

Costs of publicly provided maternity services in Rosario, Argentina

Josephine Borghi, MSc,⁽¹⁾ Silvia Bastus, BA,⁽²⁾ María Belizan, MA,⁽³⁾ Guillermo Carroli, MD,⁽³⁾ Guy Hutton, MSc, PhD,⁽⁴⁾ Julia Fox-Rushby, MSc, PhD.⁽¹⁾

Borghi J, Bastus S, Belizan M, Carroli G, Hutton G, Fox-Rushby J.
Costs of publicly provided maternity services in Rosario, Argentina.
Salud Publica Mex 2003;45:27-34.

The English version of this paper is available too at:
<http://www.insp.mx/salud/index.html>

Borghi J, Bastus S, Belizan M, Carroli G, Hutton G, Fox-Rushby J.
Los costos de servicios maternos públicos en Rosario, Argentina.
Salud Publica Mex 2003;45:27-34.

El texto completo en inglés de este artículo también está disponible en: <http://www.insp.mx/salud/index.html>

Abstract

Objective. This study estimates the costs of maternal health services in Rosario, Argentina. **Material and Methods.** The provider costs (US\$ 1999) of antenatal care, a normal vaginal delivery and a caesarean section, were evaluated retrospectively in two municipal hospitals. The cost of an antenatal visit was evaluated in two health centres and the patient costs associated with the visit were evaluated in a hospital and a health centre. **Results.** The average cost per hospital day is \$114.62. The average cost of a caesarean section (\$525.57) is five times greater than that of a normal vaginal delivery (\$105.61). A normal delivery costs less at the general hospital and a c-section less at the maternity hospital. The average cost of an antenatal visit is \$31.10. The provider cost is lower at the health centre than at the hospital. Personnel accounted for 72-94% of the total cost and drugs and medical supplies between 4-26%. On average, an antenatal visit costs women \$4.70. Direct costs are minimal compared to indirect costs of travel and waiting time. **Conclusions.** These results suggest the potential for increasing the efficiency of resource use by promoting antenatal care visits at the primary level. Women could also benefit from reduced travel and waiting time. Similar benefits could accrue to the provider by encouraging normal delivery at general hospitals, and complicated deliveries at specialised maternity hospitals. The English version of this paper is available too at: <http://www.insp.mx/salud/index.html>

Key words: cost; maternal health; pregnancy; delivery; Argentina

Resumen

Objetivo. En este artículo se presenta una estimación de los costos de los servicios maternos en Rosario, Argentina. **Material y métodos.** Evaluamos retrospectivamente el costo (US\$ 1999) en dos hospitales municipales, de un parto normal vaginal, y de una cesárea y de una visita prenatal. El costo de atención prenatal fue evaluado en dos centros de salud y los costos asumidos por las pacientes fueron evaluados en un hospital y un centro de salud. **Resultados.** El costo promedio por día-cama es de \$114.62. El costo promedio de una cesárea (\$525.57) es cinco veces superior al de un parto normal vaginal (\$105.61). El parto normal costó menos en el hospital general y la cesárea costó menos en la unidad especializada de atención materna. El costo promedio por visita prenatal es de \$31.10. El costo de prestación era más bajo en el centro de salud que en el hospital. El personal de salud representa 72-94% del costo total y los medicamentos y materiales médicos entre 4-26%. En promedio, el costo total asumido por las mujeres por cada visita prenatal asciende a \$4.70. Los costos directos son mínimos, comparados con los costos indirectos del tiempo de viaje y de espera. **Conclusiones.** Los resultados sugieren que la promoción de la atención prenatal en los centros de salud podría aumentar la eficiencia del uso de los recursos. Igualmente, las mujeres se beneficiarían de una reducción en el tiempo de viaje y de espera. Se podrían obtener beneficios similares apoyando la atención del parto normal en los hospitales generales y la de los partos complicados en unidades especializadas de atención materna. El texto completo en inglés de este artículo también está disponible en: <http://www.insp.mx/salud/index.html>

Palabras clave: costo; salud materna; embarazo; parto; Argentina

- (1) London School of Hygiene and Tropical Medicine, London, UK.
(2) Centro Unico de Facturación, Secretaría de Salud Pública, Municipio de Rosario, Argentina.
(3) Centro Rosarino de Estudios Perinatales, Rosario, Argentina.
(4) Swiss Tropical Institute, Basel, Switzerland.

Received on: February 26, 2002 • Accepted on: September 26, 2002

Address reprint requests to: Josephine Borghi, Health Policy Unit, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT.
E-mail: jo.borghi@lshtm.ac.uk

The reduction in maternal mortality rates observed in most high-income countries over the last century has been associated with changes in the access of pregnant women to skilled care during pregnancy and childbirth and to the guaranteed provision of safe interventions assisting vaginal delivery and caesarean section.¹ However, the critical question of where these interventions should take place and who qualifies as a skilled attendant remains a matter of debate.²⁻⁵ Case studies from countries that have low maternal mortality demonstrate that delivery care can be organised in different ways: from home births with a trained non-professional, to basic pregnancy and delivery care in health centres or obstetric care at a referral level with trained professionals.^{2,3} There is no information to date as to which option is more effective in reducing maternal mortality and only limited evidence as to the cost of these alternatives.^{6,7}

In Argentina, public hospitals provide the full range of routine outpatient and inpatient maternity services and deal with obstetric complications, while the health centres provide outpatient antenatal care (ANC) alone. Ninety-five percent of women deliver with trained personnel in health facilities⁸ and attend at least one antenatal visit, while the recommended national average is four antenatal visits.⁹ While maternal mortality rates are lower than the average for Latin America, the reduction in maternal morbidity and mortality over recent years is seen to be inadequate.¹⁰ One explanation is the increasing demand for obstetric services which has been exceeding available supply in the public sector, with implications for quality.¹⁰

With falling health budgets, health planners and policy makers face the challenge of improving the efficiency of the health service delivery system to meet the increase in demand, without compromising maternal health or the financial viability of the system. To this end, information is needed on the cost of providing services at different health care levels and its relation to resource inputs, as well as on the cost to the people using services.¹¹ However, in public health facilities in Argentina the focus to date has been mainly on the evaluation of efficacy rather than efficiency of health services¹¹ and cost data are lacking.

Against this background, the primary aim of this study was to examine the costs of providing antenatal care in two health centres and two hospitals and the costs of delivery care in the hospital setting. The specific objectives were to explore how and why costs differ at different levels of service delivery for different interventions (antenatal *versus* normal delivery *versus* caesarean section), to assess the efficiency of service delivery, and to discuss the potential for achieving cost

savings without hurting quality. Costs to women were also evaluated, as they serve as a useful indicator of the accessibility of health care in terms of distance to travel and affordability in terms of direct costs of receiving care.

Material and Methods

The study took place in Rosario City, located in the Province of Santa Fe, Argentina. Rosario has an estimated population of 908,875.¹² Maternidad Martín, a high complexity referral hospital and Roque Sáenz-Peña, a general hospital, and two health centres: Las Flores and Casiano Casas, were selected for the study of provider costs. All costs are presented in constant prices US\$ 1999. The criteria for site selection were that the number of hours per week allocated to antenatal visits and the number of monthly visits be representative of the district average. In Roque Sáenz-Peña and Las Flores, a sample of women who had completed an antenatal visit was interviewed on the costs they faced in accessing and receiving antenatal care.

The provider costs of inpatient maternity and delivery care were evaluated in the study hospitals. The costs of outpatient antenatal care were evaluated from the provider and patient perspectives. Data on costs were collected between May 1999 and January 2000. Financial and economic costs were estimated and classified according to recurrent and capital inputs. Inputs were considered as recurrent items if used up within a year, or capital items if lasting longer than a year. Personnel, drugs and materials (medical and non-medical), utilities and maintenance were considered as recurrent inputs; equipment and building as capital items. The direct out-of-pocket treatment costs to women associated with antenatal care were considered, as well as the indirect, opportunity cost of travelling and waiting time.

Average costs of services to the provider were estimated using a top-down approach.¹³ Services were classified as directly related to maternity care or as 'support' or shared services,* which contribute to the functioning, rather than the provision, of health care. Table I presents the methods used to measure and evaluate direct and shared costs and the data obtained for each input type and for each health facility. A direct allocation of shared costs was conducted, using where

* For example: pharmacy, laundry, laboratory, radiology, social work, haematology, anaesthesiology, maintenance, kitchen, cleaning, general administration, security.

Table I
DATA COLLECTION AND VALUATION METHODS

Input	Identification & Measurement of Inputs		Monetary Unit Valuation		Sources of Data
	Hospital	Health Centre	Hospital	Health Centre	
Recurrent					
Health care and support staff	<ul style="list-style-type: none"> - Staff lists - Discussion with health care staff 	<ul style="list-style-type: none"> - Staff lists - For staff with direct contact with pregnant women, quantified total hours of work, number of hours allocated to outpatient visits, and proportion of time devoted to ANC 	<ul style="list-style-type: none"> - Full-time equivalent salaries for each staff member 	<ul style="list-style-type: none"> - Approximated salaries from salary codes - Apportioned salary according to the proportion of time allocated to ANC visits 	<ul style="list-style-type: none"> - Personnel department; obstetricians, nurse; neonatologists - Head of centre; obstetrician; head Nurse
Drugs	<ul style="list-style-type: none"> - Hospital records 	<ul style="list-style-type: none"> - Monthly invoices from April 1997 to March 1998 - Total number of prescriptions per month per drug category for pregnant women - Typical prescription for ANC based on interview with obstetricians 	<ul style="list-style-type: none"> - Apportion drug cost based on no. of prescriptions per ward average prescription cost 	<ul style="list-style-type: none"> - Estimated average monthly drug cost and average cost of a typical prescription 	<ul style="list-style-type: none"> - Pharmacy records - Obstetricians; primary health care director
Medical materials and supplies	<ul style="list-style-type: none"> - Invoices per month per ward 	<ul style="list-style-type: none"> - Monthly invoices for medical materials 	<ul style="list-style-type: none"> - Total monthly cost per ward 	<ul style="list-style-type: none"> - Apportioned average monthly cost on basis of proportion of visits for ANC - Assume the use of medical materials is restricted to nurses (60%) and obstetricians (40%) - Apportioned to ANC based on proportion of staff working in ANC 	<ul style="list-style-type: none"> - Accounts* <ul style="list-style-type: none"> - Palacio Municipal - Secretariat of Public Health Laboratory - Department of Ultrasound - Director of primary health care
Non medical materials					
Utilities	<ul style="list-style-type: none"> - Allocation based on the surface area of each ward 	<ul style="list-style-type: none"> - Allocation based on number of rooms related to ANC 	<ul style="list-style-type: none"> - Total monthly invoices for whole facility 	<ul style="list-style-type: none"> - Total invoice for one month 	<ul style="list-style-type: none"> - Accounts (cost study)
Capital Equipment					
Building	<ul style="list-style-type: none"> - Inventory of equipment in obstetrics and neonatal wards - Replacement value obtained from local medical suppliers 	<ul style="list-style-type: none"> - Inventory of equipment in outpatient ANC rooms and nursery - Replacement value obtained from local medical suppliers 	<ul style="list-style-type: none"> - Monthly equipment costs were calculated using a linear discount factor 	<ul style="list-style-type: none"> - Direct observation in relevant departments - Local medical suppliers 	<ul style="list-style-type: none"> - Hospital director - Accounts (cost study) - Director of primary health care - Head of health centre

* Cost study conducted by Chorny Adolpho (Profesor titular de Planificación de la Escuela de Salud Pública de la Fundación Oswaldo Cruz, Brasil) for the Secretary of Public Health of Rosario in Roque Sáenz Peña Hospital

possible the number of units (i.e. prescriptions for pharmacy, tests for laboratory, food rations for kitchen) attributable to the maternity ward. Alternatively, full-time equivalent staff numbers or floor space were used as a basis for allocation. The opportunity cost of equipment used by the maternity ward but shared with other departments was not considered. Monthly utilisation data for each of the services were obtained from Centro Rosarino de Estudios Perinatales (CREP) and the Secretaría de Salud Pública.

A questionnaire to measure women's costs was developed and translated into Spanish. An interviewer was recruited and trained to carry out a supervised pilot study, before conducting facility-based exit interviews on a sample of 20 low-risk pregnant women from the general hospital and 20 from a health centre. Interviews were carried out over a two-week period in November 1999. The questions focused on women and their companion's direct costs associated with travel, drug prescriptions or tests and the indirect, opportunity costs associated with travel, waiting and visit time. For those women working, the opportunity cost of their time was based on their average wage for their time (\$0.03 per minute). For those women looking after children/doing housework, we valued their time and that of their companion (if of working age) by means of the minimum wage in Argentina.

Average, marginal* and total monthly provider costs for each activity are presented as well as monthly service-volume ratios. Total direct and indirect and costs borne by women and their families in accessing outpatient antenatal care, at the health centre and hospital levels, are also presented. One-way sensitivity analyses were conducted to test the sensitivity of the results to changes in assumptions. Salaries were scaled up to between 1.5 to 4 times the baseline level to reflect the differential between the public and the private sectors. The majority of the utilisation and cost data collected relates to a one-month period that does not capture the full extent of any inter-month/seasonal variation. Based on the findings reported elsewhere, we varied these parameters between 14% above and below their estimated values.^{14,15} Finally, we conducted a threshold analysis to determine the implications for average costs of a transfer of normal deliveries from the maternity to the general hospital and of c-sections from the general to the maternity hospital. Similarly we considered the implications for average costs of a

transfer of antenatal visits from the hospital to health centre level.

Results

Inpatient and Delivery Care: the general versus maternity hospital

Total costs are shown in Table II where each input is expressed as a monetary value and as a percentage of the total. Total costs are consistently higher in the maternity compared to the general hospital. Personnel represent between 88-90% of the total in the general hospital and 72-94% in the maternity hospital. Drugs represent 7-9% of the total in the general hospital and 4-26% in the maternity hospital.

The number of days of inpatient stay was 48% higher (824 versus 558 days) in the maternity compared to general hospital; the total number of normal vaginal deliveries was 58% higher (275 versus 174 deliveries); and the total number of caesarean sections was 37% higher (50 versus 36 c-sections). The ratio of caesarean sections to normal vaginal deliveries is approximately 1:5 in both facilities.

Table II
CONTRIBUTION TO TOTAL COST BY INPUT (PERCENTAGES OF TOTAL COST) FOR INPATIENT AND DELIVERY CARE

	Roque Sáenz-Peña	Maternidad Martín
Normal Vaginal Delivery		
Staff	11 006 (88)	36 396 (94)
Drugs & Materials	854 (7)	1 687 (4)
Utilities	175 (1)	290 (1)
Capital	454 (4)	279 (1)
Total	12 489 (100)	38 651 (100)
C-Section		
Staff	19 879 (90)	16 076 (71)
Drugs & Materials	1 606 (7)	5 897 (26)
Utilities	172 (1)	174 (1)
Capital	347 (2)	374 (2)
Total	22 003 (100)	22 521 (100)
Inpatient		
Staff	42 094 (88)	98 594 (82)
Drugs & Materials	4 358 (9)	19 032 (16)
Utilities	607 (1)	1 040 (1)
Capital	652 (1)	865 (1)
Total	47 710 (100)	119 530 (100)

Note to table: Figures are rounded and may not add up exactly

* Including drugs and medical supplies.

Table 3 shows that average costs are higher in the maternity hospital except for caesarean section, which is 32% higher in the general hospital (\$599 *versus* \$453). Indeed, the cost of inpatient stay is 72% higher and the cost of vaginal delivery 98% higher in the maternity compared to the general hospital (\$145 *versus* \$84 and \$140 *versus* \$71 respectively). Ac-section costs on average 5.8 times more than a normal vaginal delivery.

Outpatient Antenatal Care (ANC):
Hospital *versus* Health Centre

Total monthly costs of antenatal care are higher in the hospitals than the health centres (\$2 153 compared to \$32 117) (Figure 1). Personnel costs account for the highest proportion of total cost, 91% in the health centres *versus* 73% in the hospitals. Drugs and materials contribute to 23% of total cost to the hospitals *versus* 6% in the health centres. The average prescription cost is of a similar level for each health facility (\$3.09-\$5.08), however, the average number of prescriptions is substantially higher in the hospital compared to the health centre for antenatal care (401 *versus* 19 respectively) due to higher utilisation rates.

The average monthly number of antenatal care visits is almost twelve times higher in the hospitals than the health centres (899 visits *versus* 74). The visit numbers are nearly twice as high in the maternity

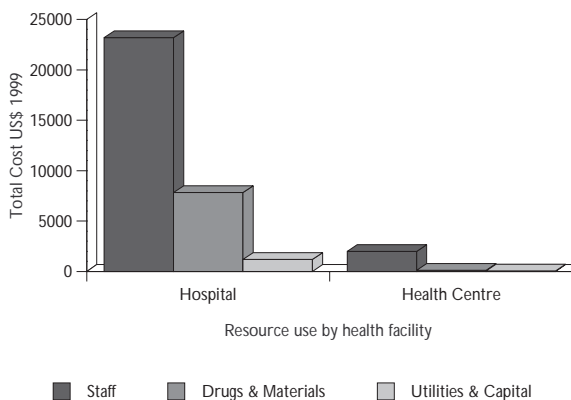


FIGURE 1. INPUT CONTRIBUTION TO TOTAL COST: OUTPATIENT ANTENATAL CARE

compared to the general hospital (1 113 *versus* 685 ANC visits). Furthermore, ANC visits represent a larger proportion of total outpatient visits in the maternity hospital than in either of the health centres (42% *versus* 2% respectively).*

* This information is not available for the general hospital.

Table III
AVERAGE AND MARGINAL COSTS OF SELECTED MATERNITY SERVICES (US\$ 1999)*

	Roque Sáenz-Peña	Maternidad Martín	Average Hospital	Las Flores	Casiano Casas	Average Health Centre
ANC						
AC (MC)	24.7 (5.1)	42.7 (10.9)	33.7 (8.0)	31.1 (0.9)	26.5 (2.4)	28.8 (1.7)
MC/AC (%)	20.6	25.6	23.8	2.8	9.2	6.0
Per hospital day						
AC (MC)	85.6 (7.8)	145.1 (23.1)	115.3 (15.5)	NA [†]	NA	NA
MC/AC (%)	9.1	15.9	13.4	NA	NA	NA
Normal Vaginal Delivery						
AC (MC)	71.8 (4.9)	140.6 (6.1)	106.2 (5.5)	NA	NA	NA
MC/AC (%)	6.8	4.4	5.2	NA	NA	NA
C-section						
AC (MC)	607.0 (44.3)	455.0 (119.1)	531.0 (81.7)	NA	NA	NA
MC/AC (%)	7.3	26.2	15.4	NA	NA	NA

* The official exchange rate used was: US \$ 1 = 1 Peso between 1992 and 1999

† NA: Data not applicable

AC: average
MC: marginal costs of selected maternity services

On average, the provision of antenatal care is more costly at the secondary (\$33.6) rather than the primary care level (\$28.75) (Table III). The highest cost per antenatal care visit, \$42.51, is in the maternity hospital, whilst the lowest cost is in the general hospital, \$24.40.

Women's Costs

Ninety-five percent of the women travelled to the health centre by foot and the remaining 5% by bus. Forty-five percent of the women interviewed in the hospital travelled by bus, followed by 30% travelling by foot or by bicycle and 15% by car. Thirty-five percent of the women were accompanied to the health facility. Average travel costs borne by women and their companion amounted to \$1.26 in the hospital (SD*: 1.32) and only one woman faced travel costs in the health centre, hence an average cost of \$0.06 (SD: 0.27). The women surveyed generally did not face any prescription charges, drugs and tests prescribed during the visit were provided for free. Only 3 women made purchases as a direct result of the visit, hence, for the total sample of women the average cost of drugs / tests was \$0.87 (SD: 0.12) per visit. Total direct costs for women and their companions was highest at the hospital: \$1.25 (SD: 1.29) compared to the health centre: \$0.14 (SD: 0.35).

Women travelled for an average of 25 minutes for a return journey to the health centre (SD: 24.24) and 34.21 minutes to and from the hospital (SD: 18.34). The length of time spent in the clinic (waiting and visit time) varied from 68.5 minutes (SD: 47.13) in the health centre to 116.75 (SD: 74.52) in the hospital (an average of 92.63 (SD: 66.22)). The opportunity cost of time for each woman and their companion per visit amounts to \$3.53 (SD: 2.46) in the health centre and \$5.37 (SD: 2.64) in the hospital.

The total cost to women and their companion per visit was \$4.70 (SD: 3.42); \$3.31 (SD: 2.53) in the health centre and \$6.08 (SD: 3.68) in the hospital. Within the hospital, patient costs represent 20% of total cost (patient plus provider) and 10% of the total within the health centre.

Sensitivity Analysis

Average costs increased significantly, by a factor of up to 3.6, with an increase in staff salaries by a factor of 4 (Table IV). Even a two fold increase in salaries, leads to a doubling of average costs.

Increases in the quantity of staff involved in the provision of each service, holding service volume constant, also had an impact on average costs. The average cost per day of inpatient stay ranged between \$48-\$200, the cost of a normal vaginal delivery between \$38-\$204 and the cost of a caesarean section between \$288-\$746. The average cost of an outpatient ANC visit was also sensitive to variations in the quantity of staff, the average cost ranging between \$15-\$41 across all facilities with a variation in staff quantities by 50% above/below the baseline value. Average costs were insensitive to variations in the average monthly volume of service utilisation data.

Discussion

The provider cost of maternity services in Argentina is driven by staff salaries, which contribute to between 72-94% of total costs. Variations in staff costs between facilities can be explained by differences in the numbers of highly skilled medical staff. The performance of deliveries by an obstetrician rather than a midwife also accounts for the high staff costs in comparison with other country-settings. For example, in a

Table IV
SENSITIVITY OF AVERAGE COSTS OF MATERNITY SERVICES TO CHANGES IN STAFF SALARY LEVELS

	ANC				Inpatient		Normal Vaginal Delivery		C-Section	
	RSP	MM	LF	CC	RSP	MM	RSP	MM	RSP	MM
Baseline	24.7	42.7	31.1	26.5	85.6	145.1	71.8	140.6	507.0	455.0
Salary cost x 2	43.0	70.2	61.0	49.2	161.1	253.6	135.1	265.9	1155.3	818.9
Salary cost x 3	61.3	94.7	90.8	72.0	236.6	358.5	198.4	385.8	1703.7	1109.1
Salary cost x 4	79.5	119.3	120.7	94.7	312.1	463.4	261.7	505.8	2252.1	1399.3

Note to table: RSP: Roque Sáenz Peña; MM: Maternidad Martín; LF: Las Flores; CC: Casiano Casas

SD: standard deviation

study of Ghana, Malawi and Uganda,⁸ staff represented a maximum of 39% of the total cost of maternal health services total costs, compared to 88% for drugs and materials.

The unit costs of inpatient and normal delivery care were greater in the maternity compared to the general hospitals due to higher drug costs and a greater number of medical staff, although the unit cost of c-section was greater in the general hospital due to lower utilisation. This shows the potential for a more efficient use of resources by promoting the referral of complicated cases to the maternity hospital for a c-section. On average, a caesarean section costs over five times more than a normal vaginal delivery. With one in five women giving birth by caesarean section over the period considered, the impact on total cost is significant. A reduction in the practise of unnecessary elective c-sections would clearly result in savings to the provider.

The unit costs of these maternal health services in Argentina are significantly higher than those in other Central¹⁶ and Southern American^{17, 18} countries (roughly four-fold) and between 6 and 10-fold higher than in Sub-Saharan Africa.¹⁹⁻²² On the contrary to the experience in other countries, in Argentina costs are generally higher in the lower level facilities, due to the lower service volume. By encouraging antenatal care at the primary rather than secondary level, providers would benefit from lower average costs, although policy makers need to ensure the availability of essential equipment, drugs and medical supplies, to ensure women are not deterred due to a lower perceived quality of care at the primary level.

In Argentina, women do not pay for prescriptions of drugs and/or tests resulting from ANC visits in public facilities, the burden of the cost of service provision falling entirely on the provider. Costs and distance associated with travel to and from the health facilities are minimal, although women were found to pay more on average when travelling to the hospital than the health centre. This suggests an easier accessibility of primary compared to secondary facilities, for user and the potential for productivity gains by using primary rather than secondary facilities for antenatal care. Women lose considerable time travelling to and from the health facility and attending antenatal care, which could have been spent more productively at work, looking after their children or doing housework. Overall, total costs facing women for each ANC visit represent 1-2% of average monthly income. The ninety-five percent antenatal care coverage rate in Argentina suggests that the burden in terms of direct cost and time do not represent a significant barrier to access.

Two studies which also considered direct costs to women in Africa (indirect costs and direct costs to companions were not included) in Africa, estimated costs from \$1.71-\$3.06 in a hospital setting and \$0.15-\$0.97 in a health centre.^{21,22} User costs are lower in Argentina as out-of-pocket payments associated with the visit were negligible.

Further research is required to extend the analysis to include additional health facilities: providers in different settings in Argentina as well as private sector facilities. An evaluation of the cost of providing a wider range of services, including the management of obstetrical complications is also recommended. Similarly, the sample of women interviewed in this study was small and our results need to be tested on a larger sample in different geographic areas.

Acknowledgements

Josephine Borghi is funded by the Department for International Development through the Maternal Health Programme at the London School of Hygiene & Tropical Medicine. This project was conducted for and funded by the Human Reproduction Programme at WHO, Geneva. We thank Professor Miranda Mugford, from University of East Anglia, who assisted in the study design and provided advice during the study. Many people assisted us with this study in Argentina. We would specifically like to thank: Daniel Giordano, Centro Rosarino de Estudios Perinatales, Rosario, Argentina. Dr Edgardo Abalos, Centro Rosarino de Estudios Perinatales, Rosario, Argentina; Beatriz C Galiano, English Translator, Argentina; Dr Miriam Acosta, Sub-director, Roque Sáenz-Peña; Dr Débora Ferrandini, Subdirector of Primary Health Care (Atención Primaria); Marta Rossi de Budai, Administrative Director; Dra Marina Duarte, Neonatology; and Mónica Giustina, Director of Statistics Department of Maternidad Martín; Marcela A Nuccetelli, Director, and Dra Gabriela Gioia, Obstetrician, Las Flores; Dr Antonio Chacra, Director, and Dr Alberto R Pais, Obstetrician of Casiano Casas; Dr Lelio Mangiaterra, Rosario, Argentina; and finally, the Staff at Palacio Municipal, Rosario, Argentina.

References

1. Loudon I, Childbirth. En: Loudon I, ed. *Western medicine: An illustrated history*. Oxford: Oxford University Press, 1997: 206-220.
2. Koblinsky MA, Campbell O, Heichelheim J. Organizing delivery care: What works for safe motherhood? Bull WHO 1999; 77: 399-406.
3. De Brouwere V, Tonglet R, Van Lerberghe W. Strategies for reducing maternal mortality in developing countries: What can we learn from the history of the industrialized West? Trop Med Int Health 1998; 3: 771-782.

4. Walraven G, Weeks A. The role of (traditional) birth attendants with midwifery skills in the reduction of maternal mortality. *Trop Med Int Health* 1999;4:527-529.
5. Graham WJ, Bell JS, Bullough CHW. Can skilled attendance at delivery reduce maternal mortality in developing countries? *Stud Health Serv-Organ Policy* 2001;17:97-130.
6. Mumford EA, Dayaratna V, Winfrey W, Sine J, McGreevey WP. Reproductive Health Cost: Literature Review. Working Paper Series No. 3. Washington, D.C.: Futures Group International, 1998.
7. Jowett M. Safe motherhood interventions in low-income countries: An economic justification and evidence of cost effectiveness. *J Health Policy* 2000; 53: 201-228.
8. Pan American Health Organization. Health in the Americas. Volume I. Washington, DC: Regional Office of WHO, 1998.
9. Villar J, Ba'aqeel H, Piaggio G, Lumbiganon P, Miguel Belizán J, Farnot U *et al.* WHO antenatal care randomised trial for the evaluation of a new model of routine antenatal care. *Lancet* 2001; 357: 1551-1564.
10. Szmoisz S, Vuegen SE, Plaza AS, Barracchini R, Checa S, Derlindati A *et al.* Argentina: Risk factors and maternal mortality in La Matanza, Province of Buenos Aires, 1990. *World Health Stat Q* 1995; 48: 4-7.
11. Villanueva H. [Ongoing health management control by cost monitoring through tracer indicators]. *Rev Panam Salud Publica* 2001; 10: 405-412.
12. Censo del 2000 paso a paso [online] 1991 [cited 2002 May 23]. Available from URL: <http://www.rosario.gov.ar/muni10e/muni1001.nsf/Paginas/Fram01>.
13. Drummond MF, O'Brien B, Stoddart G L, Torrance G W. Methods for economic evaluation of health care programmes 2nd Edition. Oxford (UK): Oxford Medical Publications, Oxford University Press, 1997.
14. Gálvez AM, Alvarez M, Sanabria G, Mugford M, Hutton G, Fox-Rushby J. A study of the costs of antenatal care alongside the World Health Organization Trial in Havana, Cuba. Norwich: School of Health Policy and Practice, 2000.
15. Thinkamrop J, Thinkamrop B, Kuchaisit C, Bagwandeem C, Mugford M, Hutton G *et al.* A study of the costs of antenatal care alongside the WHO trial in Thailand. Norwich: School of Health Policy and Practice, 2000.
16. Rosentheil G, Percy A. Maternity services in Cochabamba, Bolivia: Costs, cost recovery, and changing markets. Arlington (VA): Mothercare, John Snow, 1991.
17. Dmytraczenko T, Aitken I, Carrasco SE, Seoane KC, Kolley J, Abramson WB *et al.* Evaluación del Seguro Nacional de Maternidad y Niñez en Bolivia. Bethesda (MD): Partnerships for Health Reform Project, Abt Associates 1998, Informe Técnico 22.
18. Mitchell MD, Littlefield J, Gutter S. Reproductive Health: From policy to practice. Draft manuscript. Boston, Management Sciences for Health, 1997.
19. Weissman E, Sentumbwe-Mugisa O, Mbonye AK, Lissner C. Costing safe motherhood in Uganda. En: Berer M, Sundari-Ravindran TK, ed. Reproductive Health Matters: Safe Motherhood Initiatives Critical Issues. Oxford (UK): Blackwell Science, 1999.
20. Fox-Rushby J, Foord F. Costs, Effects and Cost-Effectiveness Analysis of a Mobile Maternal Health Care Service in West Kiang, The Gambia. *Health Policy* 1996; 35: 123-143.
21. Jinabhai C, Wamukuo J, Bagwandeem C, Mugford M, Hutton G, Fox-Rushby J. Costs of antenatal and delivery care for providers and women in Umlazy township, Durban, South Africa. Norwich: School of Health Policy and Practice, 2000.
22. Levin A, McEuen M, Dymatrachenko T, Ssengooba F, Mangani R, Van Dyck G. Costs of maternal health care services in three anglophone African countries. Special Initiatives Report 22. Bethesda (MD): Partnerships for Health Reform Project, Abt Associates 2000.