIZIV costs (€)					
Mean	771.83 ± 2,262.66	2,097.30 ± 6,584.94	1,325.47	63.20	**0.003**
Median	200.86 (86.14–302.25)	243.98 (162.70–450.14)			
Patients' costs (€)					
Mean	219.05 ± 608.78	195.14 ± 476.19	−23.91	−12.25	0.17
Median	51.68 (18.76–91.24)	62.03 (2.75–106.95)			
Other					
HCS costs (€)			9.96	11.64	0.43
Mean	75.63 ± 82.93	85.59 ± 125.04	11.55	11.94	0.57
Median	32.35 (25.73–105.04)	28.90 (25.73–109.41)			
RIZIV costs (€)					
Mean	71.19 ± 73.27	82.74 ± 124.27	−1.60	56.34	0.91
Median	32.82 (25.73–105.04)	28.90 (25.73–105.04)			
Patients' costs (€)					
Mean	4.44 ± 23.41	2.84 ± 4.92			
Median	0.00 (0.00–8.18)	0.00 (0.00–8.06)			

Values are mean ± SD and median with interquartile in euros (€); cost savings are calculated in euros (€) and percentages (%).