

# Emergency obstetric care in Mali: catastrophic spending and its impoverishing effects on households

Catherine Arsenault,<sup>a</sup> Pierre Fournier,<sup>a</sup> Aline Philibert,<sup>a</sup> Koman Sissoko,<sup>b</sup> Aliou Coulibaly,<sup>a</sup> Caroline Tourigny,<sup>a</sup> Mamadou Traoré<sup>c</sup> & Alexandre Dumont<sup>d</sup>

**Objective** To investigate the frequency of catastrophic expenditures for emergency obstetric care, explore its risk factors, and assess the effect of these expenditures on households in the Kayes region, Mali.

**Methods** Data on 484 obstetric emergencies (242 deaths and 242 near-misses) were collected in 2008–2011. Catastrophic expenditure for emergency obstetric care was assessed at different thresholds and its associated factors were explored through logistic regression. A survey was subsequently administered in a nested sample of 56 households to determine how the catastrophic expenditure had affected them.

**Findings** Despite the fee exemption policy for Caesareans and the maternity referral-system, designed to reduce the financial burden of emergency obstetric care, average expenses were 152 United States dollars (equivalent to 71 535 Communauté Financière Africaine francs) and 20.7 to 53.5% of households incurred catastrophic expenditures. High expenditure for emergency obstetric care forced 44.6% of the households to reduce their food consumption and 23.2% were still indebted 10 months to two and a half years later. Living in remote rural areas was associated with the risk of catastrophic spending, which shows the referral system's inability to eliminate financial obstacles for remote households. Women who underwent Caesareans continued to incur catastrophic expenses, especially when prescribed drugs not included in the government-provided Caesarean kits.

**Conclusion** The poor accessibility and affordability of emergency obstetric care has consequences beyond maternal deaths. Providing drugs free of charge and moving to a more sustainable, nationally-funded referral system would reduce catastrophic expenses for households during obstetric emergencies.

Abstracts in [عربي](#), [中文](#), [Français](#), [Русский](#) and [Español](#) at the end of each article.

## Introduction

Most efforts designed to reduce inequities in maternal health in low-income countries have been focused primarily on averting maternal deaths. However, in countries with poorly functioning health systems, severe obstetric complications can lead to other adverse outcomes. The following outcomes can be associated with poor access to obstetric services: maternal death, neonatal death, mental or physical sequelae among surviving women, and financial hardship. This last outcome, which results from the catastrophic expenditures sometimes associated with emergency obstetric care, has not been as frequently explored as the others.

Any health expenditure that threatens a household's ability to meet its subsistence needs is termed "catastrophic".<sup>1</sup> Emergency obstetric care, far more costly than normal delivery, can generate catastrophic expenses capable of pushing certain households below the poverty line or of plunging them deeper into poverty.<sup>2–6</sup> Several studies have explored the frequency of catastrophic health payments in sub-Saharan Africa,<sup>1,7–10</sup> but few of them have focused on catastrophic expenditure resulting from emergency obstetric care<sup>5,6</sup> and none has examined the factors that contribute to such expenditure. In addition, the ways in which households cope with these costs and their effects on their welfare have seldom been explored. Little public health research has been devoted to examining the social and economic consequences of obstetric complications,<sup>5,11,12</sup> despite evidence from one study that the high cost of emer-

gency obstetric care can strain a household's survival capacity from day to day and shape its physical, social and economic well-being for as long as one year.<sup>5</sup> The coping strategies used by households – e.g. using savings, selling assets or borrowing money – can provide important insights into how catastrophic expenditure can affect a household's future welfare.<sup>13,14</sup>

Mali is a low-income country with an annual income of 600 United States dollars (US\$) per capita in 2010 and a population of 15.3 million, 51% of which lives below the international poverty line of US\$ 1.25 per day per capita.<sup>15</sup> The study took place in Mali's western region of Kayes, which has 120 760 km<sup>2</sup> and seven districts with a combined population of 1.9 million. Because Mali has one of the highest maternal mortality ratios in the world,<sup>15</sup> two policies have been put into place to improve access to emergency obstetric care. The first policy, a national maternity referral system launched in 2002, consists of community cost-sharing schemes to help women pay for transportation to obstetric health centres.<sup>16</sup> The second policy, in effect since 2005, is the elimination of user fees for Caesarean sections. The fee exemption policy is applied to the direct costs of the Caesarean procedure, including pre-operative examinations, provision of a Caesarean kit (drugs and surgical supplies), surgery, post-operative treatment, hospitalization and laboratory tests.<sup>17</sup>

This study has two objectives. The first is to investigate the frequency of catastrophic expenditure generated by emergency obstetric care and the risk factors associated with such expenditure. The second is to identify the coping strate-

<sup>a</sup> Axe de santé Mondiale, Centre de recherche du Centre Hospitalier de l'Université de Montréal (CRCHUM), 3875 rue Saint-Urbain, 2ème étage, Montréal, Québec H2W 1V1, Canada.

<sup>b</sup> CARE International, Sévaré, Mali.

<sup>c</sup> Faculté de Médecine, Université de Bamako, Bamako, Mali.

<sup>d</sup> Institut de Recherche pour le Développement, Paris, France.

Correspondence to Catherine Arsenault (e-mail: catherine.arsenault@umontreal.ca).

(Submitted: 10 August 2012 – Revised version received: 20 November 2012 – Accepted: 5 December 2012 – Published online: 17 January 2013)

Table 1. Number and proportion of households that incurred catastrophic expenditure, as defined by three income thresholds, per household wealth quintile, Kayes, Mali, 2008–2011

Wealth quintile	No.	Average EmOC expenditure (US\$) <sup>a</sup>	Average household income <sup>b</sup> (US\$)	No. (%) of households by income threshold <sup>c</sup>		
				5% ( <i>n</i> = 259)	10% ( <i>n</i> = 162)	15% ( <i>n</i> = 100)
1 <sup>d</sup>	97	130.9	570.4	28.5 (89.7)	57.0 (76.3)	85.6 (58.8)
2	100	155.7	1301.2	65.1 (75.0)	130.1 (51.0)	195.2 (29.0)
3	99	169.8	2284.9	114.2 (52.5)	228.5 (23.2)	342.7 (13.1)
4	115	131.1	2957.6	147.9 (33.0)	295.8 (12.2)	443.6 (0.9)
5	73	181.0	7946.5	397.3 (9.6)	794.7 (0.0)	1192.0 (0.0)
<b>Total</b>	<b>484</b>	<b>151.6</b>	<b>2864.6</b>	<b>143.2 (53.5)</b>	<b>286.5 (33.5)</b>	<b>429.7 (20.7)</b>

EmOC, emergency obstetric care; US\$, United States dollar.

<sup>a</sup> Exchange rate US\$ 1 = 472 Communauté Financière Africaine francs.

<sup>b</sup> Adjusted for household size.

<sup>c</sup> Any expenditure above the threshold was considered catastrophic. Since monetary income and consumption expenditures were not directly measured in the study, the average income of the corresponding quintile, adjusted for household size, was used instead. Each quintile's average income was obtained from a study conducted in Kayes in 2008.<sup>28</sup>

<sup>d</sup> Poorest.

gies that households use to obtain the money needed to pay for the emergency obstetric care and how these strategies affect their well-being.

## Methods

### Data

Our study was conducted on a main sample of 484 women – 242 maternal deaths and 242 near-misses – and on a nested subsample of 56 women who had had a near miss. The first data collection took place in the context of an ongoing case–control study on the impact of three types of delay on institutional maternal mortality in the Kayes region from February 2008 to June 2011. The delays in question were: (i) delay in deciding to seek care; (ii) delay in reaching a health facility and (iii) delay in being provided with appropriate care. The cases selected were restricted to four obstetric complications – haemorrhage, eclampsia, postpartum infection and uterine rupture – but accounted for 79.8% of all institutional maternal deaths in the region during the study period. Each maternal death was matched to a near miss with the same complication that had occurred in the same district and on approximately the same date (median difference of 7 days). We applied a social autopsy interview method<sup>18,19</sup> and conducted social autopsies on the sample of 484 women a median of 5.5 months after the obstetric emergency. During interviews we collected obstetric data and information on women's sociodemographic characteristics and the expenses incurred by their households as

a result of the emergency obstetric care, including the costs of transportation and treatment and other related costs, such as the cost of food for the woman and accompanying family members.

We conducted a second survey in a subsample of 56 households with near-misses a median of 19 months after the obstetric emergency. We purposively selected households from any socioeconomic group whose expenditure for emergency obstetric care had exceeded the total sample median of US\$ 119.2 (exchange rate: 472 Communauté Financière Africaine francs [FCFA] to US\$ 1.00). Our aim was to study the coping strategies employed by the households and how households across different socioeconomic groups coped with similarly high expenditures. We selected only households with near-misses because in households with a maternal death we would have observed, in addition to the expenditure, the social and economic consequences of the loss of the mother. We also decided against interviewing grieving families a second time. Owing to security concerns in the region, some households had to be dropped and replaced by others during data collection. Consequently, the final subsample included two households that had spent slightly less than the median, as well as a slightly higher proportion of households in the highest quintiles than the total sample. The semi-structured interviews, conducted with the household heads, took place in November 2010 (*n* = 16) and from October to December 2011 (*n* = 40). The same local interviewer was present throughout the data collection process.

### Statistical analysis

Households' socioeconomic status was estimated with a wealth index constructed using principal component analysis, as done in other studies.<sup>4,7,20–22</sup> The principal component analysis was based on ownership of certain household assets and on the quality of the house's construction materials. The wealth index was then divided into quintiles. Health expenses are often termed “catastrophic” if they surpass a certain threshold percentage of income. However, there is no consensus on the threshold that should be used. In previous studies, it has varied from 2.5% to 25% of total household income/expenditure<sup>23,24</sup> or 40% of capacity to pay.<sup>25</sup> Some experts have also noted that using only one threshold could result in misinterpretation of important factors.<sup>1</sup> We therefore chose the commonly used 10% threshold<sup>26,27</sup> and added two others at  $\pm 5\%$ . This functions as a sensitivity analysis. Catastrophic spending was thus assessed at three thresholds, above which the health expenditure was considered catastrophic: 5%, 10% and 15% of quintile-specific household income. Since monetary income and consumption expenditures were not directly measured in our study, instead we used the average income of the corresponding quintile, adjusted for household size. We obtained the average quintile-specific income from a study conducted in the Kayes region in 2008.<sup>28</sup> Eleven covariates of interest were consecutively tested using simple logistic regressions with catastrophic spending as the outcome. The wealth quintile variable was not included,

Table 2. Characteristics of women who incurred catastrophic expenditure, as defined by three income thresholds, resulting from emergency obstetric care and mean expenditure, Kayes, Mali, 2008–2011

Characteristic	No. (%) of women by income threshold <sup>a</sup>		
	5% (n = 259)	10% (n = 162)	15% (n = 100)
<b>EmOC expenses (US\$),<sup>b</sup> mean (range)</b>			
Treatment	138.90 (0–754.20)	150.20 (0–646.20)	167.10 (0–646.20)
Transportation	38.00 (0–328.40)	43.30 (0–158.90)	48.20 (0–158.90)
Other	25.30 (0–227.80)	27.00 (0–227.80)	30.90 (0–227.80)
Total	216.40 (29.70–794.50)	241.20 (57.2–794.50)	268.40 (85.80–794.50)
<b>Sociodemographic</b>			
<b>Wealth quintile</b>			
1 <sup>c</sup>	87 (33.6)	74 (45.7)	57 (57.0)
2	75 (29.0)	51 (31.5)	29 (29.0)
3	52 (20.1)	23 (14.2)	13 (13.0)
4	38 (14.7)	14 (8.6)	1 (1.0)
5	7 (2.7)	0 (0.0)	0 (0.0)
<b>Residence</b>			
Urban	19 (7.3)	6 (3.7)	3 (3.0)
Rural	240 (92.7)	156 (96.3)	97 (97.0)
<b>District of residence</b>			
Yélimané	22 (8.5)	12 (7.4)	7 (7.0)
Kita	55 (21.2)	30 (18.5)	17 (17.0)
Kayes	78 (30.1)	49 (30.2)	33 (33.0)
Bafoulabé	21 (8.1)	12 (7.4)	7 (7.0)
Diéma	26 (10.0)	18 (11.1)	9 (9.0)
Nioro	57 (22.0)	41 (25.3)	27 (27.0)
<b>Distance to closest comprehensive EmOC centre (km)</b>			
≤ 5	50 (19.3)	28 (17.3)	14 (14.0)
5–20	44 (17.0)	31 (19.1)	16 (16.0)
20–40	43 (16.6)	17 (10.5)	10 (10.0)
> 40	122 (47.1)	86 (53.1)	60 (60.0)
<b>Age (years)</b>			
≤ 16	51 (19.7)	34 (21.0)	24 (24.0)
17–34	166 (64.1)	102 (63.0)	61 (61.0)
≥ 35	42 (16.2)	26 (16.0)	15 (15.0)
<b>Education</b>			
At least primary	36 (13.9)	14 (8.6)	8 (8.0)
None	223 (86.1)	148 (91.4)	92 (92.0)
<b>Ethnic group</b>			
Sarakole	60 (23.2)	31 (19.1)	14 (14.0)
Bambara	28 (10.8)	17 (10.5)	7 (7.0)
Fulani	88 (34.0)	66 (40.7)	47 (47.0)
Malinke	48 (18.5)	28 (17.3)	17 (17.0)
Other	35 (13.5)	20 (12.3)	15 (15.0)
<b>Obstetric</b>			
<b>Maternal outcome</b>			
Death	114 (44.0)	75 (46.3)	47 (47.0)
Near miss	145 (56.0)	87 (53.7)	53 (53.0)
<b>Diagnosis</b>			
Haemorrhage	110 (42.5)	59 (36.4)	32 (32.0)
Eclampsia	98 (37.8)	65 (40.1)	43 (43.0)
Uterine rupture	18 (6.9)	12 (7.4)	6 (6.0)
Postpartum infection	33 (12.7)	26 (16.0)	19 (19.0)

(continues. . .)

(. . .continued)

Characteristic	No. (%) of women by income threshold <sup>a</sup>		
	5% (n = 259)	10% (n = 162)	15% (n = 100)
<b>Caesarean section</b>			
Yes	103 (39.8)	65 (40.1)	43 (43.0)
No	156 (60.2)	97 (59.9)	57 (57.0)
<b>Blood transfusion</b>			
Yes	74 (28.6)	47 (29.0)	26 (26.0)
No	185 (71.4)	115 (71.0)	74 (74.0)
<b>Parity, mean (range)</b>	3.6 (0–13)	3.6 (0–13)	3.4 (0–13)

EmOC, emergency obstetric care; US\$, United States dollar.

<sup>a</sup> Any expenditure above the threshold was considered catastrophic. Since monetary income and consumption expenditures were not directly measured in the study, the average income of the corresponding quintile, adjusted for household size, was used instead. Each quintile's average income was obtained from a study conducted in Kayes in 2008.<sup>28</sup>

<sup>b</sup> Exchange rate US\$ 1 = 472 Communauté Financière Africaine francs.

<sup>c</sup> Poorest.

Note: All values in the table are absolute numbers followed by percentages (in parentheses) unless otherwise indicated.

since it was part of the calculation of the outcome variable. The variables that showed a significant relationship with catastrophic spending ( $P < 0.10$ ) were then tested simultaneously in the three logistic regression models. In the final models, odds ratios (ORs) were considered statistically significant when  $P < 0.05$ . Data were entered and analysed using SPSS statistical software version 19.0 (SPSS Inc., Chicago, United States of America).

### Ethics approval

This research was approved by the ethics committees of the Research Centre of the University of Montreal Hospital (Canada) and the Faculty of Medicine, Pharmacy and Odonto-Stomatology of the University of Bamako (Mali).

### Results

The average expenditure for emergency obstetric care was US\$ 151.6. This amount represented 1.9% and 26.6% of the annual incomes of the richest and poorest quintile, respectively. No significant difference was found between wealth quintiles in the amount spent for emergency obstetric care. As shown in Table 1, a large proportion of households incurred catastrophic expenditures. We found that 20.7%, 33.5% and 53.5% of the households incurred catastrophic expenditures greater than 15%, 10% and 5% of their annual income, respectively.

Table 2 shows the amount spent by households on emergency obstetric care and the sociodemographic characteristics and obstetric data pertaining to the women

who incurred catastrophic expenditure. The proportion spent on treatment, transportation and other items was roughly the same, independent of catastrophic threshold, with treatment accounting for the largest share.

Table 3 shows the results of the logistic regressions. The variables Caesarean section and parity were not included in the final models since they showed no significant independent association with catastrophic expenditures at any of the three expenditure thresholds. Overall, the estimates of the variables whose association with catastrophic expenditure was significant do not vary much between the three models. This shows that they are relatively insensitive to the threshold of catastrophic expenditure used.

The wealth quintile distribution of the households in the subsample and the average expenditure on emergency obstetric care corresponding to each quintile are presented and compared with those of the overall sample (Table 4). Most households used a combination of strategies to obtain the money needed to pay for the emergency care. This resulted in multiple responses per household (Table 5).

The major consequences faced by households with high expenses in emergency obstetric care are summarized in Table 6. The case stories of three women with serious consequences are presented in Box 1.

When the second survey was conducted, 8 (14.3%) women were still having health problems as a result of the obstetric complication. Three of them could not seek care because they had no

money. Two other households reported that the woman who survived was still being treated and that they were facing serious financial difficulties because of the ongoing expenses. In another household, the woman had died in her sleep 7 months after the near-miss event (case 1, Box 1). Although the cause of her death is unknown, this case serves to illustrate that a woman being alive 42 days after a near-miss event is not a guarantee that a maternal death has been averted.<sup>29</sup>

### Discussion

Our findings show that even though Mali has a national maternity referral system and has eliminated user fees for Caesarean sections in an effort to reduce the economic burden of emergency obstetric care, households still bear high costs when seeking such care and many incur catastrophic expenditures. An important finding is that between 19.4 and 47.1% of the households in which a woman died from obstetric complications also incurred catastrophic expenditures. These households faced the double burden of having to cope with the death of the mother and with the impoverishing effect of the expenses associated with emergency obstetric care.

Our results also showed an association between the type of obstetric complication and the risk of catastrophic spending. Of the four obstetric complications considered, eclampsia (OR: 2.63; 95% CI: 1.44–4.83) and postpartum infection (OR: 5.64; 95% CI: 2.51–12.65) were associated with higher odds of

catastrophic spending, perhaps because both conditions require long and costly drug therapy. The cost of treatment represented the largest component of the total expenditures associated with emergency obstetric care. Since the mean cost of treatment did not differ significantly between women who had a Caesarean section (US\$ 107.00) and those who did not (US\$ 93.40), we can conclude that the fee exemption for Caesarean sections does not protect households from catastrophic expenditures. One of the reasons was that women were often handed prescriptions for drugs that are not included in the Caesarean kits provided by the government and paid for the drugs out of pocket, as in case 2 in Box 1. Although the kit only contains amoxicillin, women often received other antibiotics after a Caesarean section. Women who were only given one antibiotic spent an average of US\$ 80.30; those who received two or more antibiotics spent an average of US\$ 165.70 ( $P \leq 0.000$ ). There have been recent reports of problems with the delivery of the Caesarean kits supplied by the government, including frequent stock-outs, insufficient quantities of drugs, and products that are either obsolete or expired and not suitable for complicated Caesareans.<sup>30,31</sup> According to these reports, the high costs of prescription drugs and transportation are still the main obstacle to access to emergency obstetric care. We also found that women who received blood transfusions had higher odds of incurring catastrophic spending (OR: 2.78; 95% CI: 1.47–5.25), most probably because Mali has a serious shortage of blood for transfusion and people are often unofficially asked to pay for the blood they receive.<sup>30,31</sup>

Additional factors associated with catastrophic expenditure were having no education, living in a rural area, living 40 km or more from the nearest emergency obstetric care centre or belonging to a Fulani ethnic group. Clearly, the poorest and most remote communities are more likely to face catastrophic expenditures and to be most severely affected by the high out-of-pocket expenditure associated with emergency obstetric care. Despite the maternity referral system, primarily designed to eliminate the financial barriers associated with transportation costs and hence reduce

Table 3. Odds of catastrophic expenditure, as defined by three income thresholds, resulting from emergency obstetric care, by maternal characteristic, Kayes, Mali, 2008–2011

Characteristic	OR (95% CI) by income threshold <sup>a</sup>		
	5% (n = 259)	10% (n = 162)	15% (n = 100)
<b>Residence</b>			
Urban	1	1	1
Rural	3.94 (1.80–8.62)	7.14 (2.51–20.41)	5.38 (1.34–21.74)
<b>Distance to closest comprehensive EmOC centre (km)</b>			
≤ 5	1	1	1
5–20	1.18 (0.53–2.63)	1.02 (0.43–2.41)	0.92 (0.33–2.57)
20–40	1.85 (0.84–4.12)	0.49 (0.20–1.18)	0.84 (0.29–2.46)
> 40	4.56 (2.18–9.55)	2.54 (1.22–5.30)	3.97 (1.63–9.69)
<b>District of residence</b>			
Yélimané	1	1	1
Kita	2.25 (0.83–6.14)	1.73 (0.58–5.13)	1.15 (0.32–4.10)
Kayes	2.94 (1.24–6.99)	2.67 (1.04–6.89)	3.04 (1.00–9.21)
Bafoulabé	1.95 (0.62–6.11)	1.56 (0.46–5.36)	0.89 (0.21–3.86)
Diéma	0.97 (0.37–2.53)	1.89 (0.66–5.40)	1.35 (0.38–4.80)
Nioro	3.69 (1.55–8.76)	3.92 (1.57–9.79)	3.34 (1.14–9.78)
<b>Age category (years)</b>			
17–34	1	1	1
≤ 16	1.93 (0.95–3.93)	1.14 (0.58–2.22)	1.22 (0.60–2.50)
≥ 35	1.64 (0.86–3.14)	1.44 (0.74–2.80)	1.50 (0.70–3.19)
<b>Education</b>			
At least primary	1	1	1
None	3.40 (1.92–5.99)	4.41 (2.18–8.93)	3.29 (1.38–7.87)
<b>Ethnic group</b>			
Sarakole	1	1	1
Bambara	2.17 (1.00–4.68)	3.18 (1.34–7.55)	2.62 (0.87–7.91)
Malinke	1.97 (0.83–4.65)	2.27 (0.90–5.72)	3.05 (1.03–9.05)
Fulani	3.32 (1.72–6.38)	4.72 (2.44–9.12)	6.24 (2.90–13.40)
Other	1.01 (0.49–2.09)	1.30 (0.59–2.88)	2.57 (1.02–6.47)
<b>Maternal outcome</b>			
Death	1	1	1
Near-miss	2.82 (1.77–4.51)	1.81 (1.13–2.92)	1.66 (0.97–2.84)
<b>Diagnosis</b>			
Haemorrhage	1	1	1
Eclampsia	2.05 (1.17–3.61)	2.63 (1.44–4.83)	2.45 (1.24–4.85)
Uterine rupture	1.18 (0.45–3.06)	1.51 (0.57–4.03)	1.25 (0.40–3.92)
Postpartum infection	2.90 (1.29–6.51)	5.64 (2.51–12.65)	6.40 (2.69–15.20)
<b>Blood transfusion</b>			
No	1	1	1
Yes	3.09 (1.68–5.68)	2.78 (1.47–5.25)	1.59 (0.78–3.24)

CI, confidence interval; OR, odds ratio.

<sup>a</sup> Any expenditure above the threshold was considered catastrophic. Since monetary income and consumption expenditures were not directly measured in the study, the average income of the corresponding quintile, adjusted for household size, was used instead. Each quintile's average income was obtained from a study conducted in Kayes in 2008.<sup>28</sup>

inequity in access, we found that 67% of women still paid for transportation in direct proportion to the distance between their house and the health facil-

ity. Thus, the mean transportation cost was US\$ 13.1 for women who lived 5 km or less from an emergency obstetric care centre and US\$ 59.1 for those who

Table 4. **Distribution and average expenditure of households in the sample and a subsample, per wealth quintile, Kayes, Mali, 2008–2011**

Quintile	No. (%) in total sample (n = 484)	No. (%) in subsample <sup>a</sup> (n = 56)	EmOC expenditure (US\$) <sup>b</sup>			
			Total sample (n = 484)		Subsample <sup>a</sup> (n = 56)	
			Average	Range	Average	Range
1 <sup>c</sup>	97 (20.0)	10 (17.9)	130.90	0–487.30	255.80	125.00–487.30
2	100 (20.7)	8 (14.3)	155.70	6.40–575.20	252.80	178.00–353.80
3	99 (20.5)	13 (23.2)	169.80	0–794.50	371.40	103.80–675.80
4	115 (23.8)	17 (30.4)	131.10	0–617.60	282.10	141.90–617.60
5	73 (15.1)	8 (14.3)	181.00	0–794.50	283.00	122.90–762.70
<b>Total</b>	<b>484 (100)</b>	<b>56 (100)</b>	<b>151.60</b>	<b>0–794.50</b>	<b>294.10</b>	<b>103.80–762.70</b>

EmOC, emergency obstetric care; US\$, United States dollar.

<sup>a</sup> Nested subsample of 56 women who had had a near miss.

<sup>b</sup> Exchange rate US\$ 1 = 472 Communauté Financière Africaine francs.

<sup>c</sup> Poorest.

Table 5. **Coping strategies employed in the face of catastrophic expenditure resulting from emergency obstetric care, Kayes, Mali, 2008–2011**

Strategy <sup>a</sup>	No. (%) (n = 56)
Borrowing	31 (55.4)
Selling assets <sup>b</sup>	24 (42.9)
Use of savings or regular earnings	17 (30.4)
Transfers from abroad	17 (30.4)
Help from the local social network	12 (21.4)

<sup>a</sup> Multiple answers per household.

<sup>b</sup> Animals (livestock), agricultural product (crops), a motorcycle, a bicycle and car parts.

Table 6. **Effect of catastrophic expenditure resulting from emergency obstetric care on household well-being, per household wealth quintile, Kayes, Mali, 2008–2011**

Consequence	No. (%) by wealth quintile					
	1 <sup>a</sup> (n = 10)	2 (n = 8)	3 (n = 13)	4 (n = 17)	5 (n = 8)	All (n = 56)
<b>None</b>	1	1	4	7	7	20 (35.7)
<b>Immediate<sup>b</sup></b>	9	7	9	10	1	36 (64.3)
Food consumption reduced	6	7	5	6	1	25 (44.6)
Agricultural productivity reduced	2	1	4	1	1	9 (16.1)
Loss of income	0	1	2	2	0	5 (8.9)
Forced migration	1	2	0	2	0	5 (8.9)
Children removed from school	0	0	3	2	0	5 (8.9)
<b>At interview<sup>b</sup> (10–30 months after complication)</b>						
Still in debt	6	2	3	2	0	13 (23.2)
Lack of food	5	5	4	3	1	18 (32.1)

<sup>a</sup> Poorest.

<sup>b</sup> Multiple answers per household.

lived 40 km or more from one. In many cases, the ambulance driver refused to transport the women before they paid for the gasoline (cases 2 and 3, Box 1). One reason for the failure of the maternity referral system to reduce transportation expenses is that the sys-

tem is underfunded. It is dependent on solidarity funds that, according to a national study, have received only 21% of the expected contributions since 2005.<sup>32</sup> These contributions come from the local district council, the mayor's office and local community associations, all

of which differ in their willingness and ability to mobilize funds. This results in large disparities in the functioning of the system from one district to another.

Our study revealed that households resort to a multitude of coping strategies to collect all the money needed when faced with high expenditure for emergency obstetric care. For the poorest households, financial assistance from friends or relatives was the most common strategy and sometimes the only one available. The richest households often used money transferred from relatives abroad and in some cases were able to pay for emergency obstetric care without much difficulty. In the Kayes region, these transfers often comprise a big share of the income of the richest households.<sup>28</sup> However, the fact that the majority of the households that could afford emergency obstetric care paid with money earned by migrant workers in richer countries is of concern. Overall, the results showed a negative gradient association between wealth quintile and the consequences suffered. Households belonging to a lower wealth quintile suffered more and graver consequences than households in the upper quintiles. However, richer households were also affected and some were even financially ruined by the expenditure on emergency obstetric care (case 3, Box 1). Other studies have also found that no socio-economic group is protected against catastrophic spending<sup>33</sup> and that expenditure for emergency obstetric care can push non-poor households below the poverty line.

This study has limitations. First, since income data were not collected

### Box 1. Examples of the consequences on a household (in wealth quintile 3 or 4) of a near-miss complication leading to catastrophic expenditure

#### Case 1 (quintile 3)

The 18-year-old woman was evacuated to the regional hospital when she developed eclampsia in her ninth month of pregnancy. She incurred expenses of US\$ 403, which her husband paid using his savings and money sent by his brothers working in France. The woman recovered and was discharged after giving birth to healthy twins. Seven months later, she was found dead in her bed one morning.<sup>a</sup> After her death, her husband had to purchase formula to feed the twins but reports that its high cost made it difficult. He requested financial help from the municipality but did not receive any. One of the twins fell ill and died at 10 months. The eldest son, who was in third grade, was taken out of school to save money. This year the drought ruined the harvest. The husband, however, manages to buy enough food with the money sent by his brothers in France. The other twin is 18 months old and has started eating solid foods.

#### Case 2 (quintile 3)

The 37-year-old woman, who was in her eleventh pregnancy, was evacuated to the district health centre because of prolonged labour. The doctor diagnosed uterine rupture, performed a Caesarean and delivered a stillborn. Over the course of the following week, the woman received four different antibiotics and four blood transfusions. She had developed a vesico-vaginal fistula and kept losing blood. She was then referred to the national hospital in Bamako, where she underwent full hysterectomy and two interventions to repair the fistula. To be driven to the capital by ambulance, the husband was asked for US\$ 159 for gas. He refused and a relative who was in the military drove them. Treatment expenses amounted to US\$ 208 at the district level and US\$ 307 in Bamako. To pay for this, the husband sold a bull and borrowed money that he later repaid by selling a bicycle, a motorcycle, a cart and four goats. His field's yield was affected by his absence and only his brother could till the field. A year and a half later, he still owes money and reports that the family has not been eating enough since the incident. He was also unable to send all his children to school and could not pay the taxes.

#### Case 3 (quintile 4)

The husband, a taxi driver, took his wife to the community health centre, where she gave birth to twins. The following day the woman had seizures and was evacuated to the district health centre, where she was treated for eclampsia. The ambulance driver demanded being paid for gas (US\$ 39) before the trip. This depleted the husband's savings. To cover treatment costs, he borrowed US\$ 212 from shop owners. The twins died within a few days. The woman survived but had to continue taking expensive medicine. The following month, the creditors began requesting payment. The husband's taxi had broken down in recent weeks. Rather than repairing it, he sold the parts to start repaying the debt and to feed his family, hence losing his only source of income. Sixteen months later, the husband reported that the family was eating half as much as before. He manages to purchase food with money donated by friends but is completely ruined. He still owes US\$ 64.

<sup>a</sup> This woman was in our near-miss sample. We learned about her death (cause unknown) when we returned to the household for the second interview.

directly in each household, estimates from another study had to be used. Catastrophic expenditures were assessed from these estimates, but because the factors were relatively insensitive to the different thresholds used, we can conclude that our results are reliable. Furthermore, those income estimates were collected in 2008, whereas the expenses were incurred between 2008 and 2011. Despite this, we do not think that major changes in household income have occurred since and therefore doubt that our results were affected. An additional limitation is the relatively small size of our subsample. However, data related to the coping strategies and their effect on household welfare seemed fairly saturated

after the accounts of 56 households. Importantly, the coping strategies and catastrophic expenses reported here pertain only to households that spent more than the median amount and are therefore not generalizable to the entire sample. Furthermore, our results are only applicable to women who reach the health system, since households in which the mother died at home and without having had contact with the health system probably spend nothing. However, the maternal deaths sampled represent 75.4% of all institutional maternal deaths and the near-miss women sampled are representative of all the 10 821 near-miss complications recorded throughout the Kayes region during the study period. The large size

of our main sample ( $n = 484$ ) and the longitudinal study design lend strength to our findings. Another strength is that we used both quantitative and qualitative methods. This will satisfy those who claim that excessive health spending and its effects are not exhaustively described when catastrophe alone is considered, and that these are better assessed through longitudinal qualitative studies.<sup>10,34</sup> Finally, although our sample is not nationally representative, it was made up of individuals with very diverse sociodemographic characteristics who were selected from various geographic and health-care settings. These results will therefore be applicable to other African regions that lie outside national capitals.

## Conclusion

Poor access to emergency obstetric care can not only lead to maternal and neonatal death, but also to long-term disability or illness in women with severe complications and to an increased risk of death as long as 4 years after the event.<sup>29</sup> Furthermore, as our study shows, the high expenses associated with emergency obstetric care can lead to serious long-lasting consequences that undermine the well-being of entire households, such as food insecurity, indebtedness and overall impoverishment. The high cost of treatment and the effort expended in coming up with the money hinder access to treatment and can result in delays that could prove fatal for the mother and the neonate.<sup>35</sup> Although the policies in place in Mali may have helped to reduce delays in treatment and the expenses borne by households,<sup>30,31</sup> they have failed to eliminate the catastrophic expenditures arising from the treatment of obstetric complications.

As currently implemented, the fee exemption for women undergoing a Caesarean is not enough to eliminate the risk of catastrophic expenditure. On the one hand, free Caesarean kits are inadequate for the management of complicated Caesareans; on the other, women who do not deliver by Caesarean are not protected by any policy. Since an important contributor to catastrophic expenditure arising from emergency obstetric care appears to be the cost of the prescription

drugs required for treatment, providing the most important of these drugs (i.e. antibiotics, analgesics, anti-hypertensives, anticonvulsants and uterotonics) free of charge could further reduce the expenses borne by households. A maternity referral system funded nationally, rather than by districts, could also be more effective at minimizing financial barriers in a sustainable way. This would be a step towards attaining equity in access to health care

and towards reducing the consequences of obstetric complications. ■

#### Acknowledgements

The authors thank the women, their families and the health workers involved in this study, as well Camille Schoemaker-Marcotte for her help in the field.

**Funding:** This research was supported by the Teasdale-Corti Global Health

Research Partnership Program of the Global Health Research Initiative (Canadian Institutes of Health Research, Canadian International Development Agency, Health Canada, International Development Research Center and Public Health Agency of Canada).

**Competing interests:** None declared.

## ملخص

الغرض تحري تواتر الإنفاق الباهظ للرعاية التوليدية الطارئة، واستعراض عوامل اختطاره، وتقييم تأثير هذا الإنفاق على الأسر في إقليم كايس في مالي. الطريقة تم جمع بيانات حول 484 حالة طوارئ توليدية (242 حالة وفاة و242 حالة وشيكة) في الفترة من 2008 إلى 2011. وتم تقييم الإنفاق الباهظ على الرعاية التوليدية الطارئة على عتبات مختلفة واستعراض العوامل المرتبطة به من خلال الارتداد اللوجستي. وبعد ذلك، أجريت دراسة استقصائية على عينة متداخلة تتألف من 56 أسرة لتحديد مدى تأثير الإنفاق الباهظ عليها.

النتائج على الرغم من سياسة الإعفاء من الرسوم الخاصة بالولادات القيصرية ونظام الإحالة للأمهات، الذي تم تصميمه للحد من العبء المالي للرعاية التوليدية الطارئة، كان متوسط النفقات 152 دولاراً أمريكياً (ما يعادل 71535 فرنكاً بعملة الجماعة المالية الأفريقية) وتكبدت نسبة 20.7% إلى 53.5% من الأسر نفقات

الغرض تحري تواتر الإنفاق الباهظ للرعاية التوليدية الطارئة، واستعراض عوامل اختطاره، وتقييم تأثير هذا الإنفاق على الأسر في إقليم كايس في مالي. الطريقة تم جمع بيانات حول 484 حالة طوارئ توليدية (242 حالة وفاة و242 حالة وشيكة) في الفترة من 2008 إلى 2011. وتم تقييم الإنفاق الباهظ على الرعاية التوليدية الطارئة على عتبات مختلفة واستعراض العوامل المرتبطة به من خلال الارتداد اللوجستي. وبعد ذلك، أجريت دراسة استقصائية على عينة متداخلة تتألف من 56 أسرة لتحديد مدى تأثير الإنفاق الباهظ عليها.

النتائج على الرغم من سياسة الإعفاء من الرسوم الخاصة بالولادات القيصرية ونظام الإحالة للأمهات، الذي تم تصميمه للحد من العبء المالي للرعاية التوليدية الطارئة، كان متوسط النفقات 152 دولاراً أمريكياً (ما يعادل 71535 فرنكاً بعملة الجماعة المالية الأفريقية) وتكبدت نسبة 20.7% إلى 53.5% من الأسر نفقات

## 摘要

**目的** 调查产科急症护理灾难性支出的频率，探索其风险因素，评估这些支出对马里凯斯地区家庭的影响。

**方法** 收集2008-2011年484例产科急症护理(242人死亡和242人濒危)的数据。对产科急症护理的灾难性支出进行不同阈值的估计，并通过逻辑回归探讨其相关的因素。随后在包含56个家庭的嵌套样本中展开调查，确定灾难性支出如何对其产生影响。

**结果** 尽管有旨在减少产科急症护理财政负担的剖腹产、产妇转诊系统的费用豁免政策，平均费用仍有152美元(相当于71535非洲金融共同体法郎)，20.7-53.5%的家庭蒙

受灾难性支出。产科急症护理的高支出迫使44.6%的家庭减少其食品消费，23.2%的家庭在10个月至2年半后仍然负债。生活在偏远农村地区与灾难性支出风险相关，这显示了转诊系统无法消除偏远地区家庭的财务障碍。接受了剖腹产的女性继续承担灾难性的支出，当政府提供的剖腹产护理包中不包含处方药物时尤其如此。

**结论** 产科急症护理看病难、看病贵所造成的后果不仅仅在于孕产妇死亡。提供免费的药品，转为更具可持续性、全国统筹的转诊系统可望减少产科急症中家庭的灾难性支出。

## Résumé

### Soins obstétricaux d'urgence au Mali: les dépenses catastrophiques et leurs effets appauvrissants sur les ménages

**Objectif** Étudier la fréquence des dépenses catastrophiques en soins obstétricaux d'urgence, explorer leurs facteurs de risque et évaluer l'effet de ces dépenses sur les ménages dans la région de Kayes, au Mali.

**Méthodes** Les données de 484 urgences obstétricales (242 décès et 242 accidents évités de justesse) ont été recueillies sur la période 2008-

2011. Les dépenses catastrophiques en soins obstétricaux d'urgence ont été évaluées à différents niveaux, et leurs facteurs associés ont été étudiés par régression logistique. Une enquête a ensuite été effectuée auprès d'un échantillon imbriqué de 56 ménages, afin de déterminer comment les dépenses catastrophiques les avaient affectés.



**Résultats** Malgré la politique d'exonération de frais pour les césariennes et le système de maternité de référence, conçu pour réduire la charge financière des soins obstétricaux d'urgence, les dépenses moyennes étaient de 152 dollars des États-Unis (équivalent à 71 535 francs de la Communauté financière africaine), et 20,7 à 53,5% des ménages faisaient face à des dépenses catastrophiques. Des dépenses élevées pour les soins obstétricaux d'urgence ont forcé 44,6% des ménages à réduire leur consommation alimentaire, et 23,2% d'entre eux étaient encore endettés, dix mois à deux ans et demi plus tard. Vivre dans des zones rurales reculées était associé au risque de dépenses catastrophiques, ce qui montre que le système de référence ne peut éliminer les obstacles

financiers pour les ménages éloignés. Les femmes ayant subi une césarienne ont continué à faire face à des dépenses catastrophiques, en particulier lorsque les médicaments prescrits n'étaient pas inclus dans les kits de césarienne fournis par le gouvernement.

**Conclusion** Le fait que les soins obstétricaux d'urgence soient difficilement accessibles et peu abordables a des conséquences au-delà des décès maternels. Fournir gratuitement des médicaments et passer à un système de référence plus durable, financé au niveau national, permettrait de réduire les dépenses catastrophiques pour les ménages en situation d'urgence obstétricale.

## Резюме

### Неотложная акушерская помощь в Мали: чрезвычайно высокие затраты и разорительные последствия для семей

**Цель** Исследовать периодичность чрезвычайно высоких расходов на неотложную акушерскую помощь, изучить связанные с ними факторы риска и оценить влияние этих расходов на домохозяйства в регионе Каес (Мали).

**Методы** Были собраны данные по 484 экстренным акушерским случаям (242 смертельных случая и 242 угрозы жизни) за период с 2008 по 2011 гг. Оценка чрезвычайно высоких расходов на неотложную акушерскую помощь проводилась на разных пороговых уровнях, и исследовались связующие факторы с помощью логистической регрессии. Впоследствии было проведено исследование методом вложенной выборки 56 домохозяйств для определения влияния на них чрезвычайно высоких расходов.

**Результаты** Несмотря на политику предоставления льгот женщинам, перенесшим кесарево сечение, и реферальную систему пособий в связи с родами, которые направлены на сокращение финансового бремени неотложной акушерской помощи, средний размер расходов составлял 152 доллара США (что составляет 71 535 франков Африканского финансового

сообщества), что для 20,7-53,5% домохозяйств представляло собой чрезвычайно высокие расходы. Высокие расходы на неотложную акушерскую помощь вынудили 44,6% семей сократить расходы на продукты питания, а 23,2% были обременены долгами в последующий период от девяти месяцев до двух с половиной лет. Проживание в отдаленных сельских районах было связано с риском чрезвычайно высоких затрат, что демонстрирует неспособность реферальной системы устранить финансовые трудности для удаленных домохозяйств. Женщины, перенесшие кесарево сечение, продолжали нести чрезвычайно высокие расходы, особенно при назначении лекарственных средств, не включенных в наборы медикаментов для родов с помощью кесарева сечения, оплачиваемые государством.

**Вывод** Недостаточная доступность неотложной акушерской помощи, помимо материнских смертей, влечет за собой и другие последствия. Бесплатное предоставление лекарственных средств и переход к более рациональной реферальной системе, финансируемой государством, снизили бы уровень расходов для домохозяйств при экстренных акушерских случаях.

## Resumen

### Atención obstétrica de urgencia en Malí: gastos catastróficos y sus efectos empobrecedores en los hogares

**Objetivo** Investigar la frecuencia de los gastos catastróficos en la atención obstétrica de urgencia, examinar los factores de riesgo y evaluar el efecto de dichos gastos en los hogares de la región de Kayes en Malí.

**Métodos** Se recogieron los datos de 484 situaciones obstétricas de urgencia (242 fallecimientos y 242 errores evitados) entre 2008 y 2011. El gasto catastrófico de la atención obstétrica de urgencia se evaluó en umbrales diferentes y los factores relacionados se examinaron por medio de una regresión logística. Posteriormente, se realizó una encuesta en una muestra jerarquizada de 56 hogares a fin de determinar los efectos de dicho gasto catastrófico.

**Resultados** A pesar de la política de exención de pago para las cesáreas y el sistema de derivación para la atención de maternidad, diseñado para reducir la carga financiera de la atención obstétrica de urgencia, el gasto medio fue de 152 dólares estadounidenses (71 535 francos CFA) y del 20,7 al 53,5% de los hogares incurrieron en gastos catastróficos. El gasto elevado de la atención obstétrica de urgencia

obligó al 44,6% de los hogares a reducir su consumo de alimentos, y el 23,2% seguía endeudado entre 10 meses y dos años y medio más tarde. Vivir en un área rural remota estuvo asociado con el riesgo de gasto catastrófico, lo que muestra la incapacidad del sistema de derivación de eliminar los obstáculos financieros para los hogares de zonas remotas. Las mujeres que se sometieron a una cesárea continuaron acumulando gastos catastróficos, en particular en los casos en los que se prescribieron medicamentos no incluidos en los botiquines para cesáreas proporcionados por el gobierno.

**Conclusión** La mala accesibilidad y asequibilidad de la atención obstétrica de urgencia tiene consecuencias más allá de las muertes maternas. Suministrar medicamentos gratuitos y el cambio a un sistema de derivación financiado a nivel nacional y más sostenible reduciría los gastos catastróficos de los hogares en los casos de emergencias obstétricas.

## References

- Su TT, Kouyaté B, Flessa S. Catastrophic household expenditure for health care in a low-income society: a study from Nouna District, Burkina Faso. *Bull World Health Organ* 2006;84:21–7. doi:10.2471/BLT.05.023739 PMID:16501711
- Borgi J, Hanson K, Acquah CA, Ekanmian G, Filippi V, Ronsmans C et al. Costs of near-miss obstetric complications for women and their families in Benin and Ghana. *Health Policy Plan* 2003;18:383–90. doi:10.1093/heapol/czg046 PMID:14654514
- Kowalewski M, Mujinja P, Jahn A. Can mothers afford maternal health care costs? User costs of maternity services in rural Tanzania. *Afr J Reprod Health* 2002;6:65–73. doi:10.2307/3583147 PMID:12476730
- Perkins M, Brazier E, Themmen E, Bassane B, Diallo D, Mutunga A et al. Out-of-pocket costs for facility-based maternity care in three African countries. *Health Policy Plan* 2009;24:289–300. doi:10.1093/heapol/czp013 PMID:19346273
- Storeng KT, Baggaley RF, Ganaba R, Ouattara F, Akoum MS, Filippi V. Paying the price: the cost and consequences of emergency obstetric care in Burkina Faso. *Soc Sci Med* 2008;66:545–57. doi:10.1016/j.socscimed.2007.10.001 PMID:18061325
- Honda A, Randaoharison PG, Matsui M. Affordability of emergency obstetric and neonatal care at public hospitals in Madagascar. *Reprod Health Matters* 2011;19:10–20. doi:10.1016/S0968-8080(11)37559-3 PMID:21555082
- Nguyen HT, Rajkotia Y, Wang H. The financial protection effect of Ghana National Health Insurance Scheme: evidence from a study in two rural districts. *Int J Equity Health* 2011;10:4. doi:10.1186/1475-9276-10-4 PMID:21247436
- Castillo-Riquelme M, McIntyre D, Barnes K. Household burden of malaria in South Africa and Mozambique: is there a catastrophic impact? *Trop Med Int Health* 2008;13:108–22. doi:10.1111/j.1365-3156.2007.01979.x PMID:18291009
- Xu K, Evans DB, Kadama P, Nabyonga J, Ogwal PO, Nabukhonzo P et al. Understanding the impact of eliminating user fees: utilization and catastrophic health expenditures in Uganda. *Soc Sci Med* 2006;62:866–76. doi:10.1016/j.socscimed.2005.07.004 PMID:16139936
- Onoka CA, Onwujekwe OE, Hanson K, Uzochukwu BS. Examining catastrophic health expenditures at variable thresholds using household consumption expenditure diaries. *Trop Med Int Health* 2011;16:1334–41. doi:10.1111/j.1365-3156.2011.02836.x PMID:21752164
- Storeng KT, Murray SF, Akoum MS, Ouattara F, Filippi V. Beyond body counts: a qualitative study of lives and loss in Burkina Faso after 'near-miss' obstetric complications. *Soc Sci Med* 2010;71:1749–56. doi:10.1016/j.socscimed.2010.03.056 PMID:20541307
- Filippi V, Ganaba R, Baggaley RF, Marshall T, Storeng KT, Sombié I et al. Health of women after severe obstetric complications in Burkina Faso: a longitudinal study. *Lancet* 2007;370:1329–37. doi:10.1016/S0140-6736(07)61574-8 PMID:17933647
- Leive A, Xu K. Coping with out-of-pocket health payments: empirical evidence from 15 African countries. *Bull World Health Organ* 2008;86:849–56. doi:10.2471/BLT.07.049403 PMID:19030690
- Flores G, Krishnakumar J, O'Donnell O, van Doorslaer E. Coping with health-care costs: implications for the measurement of catastrophic expenditures and poverty. *Health Econ* 2008;17:1393–412. doi:10.1002/hec.1338 PMID:18246595
- The State of the World's Children 2012*. New York: United Nations Children's Fund; 2012. Available at: [www.unicef.org/sowc2012/](http://www.unicef.org/sowc2012/) [accessed 20 December 2012].
- Fournier P, Dumont A, Tourigny C, Dunkley G, Dramé S. Improved access to comprehensive emergency obstetric care and its effect on institutional maternal mortality in rural Mali. *Bull World Health Organ* 2009;87:30–8. doi:10.2471/BLT.07.047076 PMID:19197402
- Ministère de la Santé. *Décret n° 05 350 / P-RM du 04 août 2005, Gratuité césarienne*. Bamako: MS; 2005. French
- Waiswa P, Kalter HD, Jakob R, Black RE; Social Autopsy Working Group. Increased use of social autopsy is needed to improve maternal, neonatal and child health programmes in low-income countries. *Bull World Health Organ* 2012;90:403–403A. PMID:22690025
- Källander K, Kadobera D, Williams TN, Nielsen RT, Yevoo L, Mutebi A et al. Social autopsy: INDEPTH Network experiences of utility, process, practices, and challenges in investigating causes and contributors to mortality. *Popul Health Metr* 2011;9:44. doi:10.1186/1478-7954-9-44 PMID:21819604
- Filmer D, Pritchett LH. Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India. *Demography* 2001;38:115–32. PMID:11227840
- Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. *Health Policy Plan* 2006;21:459–68. doi:10.1093/heapol/czl029 PMID:17030551
- Nwaru BI, Klemetti R, Kun H, Hong W, Yuan S, Wu Z et al. Maternal socio-economic indices for prenatal care research in rural China. *Eur J Public Health* 2012;22:776–81. PMID:22158993
- Wagstaff A, van Doorslaer E. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993–1998. *Health Econ* 2003;12:921–34. doi:10.1002/hec.776 PMID:14601155
- van Doorslaer E, O'Donnell O, Rannan-Eliya RP, Somanathan A, Adhikari SR, Garg CC et al. Catastrophic payments for health care in Asia. *Health Econ* 2007;16:1159–84. doi:10.1002/hec.1209 PMID:17311356
- Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJ. Household catastrophic health expenditure: a multicountry analysis. *Lancet* 2003;362:111–7. doi:10.1016/S0140-6736(03)13861-5 PMID:12867110
- Ranson MK. Reduction of catastrophic health care expenditures by a community-based health insurance scheme in Gujarat, India: current experiences and challenges. *Bull World Health Organ* 2002;80:613–21. PMID:12219151
- Bonu S, Bhushan I, Rani M, Anderson I. Incidence and correlates of 'catastrophic' maternal health care expenditure in India. *Health Policy Plan* 2009;24:445–56. doi:10.1093/heapol/czp032 PMID:19687135
- Samake A, Belieres J, Corniaux C, Dembele N, Kelly V, Marzin J et al. *Changements structurels des économies rurales dans la mondialisation, Programme RuralStruc - Phase II, World Bank*. Bamako: The World Bank; 2008. Available from: <http://www.worldbank.org/afr/ruralstruc> [accessed 20 December 2012].
- Storeng KT, Drabo S, Ganaba R, Sundby J, Calvert C, Filippi V. Mortality after near-miss obstetric complications in Burkina Faso: medical, social and health-care factors. *Bull World Health Organ* 2012;90:418–425B. PMID:22690031
- El-Khoury M, Gandaho T, Arur A, Keita B, Nichols L. *Improving access to life-saving maternal health services: the effects of removing user fees for Caesareans in Mali*. Bethesda: Health Systems 20/20 & Abt Associates Inc.; 2011.
- Touré L, Fofana S, Koné S, Sanogo Y. La mise en œuvre de la politique de gratuité de la césarienne. Étude comparative dans 3 sites d'enquête, L'abolition du paiement des services de santé en Afrique de l'Ouest (Burkina Faso, Mali, Niger). *Miseli-Mali* October 2012: Bamako. French
- Balique H. Bilan de la mise en œuvre de la stratégie de la gratuité de la césarienne 2005–2009. In: *Promouvoir l'accouchement en maternité au Mali, Document de travail*. Bamako: Direction Nationale de la santé & Ministère de la Santé; 2010. French
- Quayyum Z, Nadjib M, Ensor T, Suchahya PK. Expenditure on obstetric care and the protective effect of insurance on the poor: lessons from two Indonesian districts. *Health Policy Plan* 2010;25:237–47. doi:10.1093/heapol/czp060 PMID:20007133
- Barros AJ, Bastos JL, Dâmaso AH. Catastrophic spending on health care in Brazil: private health insurance does not seem to be the solution. *Cad Saude Publica* 2011;27:S254–62. doi:10.1590/S0102-311X2011001400012 PMID:21789417
- Borgi J, Storeng K, Filippi V. Overview of the costs of obstetric care and the economic and social consequences for households. *Stud Health Serv Organ Pol* 2008;24:23–46.