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Accessibility and utilisation of delivery care within a Skilled Care Initiative in rural Burkina Faso

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Summary

OBJECTIVES The Skilled Care Initiative (SCI) was a comprehensive skilled attendance at delivery strategy implemented by the Ministry of Health and Family Care International in Ouargaye district (Burkina Faso) from 2002 to 2005. We aimed to evaluate the relationships between accessibility, functioning of health centres and utilisation of delivery care in the SCI intervention district (Ouargaye) and compare this with another district (Diapaga).

METHODS Data were collected on staffing, equipment, water and energy supply for all health centres and a functionality index for health centres were constructed. A household census was carried out in 2006 to assess assets of all household members, and document pregnancies lasting more than 6 months between 2001 and 2005, with place of delivery and delivery attendant. Utilisation of delivery care was defined as birth in a health institution or birth by Caesarean section. Analyses included univariate and multivariate logistic regression.

RESULTS Distance to health facility, education and asset ownership were major determinants of delivery care utilisation, but no association was found between the functioning of health centres (as measured by infrastructure, energy supply and equipment) and institutional birth rates or births by Caesarean section. The proportion of births in an institution increased more substantially in the SCI district over time but no changes were seen in Caesarean section rates.

CONCLUSION The SCI has increased uptake of institutional deliveries but there is little evidence that it has increased access to emergency obstetric care, at least in terms of uptake of Caesarean sections. Its success is contingent on large-scale coverage and 24-h availability of referral for life saving drugs, skilled personnel and surgery for pregnant women.

keywords skilled care Initiative, health care access, health care utilisation, delivery care, Burkina Faso

Introduction

Ensuring that women give birth with a skilled attendant is regarded as one of the pre-requisites for achieving the fifth millennium development goal (MDG 5) of reducing maternal mortality by three quarters by 2015 (World Bank 2007). General trends in assistance at childbirth show a movement towards professionalisation, but millions of women are still left without care, particularly in rural areas and among the poor. Progress has been hampered by a number of factors, including the scarcity of skilled providers, the high cost and the poor quality of delivery care (Koblinsky *et al.* 2006). The sheer shortage of skilled providers and the infrastructure to support them has now been recognised as one of the main obstacles to increasing professionalisation of delivery care in poor countries. It has been estimated that about 700 000 more health professionals and 24 000 birthing centres are needed for full coverage of women during childbirth by 2030 (World Health Organisation 2005).

A health centre based intra-partum care strategy with midwives as the main providers is thought to be the best bet for reducing maternal mortality (Campbell *et al.* 2006). Such a strategy aims at maintaining the normality of the birthing process whilst ensuring timely access to basic emergency obstetric functions within the health centre, and transfer to referral level comprehensive care when needed. There have, however, been surprisingly few studies examining the effect of the level of functioning of health centres on utilisation of delivery care. Distance from

households to a health provider – or a health facility – is known to affect uptake of delivery care (Hodgkin 1996; Magadi *et al.* 2000; Chowdhury *et al.* 2006; Tanser 2006), but whether the level of functioning of the health centre shapes actual uptake is not known.

In this study, we investigate the relationship between accessibility and functioning of health centres and utilisation of delivery care in two rural districts in Burkina Faso. In one of the districts, a safe motherhood initiative to improve access to skilled care (Skilled Care Initiative, SCI) was implemented by Family Care International (FCI) (Graham *et al.* 2008). This initiative did not entirely meet international standards in terms of using exclusively professionally recognised staff to attend deliveries, since it included enhancing the skills of established, traditional birth attendants (*Matronnes*) who worked alongside professional colleagues, and included the Burkinabé health service cadres of *Accoucheuses Auxiliares* and *Agents Itinérants de Santé*, all of whom were included in further training for staff. As part of the evaluation of this initiative, each health centre in an intervention and comparison district was assessed in terms of staffing and physical functioning, enabling the classification of health centres by their level of functionality (Hounton *et al.* 2008). In addition, detailed socio-demographic characteristics of the population were ascertained using a census (Hounton *et al.* 2008). Our goal was to assess the link between the distance to and characteristics of health centres with rates of births in health facilities and Caesarean sections, whilst adjusting for known socio-demographic characteristics associated with the use of delivery care. We chose institutional birth rates as an outcome to capture the direct effect of a health centre's accessibility, while Caesarean section rates in such a setting indicate whether access to a health centre translates into better access to comprehensive emergency obstetric care (CEmOC) (Dubourg *et al.* 2007).

Methods

Study area

Ouargaye district is located 225 km to the south-east of Ouagadougou, the capital of Burkina Faso. The district covers a population of 213 690 and has 22 health facilities. Prior to SCI field activities in 2002 there was one medical doctor per 213 000 population and one nurse or midwife per 8300 population (Diallo *et al.* 2002). Women requiring a Caesarean section are generally referred to Ouargaye district hospital or to the regional hospital situated 65 km north of the Ouargaye town. The district of Diapaga is located in the extreme east of Burkina Faso, covers a population of 268 336, and has 21 health facilities. Diapaga district hospital is the main source of surgical care, with no nearby regional facility. In 2001, the physician to population ratio was 1:134 000 and there was one nurse or midwife per 6400 populations (Diallo *et al.* 2002). Both districts are remote and rural, generally lacking electricity (although the town of Diapaga is electrified), running water and suitable roads. The main source of income is farming and female literacy is very low in both districts (National Institute of Statistics and Demography and Macro International Inc. 2004).

Family Care International launched the SCI in Ouargaye district in January 2002 in five health centres and the district hospital, and in January 2003 in another eight health centres (Graham *et al.* 2008). The intervention consisted of strengthening both the supply and demand sides of delivery care. The supply side intervention consisted of training all workers at the 14 health facilities, and provision of medical equipment, communications, solar power for health centres and some staff houses. Supervision was also augmented and buildings upgraded. The district hospital was strengthened (operating room and ambulance for emergency referrals). The demand side intervention consisted of extensive community mobilisation (advocacy and awareness, social marketing, behavioural communication change and capacity strengthening), including community workshops with traditional leaders and the posting and training of community link workers. The community intervention was gradually implemented over time across the whole district (Graham *et al.* 2008).

Although the main target for community mobilisation activities was the catchment populations of the 14 health facilities, it reached beyond this area because community leaders were responsible for much larger populations. Furthermore, some training on obstetric best practices was offered to all heads of maternity units within the intervention district and other donors and programmes intervened with similar inputs in the health centres of Ouargaye that were not covered by the SCI.

Health facilities

All 43 health facilities in the two districts were surveyed between 10th March and 5th May 2006 to describe particular aspects of their functioning. Each was visited for between 1 and 3 days by a team of medical doctors and professional midwives. Information was collected on numbers and types of health workers and the physical functioning of the facility, including equipment, infrastructure and energy.

Each health centre is typically led by a nurse, usually male and state certified (*Infirmier Diplômé d'Etat*). Some-

times, the health centre is led by a state enrolled male nurse (*Infirmier Breveté*) or by the outreach health worker (*Agent Itinérant de Santé*). Deliveries and other health centre based maternal care are typically provided by an auxiliary midwife (*Accoucheuse Auxiliaire*). Trained traditional birth attendants (*Matronnes*) are meant to have an assisting and supervised role in larger centres, but in some rural or remote centres they remain the main maternal care givers. Female and male professional midwives (*Sage-femme d'Etat* and *Maïeuticien d'Etat*) are only found in the two district hospitals. The measure of human resources thought to most closely represent the delivery care input was all staff (including trained traditional birth attendants). The measure was converted to a rate per 10 000 population living in the area served by each centre.

Physical inputs measured included infrastructure, energy supply and equipment (Chapman *et al.* 2006). Infrastructure was scored for quality and quantity of each type of building. Water supply was included as part of infrastructure. Energy sources were rated by reliability and the light quality they produced as well as by quantity. The equipment measured was that commonly used in maternity units or dispensaries (PRSS 2001). The equipment component was population weighted since centres serving larger populations and with larger through-puts could be expected to have more equipment. Each of the three physical components received equal weighting and then the result was rescaled to range from 0 to 100. There was substantial variation in some inputs. For example, a count of essential equipment found the bottom 20% of health centres having around 33% of required equipment compared with the top that had 77%.

Target populations

A census was conducted between February and May 2006, covering the total population in both districts. All women aged 12–49 years were asked about all live and stillbirths between 2001 and 2005. The questionnaire was modified from the standard Demographic and Health Survey (DHS) questionnaire, including questions on the outcome of the pregnancy, place of and attendant at delivery and whether the birth was by Caesarean section. An institutional birth was defined as a birth in a health centre or hospital.

Each birth was assigned to a particular health centre catchment area. In Burkina Faso, each village or urban sector has been assigned to a health centre and we used this administrative definition to categorise catchment areas, even though this did not in all cases correspond to the nearest health centre.

Statistical methods

We used logistic regression models to identify determinants of institutional birth or Caesarean section for all pregnancies of at least 6 months duration reported between 2002 and 2005. The logistic regression models were adjusted for clustering at the health facility level using Generalized Estimating Equations (Hardin & Hilbe 2003); statistical significance was assessed using Wald tests. Births in 2001 were excluded because they were under-reported (Hounton *et al.* 2008).

We explored associations between the two outcomes (institutional delivery and Caesarean section rates) and the number of health workers per 10 000 population (by quintile), the physical inputs of the health centre (by quintile), whether or not the health centre was directly involved in the SCI intervention, distance from the health centre and main referral hospital, maternal age at birth, parity, multiple birth, education of the mother, asset quintile and year of birth. We computed asset quintiles using the principal components analysis method of Filmer and Pritchett (2001) for all surveyed households. We used the following asset variables: source of drinking water; type of latrine; principal material of floor, wall, and roof; electricity supply; ownership of radio, television, bicycle, car, cart, refrigerator, phone (landline and cellular) and energy source for cooking. The asset quintiles were derived from the first principal component.

Predictors associated with the outcomes (P-value < 0.2) in a simple logistic regression model were considered for inclusion in a multiple logistic regression model. In the final model, only factors significant at the 5% level were retained. Variable selection was carried out by using a manual stepwise procedure. All statistical analyses were performed with SAS 9.1 (SAS Institute Inc., Cary, NC, USA) and R 2.3 (R Foundation for Statistical Computing, Vienna, Austria).

The overall Immpact research proposal was approved by the Ministry of Health National Health Research Ethics Committee (Ouagadougou, Burkina Faso). The specific Evaluation and Evidence Research Group protocol was approved by Centre Muraz (Bobo-Dioulasso, Burkina Faso) Institutional Review Board. Administrative authorizations were obtained at all level of the administrative chain (Ministry of Health, Region Governorates, Regional Directorates of Health, National and Regional Hospital Directorates, Province High Commissioners, District Health Management Teams, Heads of Clinical Services in Hospitals and village community leaders.

Results

Determinants of institutional birth

There were 81 536 births in the two districts between 2002 and 2005, 31 345 (38.4%) of which took place in a health facility. Nearly, all (95%) institutional births were in a health centre. The median number of health workers per 10 000 population was 3.3 (range 0.7–19.7). Excluding trained traditional birth attendants, the median number was 3.1 (range 0.7–14.0). There was a strong association between the number of health workers in a health centre and the proportion of institutional births in the health centre's catchment area (Table 1). Less than a third (29.0%) of births associated with health centres having two or fewer health workers per 10 000 population were institutional, compared to about half (54.2%) for the health centres with more than six health workers per 10 000 population (unadjusted *P*-value for linear trend <0.001). Physical inputs into health centres were not associated with institutional birth rates ($P = 0.365$).

Births in Diapaga district were much less likely to be institutional than births in Ouargaye district. Births in institutions increased over time ($P < 0.001$), and there was a significantly larger increase in Ouargaye district [odds ratio (OR) per year 1.23 (1.18–1.28)] than in Diapaga [OR per year 1.08 (1.05–1.12)], (difference in trend $P < 0.001$), (Figure 1). Within Ouargaye district, the trends were similar for the SCI and non-SCI facility catchment areas (difference in trend $P = 0.822$) (Figure 1).

Distance to health centre was a major determinant of institutional delivery: three quarters (76.7%) of births within 1 km of the health centre took place in a facility, compared with a mere fifth (18.5%) for births further than 10 km from the health centre. Socio-economic differentials in institutional birth rates were huge. Though very few (0.9%) women had received secondary or higher education, their utilisation of institutional delivery was nearly universal (88.1%), compared with only a third (37.4%) for the large group of uneducated women ($P < 0.001$). Asset ownership showed a similar pattern, institutional birth being 24.5% in the poorest quintile compared with 56.8% in the richest quintile ($P < 0.001$).

In the multivariate analysis, the density of health workers per 10 000 population was not associated with institutional birth ($P = 0.631$). Distance to the health centre and socio-demographic characteristics of the mother or family remained important determinants (Table 2). Interestingly, the effect of distance to the health centre was very pronounced up to about 7 km from the health centre (OR 0.77/km), levelling off beyond that (OR 0.97/km). Distance to the district hospital remained an important independent predictor of institutional birth. Time trends in institutional births remained significant in both districts.

Determinants of Caesarean section

Only 0.4% of women reported a birth by Caesarean section. The number of health workers per 10 000 population, physical inputs in health centres, distance to health centre or hospital and maternal education were all associated with birth by Caesarean section, though in none of these sub-groups was the Caesarean section rate above 1%, except for the very few women with secondary or higher education who had a Caesarean section rate of 2.4% (Table 2). There was no difference overall between the districts in Caesarean section rates, though there was an increase over time of borderline significance in Ouargaye ($P = 0.081$) which was not seen in Diapaga (Figure 2). The Caesarean section rate appeared to rise somewhat faster in the areas not covered by the SCI, but this difference was not significant ($P = 0.712$). The multivariate analysis did alter the findings: none of the health centre characteristics remained in the model ($P = 0.135$ and 0.067 for health worker density and physical inputs, respectively), but distance to health centre and hospital and maternal education persisted.

Discussion

The strategy of strengthening the supply and demand for delivery care in health centres was successful in increasing the rate of institutional births with skilled attendants (sometimes working alongside less trained colleagues) in a poor district in Burkina Faso. The rate of increase of institutional births was significantly higher in the SCI district, where the level of facility-based intervention was greater, and the overall package more wide-ranging in terms of extensive efforts to mobilise communities through community leaders and other groups. It is reasonable to conclude that SCI was successful in its aim of increasing skilled attendance at delivery in Ouargaye district. It could also be conjectured that community outreach might be an important synergistic determinant to accessible delivery care in order to achieve increased utilisation. However, these trends have to be seen alongside a continuing, huge unmet need for potentially life-saving Caesarean sections, and the intervention seemingly did not manage to overcome the substantial barriers to accessible life-saving surgery.

Surprisingly, health worker density was not an important determinant of uptake of delivery care. At the crude level, the nature of the association between health worker density and uptake of skilled attendance at birth was

Table 1 Socio-demographic and health centre characteristics associated with institutional births and Caesarean sections in Ouargaye and Diapaga districts in Burkina Faso (2002–2006)

		Institutional births			Caesarean sections		
	Births (*n*)	*n*	%	*P*-value†	*n*	%	*P*-value†
Health workers per 10 000 population in health area (quintile)				<0.001			0.009
≤2	27 269	7914	29.0		91	0.33	
>2 to ≤2.5	16 642	7365	44.3		53	0.32	
>2.5 to ≤3.3	17 726	7925	44.7		89	0.50	
>3.3 to ≤6	11 399	3534	31.0		45	0.39	
>6	8500	4607	54.2		73	0.86	
Index of physical inputs in health centres				0.365			0.030
Lowest quintile	14 311	6850	47.9		59	0.41	
Second lowest quintile	22 283	5608	25.2		46	0.21	
Mid quintile	16 005	6488	40.5		96	0.60	
Second highest quintile	17 112	7342	42.9		75	0.44	
Highest quintile	11 825	5057	42.8		75	0.63	
District/intervention				0.005			0.406
Diapaga	44 637	14 363	32.2		207	0.46	
Ouargaye SCI	23 353	10 610	45.4		79	0.34	
Ouargaye non-SCI	13 546	6372	47.0		65	0.48	
Distance to hospital				<0.001			0.019
≤10 km	5217	2903	55.6		37	0.71	
>10 to ≤20 km	9185	4238	46.1		38	0.41	
>20 to ≤30 km	16 040	7796	48.6		83	0.52	
>30 to ≤40 km	15 654	5890	37.6		55	0.35	
>40 to ≤50 km	14 403	5144	35.7		79	0.55	
>50 to ≤60 km	14 120	4276	30.3		39	0.28	
>60 km	6917	1098	15.9		20	0.29	
Distance to health centre				<0.001			0.005
≤1 km	7981	6120	76.7		65	0.81	
1–2.5 km	10 014	6134	61.3		61	0.61	
2.5–5 km	14 431	6749	46.8		68	0.47	
5–7.5 km	15 925	5278	33.1		44	0.28	
7.5–10 km	12 932	3312	25.6		48	0.37	
10–15 km	10 640	2285	21.5		35	0.33	
>15 km	9613	1467	15.3		30	0.31	
Year of birth				<0.001			0.040
2002	16 646	5540	33.3		58	0.35	
2003	19 635	6794	34.6		75	0.38	
2004	20 206	7639	37.8		95	0.47	
2005	25 049	11 372	45.4		123	0.49	
Maternal formal education				<0.001			<.001
None	76 745	28 723	37.4		301	0.39	
Primary	2141	1486	69.4		22	1.03	
Secondary or higher	734	647	88.1		18	2.45	
Asset quintiles				<0.001			0.052
Most poor	17 333	4240	24.5		69	0.40	
Very poor	15 766	4691	29.8		62	0.39	
Poor	15 626	5810	37.2		45	0.29	
Less poor	16 485	7326	44.4		79	0.48	
Least poor	16 326	9278	56.8		96	0.59	

†*P*-value for any association for nominal risk factors or linear association for ordinal or continuous risk factors from logistic regression model, adjusted for clustering of pregnancy outcomes within health centre catchment areas.

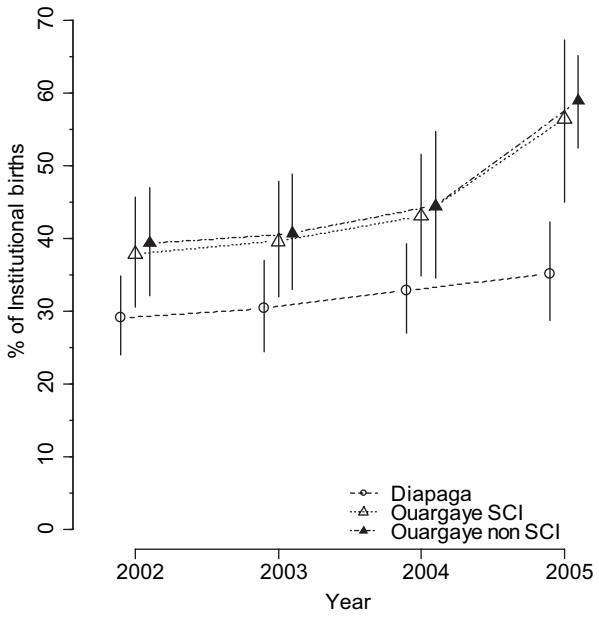

Figure 1 Trends in institutional births by district and Skilled Care Initiative area in Ouargaye and Diapaga districts in Burkina Faso (2002–2006).

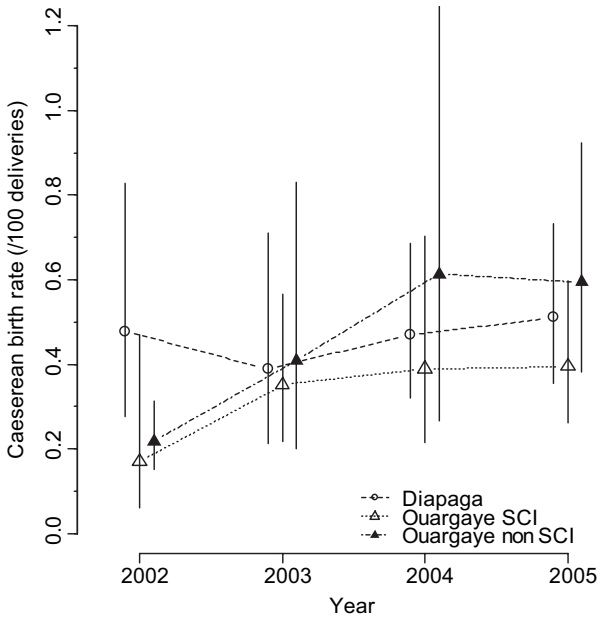

Figure 2 Trends in Caesarean sections by district and Skilled Care Initiative area in Ouargaye and Diapaga districts in Burkina Faso (2002–2006).

similar to that observed by Chen and colleagues (Chen *et al.* 2004). In their ecological study, 20% skilled attendance was achieved with a density of two workers per 10 000 population, increasing to over half of all births at a worker density of six per 10 000. The crude associations in the two districts did not persist after taking into account other factors; however, and this was mostly because of the fact that low health worker densities occurred mainly in

Table 2 Multivariate model for socio-demographic and health centre characteristics associated with institutional births and Caesarean sections in Ouargaye and Diapaga districts in Burkina Faso (2002–2006)

	Institutional births			Caesarean sections		
Risk factor	Odds ratio	95% CI	*P*-value	Odds ratio	95% CI	*P*-value
Distance to health centre						
Trend for <7.5 km (odds ratio/km)	0.77	(0.75,0.79)	<0.001	0.90	(0.85,0.96)	0.002
Trend for ≥7.5 km (odds ratio/km)	0.97	(0.95,0.98)	<0.001	1.00	(0.95,1.04)	0.878
Distance to hospital						
Trend (odds ratio/10 km)	0.83	(0.77,0.91)	<0.001	0.90	(0.84,0.97)	0.007
year of birth						
Trend for Diapaga (odds ratio/year)	1.10	(1.07,1.14)	<0.001	1.04	(0.89,1.21)	0.627
Trend for Ouargaye (odds ratio/year)	1.38	(1.30,1.46)	<0.001	1.25	(1.06,1.46)	0.006
Formal maternal education			<0.001			<0.001
No education (odds ratio)	0.21	(0.15,0.29)		0.28	(0.16,0.52)	
Primary (odds ratio)	0.46	(0.34,0.64)		0.58	(0.27,1.22)	
Secondary or higher (odds ratio)	Reference			Reference		
Asset index						
odds ratio/quintile	1.22	(1.16,1.28)	<0.001			

Odds ratios, CI (confidence interval) and *P*-values obtained from a multivariate logistic regression model, adjusted for clustering of pregnancy outcomes within health centre catchment areas. All odds ratios are adjusted for all other factors and maternal age, parity and multiple births. Only predictors significant at the 5% level were retained in the model.

remote health centres located far from the district hospitals. Distance to the nearest hospital was an important correlate of skilled attendance in health centre catchment areas, with uptake of skilled attendance at birth only 16% in the most remote areas. Although this is partly related to the fact that fewer health workers resided in remote areas, distance to hospital also reflects other aspects of remoteness such as poor road infrastructure, poor communication between communities, poverty, limited access to information, strong adherence to traditional values and other disadvantages that are difficult to measure quantitatively.

The functioning of health centres – as measured by infrastructure, energy supply and equipment – was not related to uptake of skilled attendance at birth. This may, in part, be due to the fact that we measured the functioning of health centres at one point in time only. The absence of a difference in functioning between the SCI and the non-SCI health centres (data not shown) supports the hypothesis that the SCI may have targeted the less well-functioning health centres. Also, health centres in Burkina Faso adhere to strict norms in terms of building, equipments, staffing regardless of the sources of funding (Direction de la Santé de la Famille 2004a,b,c; Direction des Infrastructures des Equipements et de la Maintenance, DIEM 2004), though there can be exceptions. Moreover, the inputs measured may not have been the most relevant ones. For example, we could not effectively measure the supply of drugs nor could we assess obstetric skills and competencies of staff. Finally, the construction of a pooled index may have hidden the effect of individual inputs. None of the inputs, when examined separately however, were independent predictors of professional care at birth (data not shown).

The lack of a difference in uptake of skilled attendance at birth between the SCI and the non-SCI catchment areas is perhaps not surprising, and should not be interpreted as a failure of the SCI. Though the upgrading of facilities and training of providers was limited to the SCI-supported health centres only, the community mobilization reached much larger populations within the district, and the sharp increase in institutional births in 2005 may reflect the cumulative effect of years of outreach to communities. Furthermore, some newer health centres were located in non-SCI areas. District managers will use whatever resources they can get in order to fund services. When SCI decided to fund certain health centres, other funders would be directed to other facilities, possibly diluting any uniquely measurable SCI effect, even though the overall district effect could be positive.

There is little evidence that the SCI increased access to Caesarean sections. Even though not all Caesarean sections are necessarily life-saving, Caesarean section rates of less than 1% indicate an unmet need for potentially life-saving care (De Brouwere & Van Lerberghe 1998; Dubourg *et al.* 2007). Changing the organizational culture of a hospital is difficult and the SCIs efforts to modify the Ouargaye hospital from one that did little surgery to one offering readily accessible CEmOC was not successful. This confirms that the challenge of changing an institution's ethos and performance is not easily addressed through project investments alone. In Burkina Faso, surgery can be performed by trained doctors and experienced nurses with a dedicated 2- to 3-year period of training in surgery and anaesthesia but devolution of responsibilities and continuity of care are not always ensured. In Diapaga, long-term isolation from alternative facilities had ensured that trained doctors and nurse–surgeons worked as a team, though the overall Caesarean section rate remained equally low. This underscores the importance of understanding the barriers to accessing Caesarean sections and of continuing to search for ways to overcome them.

The inequalities in access to a skilled attendant by asset quintile and education shown here are not new (Koblinsky *et al.* 2006), although the magnitude of the effect is much smaller than that seen at national level (National Institute of Statistics and Demography and Macro International Inc. 2004). At the national level, 20% of the poorest give birth in a health centre, compared with 80% of the richest quintile. In our study, this disparity was smaller (24% and 57%, respectively). These inequalities attest to the important role of ensuring access to financial support and information, even where health workers are present.

The study has some limitations. First, we report the density of health workers in health centres while institutional births include births in hospital. Most (95%) institutional births are in health centres; however, and the bias, if any, is minimal. Second, our measure of health worker density included outreach health workers and trained traditional birth attendants who are not formally trained or licensed to manage routine deliveries. While the WHO definition of skilled attendants is restricted to accredited health professionals (doctors, nurses and midwives), a country such as Burkina Faso faces a serious shortage of accredited providers, and most health centres have to be staffed by lower cadres, such as auxiliary midwives (*Accoucheuse Auxiliaire*) or outreach health workers (*Agent Itinérant de Santé*). There were only four accredited professional midwives in the two districts at the time of this study, and the SCI targeted all workers, regardless of prior training. It can be conjectured that some very experienced outreach workers and traditional birth attendants may be individually as effective as inexperienced but formally trained workers – though this is not an

argument against policies insisting on formal training. In the absence of any explicit measure of skills, we chose to examine institutional birth rates, not making any assumptions about the actual performance of health workers. It is also not possible to infer that health outcomes automatically improve as a result of increasing rates of skilled attendance, and outcome measures still need to be assessed (Bell *et al.* 2008). Third, we classified villages by health centre catchment areas, thus assuming that women only use the health facility falling within the administrative unit to which the village has been assigned. If women use other health centres, this could have diluted the association between health centre characteristics and utilisation. Finally, we only measured distance to the district hospital, ignoring the fact that women may seek emergency care from the regional hospital or even facilities in neighbouring countries. We may thus have underestimated the effect of distance to the nearest hospital, although at least the separation between the two districts studied should have minimised any cross-over effect.

Evidence-based public health must draw on studies with designs other than randomised controlled trials, particularly, when the intervention and causal chain between the intervention and outcome are complex (Victora *et al.* 2004). In our evaluation, we ruled out alternative explanations by using a comparison group and by addressing confounding variables. Victora *et al.* (2004) propose three pre-requisites for drawing valid causal inferences from intervention studies without random allocation: (1) the causal pathway must be short and simple; (2) the expected impact must be large and consistent with the temporal sequence of the intervention and (3) confounding must be unlikely. We adjusted for a number of confounders in our study, but the causal pathways that we studied were complex, and the time frame may have been too short to measure any meaningful changes. Most importantly, we could not effectively measure a number of key processes that would have helped to explain the underlying pathways, such as staff competencies or availability of drugs in health centres. Measuring provider skills is notoriously difficult (Hussein *et al.* 2004), and though we collected data on drug availability, very few health centres had good records. Lastly, interventions also took place in the health centres of Ouargaye that were not covered by the SCI, and this may have diluted the effects seen. For all these reasons, we remain cautious in attributing the changes observed solely to the SCI intervention.

The findings of this study pose a number of challenges to the Burkinabé health services. Utilisation of delivery care is lowest among the poor and those living in remote areas and the size of this effect is remarkable given the apparently low and superficially homogeneous asset ownership of the populations in the two districts studied here. Distance is also a very important factor for accessing delivery care and investment in transport and communication is urgently needed to overcome this barrier. Community mobilization may be an important component for improving institutional delivery in remote, rural settings, alongside strengthened health facilities. Investment in skilled attendants is clearly important, including enhancements to their professional environment. Despite a discouraging overall picture in which access to life-saving emergency interventions remains limited, the SCI has shown that improvements can be made. Nevertheless, there is a long way to go in terms of achieving the MDG 5 in this setting.

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Conflicts of interest

The authors have not declared any conflicts of interest.

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