Original article

Cesarean delivery practices in teaching public and non-government/private MCH hospitals, Addis Ababa

Hussen Aman[1], Shiferaw Negash[1], Lukman Yusuf[1]

Abstract

Background: Cesarean section is one of the skilled delivery interventions that have proven to be a life-saving procedure. It should be done under appropriate indications owing to the inherent short and long term complications and high cost. In Ethiopia, a study comparing the practice of cesarean sections in government and non-government hospitals has not been undertaken before.

Objective: To **d**escribe and compare the practices of cesarean delivery in the teaching public and non-governmental MCH hospitals in Addis Ababa, Ethiopia.

Methods: Retrospective cross-sectional study using the cesarean section data of 2011 G.C. from three teaching government and three private-MCH hospitals. The data was analyzed and the mean with standard deviation for continuous variables and proportions for categorical variables were used as descriptive statistics. Chi-square test was used to measure the strength of associations where appropriate, with level of significance set at p-value <0.05.

Results: The difference in the proportion of cesarean delivery between the two groups was statistically significant, 31.1% and 48.3% (P<0.05) in the teaching government hospitals and the non-governmental hospitals, respectively. Non-government MCH hospitals contributed to one-third of the total deliveries and 40% of the cesarean sections. Non-reassuring fetal heart rate pattern, previous cesarean section scar, and cephalo-pelvic disproportion account for 51.3% and 59.6% of the indications in the teaching hospitals and non-governmental hospitals, respectively. When individual indications were analyzed between the two groups, previous cesarean section was higher in the non-governmental hospitals, 29.3% vs. 14.6%, (P<0.05), and non-reassuring fetal heart rate pattern frequented more in the teaching hospitals 26.3% vs. 17.8%,(P<0.05), contributed significantly. Maternal request per se contributed to 7.5% of the indication in the non-governmental hospitals compared to none in the teaching hospitals. Of the repeat cesarean sections, 70.3% were done merely for reasons of first cesarean section in non-governmental hospitals compared to 16.8% in the teaching (P<0.05). The proportion of low birth weight, post-term pregnancy and unknown date were seen more in the teaching hospitals compared to non-governmental hospital, (P<0.05). Though three dosing was the most frequently practiced prophylaxis in both study groups, there is a great deal of variability in the choice of antibiotics.

Conclusion: The higher proportion of maternal morbidities/mortalities and poor peri-natal outcomes in the setting of higher proportion of emergency cesarean delivery in teaching government hospitals need further study to explore for factors that have contributed so as to improve the quality of care. The high rate of repeat cesarean delivery for one previous cesarean section scar and other non medical indications like maternal request in the non-government MCH hospitals elucidates the need to monitor the appropriateness of these indications. We also recommend standardization of prophylactic antibiotic use and expand use of regional anesthesia for cesarean section. [*Ethiop. J. Health Dev.* 2014;28(1):22-28]

Introduction

Cesarean section (CS) is one of the life saving surgical interventions attributed to the decrease of maternal and perinatal mortality and morbidity. The capability to perform safe cesarean delivery has been one of the major advances in obstetrics in the 20th century. The safety of the operation has improved with time, largely due to improved surgical and anesthetic techniques as well as the availability of blood transfusion services and broader choices of antibiotics. As any surgical procedure, it is associated with a variety of short and long term complications relating to anesthesia, bleeding and damage to the bladder, aspiration pneumonia, cardiac arrest, drug-related complications and post-operative infections including thrombophlebitis are among the common short term complications, whereas scar dehiscence and high rate of repeat cesarean section are cited as the common long term complications. Cesarean section also poses much higher cost and prolonged hospital stay compared to vaginal delivery (1).

Appropriate range for cesarean section is debatable, however, the World Health Organization (WHO) recommends the 5-15% optimum range. Most middle and high income countries report figures higher than the upper limit, while low income countries report the opposite. According to the 2007 WHO estimates, rates as high as 21.1% in the developed and as low as 2.1% in the least developed has been documented (2). Reports show that cesarean rates exceeding the World Health Organization upper threshold of 15% which has been recently wavered are more common in the private fee–for–service hospitals than public hospitals. The phenomenon is seen in both the developed and developing world (2, 3).

[1]Department of Obstetrics and Gynaecology, School of Medicine, Addis Ababa University.

Previous cesarean delivery is the single most common indication for elective cesarean sections worldwide, and offering vaginal birth after cesarean section (VBAC) is one way of reducing the high cesarean rates. However, rates of VBAC are declining in the USA, from 28.3% in 1996 to 12.7% in 2002. This is in contrast to the UK, where the rates of VBAC remain fairly high at 33%, and this is because of the contrasting views about the maternal and perinatal morbidity and mortality. Despite this, the National Institute of International Excellence in the UK provides guidelines in which information is shared with all women who have had a previous cesarean delivery to help them make an informed choice regarding the mode of delivery. Thus, sufficient time should be taken by all doctors to provide efficient counseling (4-6).

Once limited to western countries, particularly the United States and the United Kingdom, high rates of cesarean deliveries have now become international phenomena. A hospital-based study in Kenya, Nairobi, demonstrated a cesarean rate of 20.4% in 1996 and 38.1% in 2004, a rise per year of 2%. Similarly, a study from Ribeirao, Brazil, shows the rising cesarean rate of 1.2% each year, 30.3% in 1978 to 50.8% in 1994 (7, 8). The reasons for the rise in the rate of cesarean section delivery include in part an increase in facility–based delivery and access to health care, convenience of delivery time as well as malpractice related financial gain (9, 10, 11). The national cesarean rate for Ethiopia ranges from 0.6% (the national review of cesarean delivery), to 1.5% (Demographic and Health Survey report of 2011), depicting the figure far below the WHO optimum range, 5-15%. The figures across the sub-national regions are variable, ranging from 0.2- 9%. However, the institutional cesarean rate in the country is quite the opposite, 15% from the public hospitals to 46% in the private sectors (12, 13). Though a lot has to be done to achieve comprehensive obstetric care coverage in the country, which could be elucidated partly by addressing the World Health Organization optimum cesarean rate of 5-15%, efforts should be made to explore the underlying reasons behind increased institutional (public/private) cesarean rates.

The objective of this study is to compare the cesarean delivery practices between teaching government and non-government and private fee-for-service MCH hospitals: in terms of proportion, common indications, anesthesia choice, prophylactic antibiotic use, and maternal and perinatal outcomes, and explore the compliance with international benchmarks of the practice.

Methods

A retrospective cross-sectional study that compared cesarean section practice in the teaching and non-teaching hospitals was undertaken using the delivery registry data of the year, 2011 GC. The study sites were GMH (Gandhi Memorial Hospital), TASH (Tikur Anbasa Specialized Hospital), SPH (Saint Paul's Hospital); two private and one non-government, MCH fee–for-service hospitals. All the hospitals are located in Addis Ababa, the capital city of Ethiopia. TASH and SPH are the national referral and teaching hospitals; whereas GMH is the only government owned maternity hospital and affiliated teaching institution for undergraduate and postgraduate specialty in Gynecology and Obstetrics. In these three government hospitals, approximately 12,000-15,000 deliveries are conducted per year. Two private MCH and one non-government fee–for-service hospitals were randomly chosen to represent the non-governmental hospitals.

Using the sample size determination formula for comparisons of proportion between the two groups at a power of 95% and a confidence level of 95%, a minimum sample size of 487 cases for each hospital group were determined making the total sample size of 974. Equal numbers of cases are allotted to each hospital under the study.

Systematic sampling was used after developing a separate sampling frame for each study group. The first case was randomly selected for each hospital group, and then every 5^{th} case for non-government hospitals and every 8^{th} case for government hospitals were selected from the delivery record of the year 2011 (from January 1, 2011 to December 30, 2011) till the required sample size was achieved.

The total of 944 charts (479 from the teaching government and 465 from the non-government) were available for the final analysis making the chart retrieval rate of 95.6%. The data was collected, entered, cleaned, and analyzed using the SPSS software version 20. Mean with standard deviation and percentages were used to describe the numerical and categorical data respectively. T-test for difference in independent numerical variables and chi-square test for categorical variables to measure associations were used, with level of significance set at $P< 0.05$.

Ethical clearance was obtained from the Institutional Review Board of the College of Health Sciences, Addis Ababa University and permission obtained from the medical directors of the respective hospitals. Confidentiality and privacy of all data were highly secured and maintained throughout the different stages of the study.

Results

The total number of deliveries in the three teaching hospitals and three non-teaching hospitals during the year 2011 were 12, 534 and 5,227 respectively, of which 3,899 (31.1%) of the cases in the teaching government and 2524 (48.3%) cases in the non-government MCH hospitals were cesarean deliveries, the difference in the proportion between the two groups was statistically significant, $P<0.05$. The non-governmental hospitals contributed to 5,227/17761 (29.4%) of the total deliveries and 2,524/6423 (39.3%) of the cesarean deliveries.

The age distribution is similar in both groups, except, the proportion of subjects with age ≤ 19 years were approximately 3.5 times higher, 18 (3.8%) vs. 5 (1.1%), P<0.05, in the teaching hospitals. About half of the subjects in both groups were nulliparous, 246 (51.4%) and 226 (48.6%), in teaching and non-governmental hospitals, respectively, but grand multiparity was ten times higher in the teaching hospitals 19 (4%) vs. 2 (0.4%), P<0.05. The antenatal care status (ANC) was similar in the study groups, 457 (95.4%) and 432 (93%) for the teaching and non-governmental hospitals, respectively. While 447 (96.1%) of the women who delivered in the non-governmental hospitals had ANC in the same hospital whereas only 125 (26.1%) of the total deliveries in the teaching hospitals had ANC in the same hospitals (Table 1 & 2).

Table 1: **Maternal demographic characteristics by type of hospitals, A.A, Jan – Dec, 2011**

Variables	Teaching hospitals		Non-governmental hospitals		P – value
	Freq	%	Freq	%	
Address					0.000
Addis Ababa	393	82	457	98.3	
Out side	84	17.5	6	1.3	
Not documented	2	0.4	2	0.4	
total	479	100	465	100	
Marital status					
Married	426	88.9	453	97.4	0.000
Unmarried	20	4.2	-	-	
Not documented	33	6.9	12	2.6	
Total	479	100	465	100	
Age range					
16 – 19 year	18	3.8	5	1.1	0.000
20 – 34 vear	414	86.4	421	90.6	
≥ 35 year	47	9.8	39	8.4	
Total	479	100	465	100	

Table 2: **Indications of cesarean section by type of Hospitals, A.A, Jan – Dec, 2011**

Indications	**Teaching hospitals**		**Non-governmental hospitals**		**P-value**
	Freq	**%**	**Freq**	**%**	
Non-reassuring fetal heart rate pattern	126	26.3	83	17.8	0.000
Previous cesarean section scar	70	14.6	136	29.3	
Cephalo-pelvic disproportion	50	10.4	58	12.5	
Breech presentation	40	8.4	31	6.7	
Dysfunctional labor	39	8	15	3.2	
Multiple pregnancy	37	7.7	14	3	
Antepartum hemorrhage	25	5.2	7	1.5	
Mal-presentation	24	5	5	1.1	
Failed induction	20	4.2	33	7.1	
Maternal request	-	-	35	7.5	
Unfavorable cervix with Non-reassuring biophysical profile RBPP	14	2.9	18	3.9	
Preeclampsia-eclampsia syndrome	11	2.3	10	2.2	
PMTCT*	3	0.6-	14	3	
Others**	19	4	7	1.5	
Total	479	100	465	100	

*Prevention of Mother to Child Transmission

** Includes other mal-positions like direct occipito-posterior, deep transverse arrest, asynclitism; compound presentation, obstructed labor, cord prolapse and cord presentation.

The three major indications for cesarean section in the teaching hospitals were non-reassuring fetal heart rate pattern (NRFHRP), previous one cesarean section scar and cephalo-pelvic disproportion (CPD), each contributing to 126 (26.3%), 70 (14.6%), and 50(10.4%), respectively. The leading indications in the non-governmental hospitals were: previous one cesarean section 138 (29.7%), NRFHRP 83 (17.8%), and CPD 58 (12.5%). When the indication for the current cesarean section in women with previous one cesarean delivery further analyzed, 97 (70.1%) done in non-governmental hospitals, merely for one cesarean delivery compared to 17 (16.8%) in teaching hospitals, the difference was statistically significant, P<0.05. Maternal requests per se was responsible for 35 (7.5%) of the indications in non-governmental hospitals compared to nil in the teaching hospitals (Table 2).

When gestational age distribution is analyzed, the contributions of the unknown date and post-term were significantly different in the teaching hospitals compared to non-governmental hospitals 142 (29.6%) vs. 23 (4.9%) and 54 (11.3%) vs. 26 (5.6%) respectively, P<0.05 (Table 3). There is a statistically significant difference in the contribution of emergency cesarean section in the teaching hospitals compared to the non-governmental hospitals 413 (86.2%) and 290 (62.4%), P<0.05.

There is no significant difference in the choice of anesthesia between the study groups, with spinal anesthesia use of 48.7% vs. 51.3% in the teaching hospitals and non-governmental hospitals, the rest being general anesthesia. Lower uterine segment transverse incision was performed for all cases in both groups.

Table 3: **Reproductive characteristics of mothers by type of hospitals, A.A, Jan – Dec, 2011**

Variables	Teaching hospitals		Non-governmental hospitals		P-value
	Freq	%	Freq	%	
Parity					
Nulliparous	246	51.4	226	48.6	0.000
1-4	214	44.7	237	51	
≥5	19	4	2	0.4	
Total	479	100	465	100	
Gestational age					
Preterm	37	7.7	26	5.6	0.000
Term	246	51.4	390	83.9	
Post term	54	11.3	26	5.6	
Unknown data	142	29.6	23	4.9	
Total	479	100	465	100	
ANC status					
Yes	457	95.4	432	93	0.000
No	20	4.2	3	0.6	
Not documented	2	0.4	30	6.5	
Total	479	100	465	100	

Ampicillin as prophylaxis was used in the 417 (87.1%) of cases in the teaching hospitals, whereas, augmentin 151 (32.5%), ceftriaxone 147 (31.6%), and ceftriaxone with gentamycin 85 (18.5%) were the three most commonly prescribed prophylactic antibiotics in the non-governmental hospitals. Three dosing was used in most cases of both the teaching hospitals and non-governmental hospitals, 365 (76.2%) and 336 (72.3%), respectively. Though the exact time in relation to the incision time was not described, there is a statistically significant difference in the preoperative initiation of prophylactic antibiotics in the non-governmental hospitals compared to the teaching hospitals, 450(93.9%) and 156 (33.5%), P<0.05 (Table 4).

No significant difference was observed in the proportion of weight between 2500 gm – 3999 gm in both groups, 362 (78.5%) vs. 381 (81%), in teaching hospitals and non-governmental hospitals but the proportion of low birth weight and very low birth weight were significantly different in the teaching hospitals compared to non-governmental hospitals, 117 (22.1%) vs. 49 (10.1%) and 16 (3.1) vs. 3 (0.6%), P<0.05. The proportion of newborns with the first minute Apgar score of 4-6, 1-3, and the stillborn were significantly different in the teaching hospitals compared to the non-governmental hospitals; 55 (10.5%) vs. 12 (2.5%), 8 (1.5%) vs. 2 (0.41%), and 9 (1.7%) vs. 4(0.82%), respectively, P <0.05 (Table 5).

Table 4: **Type of antibiotics, total number of doses, & time of initiation by type of hospitals, AA, Jan-Dec, 2011**

Type of antibiotics	Teaching hospitals		Non-governmental hospitals		P-value
	Freq	%	Freq	%	
Ampicillin	417	87.1	73	15.7	0.000
Ceftriaxone	11	2.3	147	31.6	
Augmentin	-	-	151	32.5	
Ceftriaxone & gentamycin	1	0.2	85	18.5	
Ceftriaxone & metronidazole	50	10.4	-	-	
Augmentin & gentamycin	-	-	9	1.9	
Total	479	100	465	100	
Antibiotic dosage					
Single dose	55	11.5	24	5.2	0.000
Two dose	4	0.8	43	9.2	
Three dose	365	76.2	336	72.3	
48-72 hrs	2	0.4	60	12.9	
Therapeutic	53	11.1	2	0.4	
Total	479	100	465	100	
Time of initiation of antibiotics					
Preoperative	161	33.6	437	94	0.000
Postoperative	318	66.4	28	6	
Total	479	100	465	100	

Table 5: **Neonatal outcomes by type of hospitals, A.A, Jan – Dec, 2011**

Neonatal birth weight	Teaching hospitals		Non-governmental hospitals		P-value
	Freq	%	Freq	%	
1000-1499 gm	16	3.1	3	0.6	0.000
1500-2499 gm	117	22.4	49	10.1	
2500-3999 gm	362	69.3	381	78.9	
≥4000 gm	27	5.2	50	10.1	
Total	522	100	483	100	
1st minute APGAR score					
≥7	450	86.2	465	96.3	0.000
4-6	55	10.5	12	2.5	
0-3	6	1.4	-	-	
Still birth	9	2.1	4	0.9	
Total	522	100	483	1100	

The reported maternal morbidity rate was higher in government hospitals compared to non-governmental hospitals, 37 (7.7%) and 2 (0.4%), P<0.05, the common morbidities identified being, wound infection 17 (45.9%), puerperal sepsis 15 (40.5%), and post-partum hemorrhage 3 (8.1%). There were three maternal deaths reported in the teaching hospitals but none in the non-governmental hospitals during the study period. The post-operative hospital stay was 4-7 days in 75.4% of cases in the teaching hospitals as compared to 2 – 3 days and 24 hours in 66.2% and 33.3% of cases in the non-governmental hospitals (Table 6).

Table 6: **Maternal postoperative course by type of hospitals, A.A, Jan – Dec, 2011**

Postoperative course	Teaching hospitals		Non-governmental hospitals		P-value
	Freq	%	Freq	%	
Smooth postoperative course	439	91.6	463	99.6	0.000
Postoperative maternal	37	7.8	2	0.4	
Maternal death	3	0.6	-	-	
Total	479	100	465	100	
Days of hospital stay					
24 hrs	-	-	141	30.3	0.000
48-72 hrs	64	13.3	308	66.2	
4-7 days	361	75.4	13	2.8	
> 7 days	54	11.3	3	0.6	
Total	479	100	465	100	

Discussion

The cesarean delivery rate of 31.1% from public hospitals in our study is higher than the previous report from TASH and the national review report of the 15% and 18% cesarean rate in public hospitals and overall institutional rates, respectively (12, 14). This difference could possibly be explained by the fact that these selected hospitals serve as the main referral centers for most complicated pregnancies in the city and its vicinity. Contrary to this, the cesarean delivery rate in the private fee-for-service hospitals, 48.3%, found in our study is comparable to the 46% rate in private hospitals as shown in the national review report of 2011, but lower than the report from Chile, South Africa, and Brazil but higher than that of Eritrea (12, 15-17).

Some of the driving forces attributed to the increased caesarian delivery rate in other studies, like; the medically unnecessary indications such as maternal request, unfavorable cervix , poor intrauterine status, decreased trial of scar, failed induction are shown to operate in our set-up as well (10, 11, 15-17).

The 26.3% contribution of NRFHRP in government teaching hospitals shown in our study is similar to the earlier report from TASH but higher than the reports from other studies (4, 15). This is explained partly by the tendency to overlook the primary causes for NRFHRP, the use of crude methods for intra-partum fetal monitoring, and lack of facility for electronic fetal heart rate monitoring and fetal acid –base studies. The interesting finding in this study is that two of the private hospitals were found to use electronic fetal monitoring consistently, the practice to be acknowledged.

The significant contribution of previous one cesarean section as the leading indication in the non-government hospitals observed in our study is comparable to studies from South Africa. However, on further analysis of the repeat cesarean sections, three-fourth(70.1%)were performed merely for one previous cesarean, without considering other factors, which is significantly higher than the 46.8% report in private – fee – for service hospital from South Africa, seems to leave no room for VBAC (15, 16).

A primary cesarean section on maternal request of 7.5% found in our study in the non-governmental hospitals is similar to the 8.3% and 7% report from private sectors in South Africa and UK, and may reflect the socio – economic status of the subjects (middle and high) in the Non-governmental hospitals. This might reflect the rising trend of non-medical indications and medical malpractice which might contribute to the difference in cesarean section rate between governmental and non-government – fee – for service facilities within the country (6, 16).

The primary cesarean rate of 49.9% in both study groups is similar to the earlier report from TASH, but higher than the 36.7% report from Nigeria. This rate is unacceptably high because of the implication of cesarean section on the future reproductive performances of these groups of mothers, especially in societies where large family size is desired (14, 18).

A higher proportion of emergency cesarean section reported in the teaching government hospitals compared to the non-government hospitals in our study is similar to the studies from Eritrea, Nigeria, and TASH. This finding elucidates the fact that most cases who delivered in the government hospitals were referred cases from other health institutions that might have some obstetric complications requiring operative intervention. The elective cesarean rate of 37.4% in the non-government hospitals, though 2.7 times higher than the proportion in the teaching government hospitals, is lower than the 52.2% report in private hospitals from South Africa (14-16, 18).

Regional anesthesia was used at a very low rate in both study groups, spinal anesthesia in all cases, compared to higher rates reported from different countries. It is the preferred method because of its safety and simplicity (19-21). Such disparity could possibly be due to the urgency of the indications, availability of the drugs, the providers experience and preference.

The maternal morbidity and fetal wastage of 8% and 3.5% described in our study in the teaching public hospitals is significantly higher than the non-government hospitals. This is lower than the 20% and 12% from Jimma teaching hospital and the national review of cesarean delivery report for maternal morbidity and the 14% and 7.5% report for fetal wastage in a national review of cesarean delivery and the earlier study from TASH respectively. These could possibly be explained by the difference in primary objectives, as our study is focused primarily on outcomes of cesarean deliveries (12, 14, 22).

A primary cesarean delivery done on maternal request, failed induction, PMTC and a repeat cesarean section done merely for a previous one cesarean section contributed to the rising rates in the non-governmental hospitals. Therefore, a careful thought should be given when making the decision to perform a primary cesarean section and auditing of the cesarean deliveries could be considered as a strategy to curb the rising rates in the private sectors.

We recommend equipping the government hospitals with cardiotocography for continuous monitoring of labor and fetal condition especially for those with high risk pregnancies, as NRFHRP was the single most indication identified in this group. Developing of strategies to scale-up the use of regional anesthesia and national guideline for prophylactic antibiotic use for cesarean section based on contemporary evidences should be given due priority.

Though the national cesarean delivery rate in Ethiopia is far below the optimum recommendation by the World Health Organization, the situations in the studied institutions, especially the private sectors, is quite the opposite, and giving the false impression. Therefore, we recommend further studies to better understand the precise forces sustaining these trends of increased caesarian section rate in their broader context, and to develop appropriate policies and guidelines for performing and monitoring cesarean deliveries in the country. We further recommend improve recording in both teaching government and non-government hospitals, as some of the important sociodemographic factors, like, income and educational levels were missing in almost all records.

Acknowledgments

We would like to express our gratitude to the Addis Ababa City Administration Health Bureau for its timely response in writing a letter of cooperation to the non-governmental hospitals. Our heartfelt appreciation goes to the directors of the respective hospitals for allowing us to use the data. We would also like to thank the final year medical students of the Addis Ababa University School of Medicine, who assisted us in retrieving data from the delivery registry.

References

1. Todman D. A history of caesarean section: From ancient to the modern era. *Aust N Z J Obstet Gynecol* 2007;47:357-61.
2. Betrian AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, VanLook P, Wagner M. Rates of caesarean section: analysis of global, regional, and national estimates. *Paediatr Perinat Epidemiol* 2007;21(2):98-113.
3. Leung GM, Lam T, Thach TQ, Wan S, Ho LM. Rates of caesarean births in Hong Kong: 1987–1999. *Birth* 2001;28(3):166–72.
4. Guise JM, Hashima J, Osterweil P. Evidence-based vaginal birth after caesarean section. *Best Pract Res Clin Obstet Gynaecol* 2005;19(1):117–30.
5. Rosen M, Dickinson J. Vaginal birth after caesarean: a meta-analysis of morbidity and mortality. *Obstet Gynecol* 1991;77(3):465–70.
6. McMahon MJ, Luther E. Comparison of a trial of labor with an elective second caesarean section. *N Engl J Med* 1996;335(10): 689–95.
7. Wanyonyi S, Sequeira E, Obura T. Caesarean section rate and the Aga Jhan University hospital. *East Afri Med J* 2006;83(12):651-58.
8. Gomes UA, Silva AA, Bettiol H, Barbieri MA. Risk factors for increasing caesarean rate in Southeast Brazil: a comparison of two birth cohorts, 1978-1979 and 1994. *Int J Epidemiol* 1999;28:687-94.
9. Khawaja M, Jurdi R. Rising trends in Caesarian Section Rates in Egypt. *Birth* 2004;31(1):12-16.
10. Almeid S, Bettiol H, Silva A. Significant differences in caesarean section rates between a private and a public hospital in Brazil. *Cad Saude Publica* 2008;24:2909-18.
11. Souza JP, Gülmezoglu AM, Lumbiganon P, Laopaiboon M, Carroli G, Fawole B, et al. Caesarean section without medical indications is associated with an increased risk of adverse short-term maternal outcomes: the 2004-2008 WHO Global Survey on Maternal and Perinatal Health. *BMC Medicine* 2010;8:71.
12. Fisseha N, Getachew A, Hiluf M, Gebrehiwot Y, Baily P. A national review of caesarean delivery in Ethiopia. *Int J Gynaecol Obstet* 2011;115(1):106-11.
13. Macro ORC: Central Statistical Agency: Ethiopia Demographic and Health Survey 2011. Addis Ababa and Calverton; 2011.
14. Tadesse E, Adane M, Abiyou M. Caesarean section deliveries at TikurAnbessa Teaching Hospital, Ethiopia. *East Afr Med J* 1996;73(9):619-22.
15. Bereket S, Assefash Z. Caesarean section rates in private and public hospitals in Eritrea in 2007. *JAMA* 2009; 4.
16. Naidoo N, MoodleyJ. Rising rate of caesarean section – an audit of caesarean section in a specialty private practice. *SA Fam Pract* 2009;5 (3):254-58.
17. Belizan JM, Althabe F, Barros FC, Alexander S. Rates and implications of caesarean section in Latin America: Ecological study. *BMJ* 1999;319:1397–1400.
18. National Institute for Clinical Excellence (NICE). Clinical Guideline 13. Caesarean Section. London: NICE; 2004.
19. Ng K, Parsons J, Cyna AM, Middleton P. Spinal vs. epidural anaesthesia for C/S (Cochrane Review). *The Cochrane Database of Systematic Review* 2004; Issue 2.
20. Palanisamy A, Mitani AA, Tsen LC. General anaesthesia for caesarean delivery at a tertiary care hospital from 2000 to 2005; a retrospective analysis and 10-year update. *Int J Obstet Anesth* 2011;20:10-6.
21. Bucklin BA, Hawkins JL, Anderson JR, Ullrich FA. Obstetric anaesthesia workforce survey twenty-year update. *Anaesthesiology* 2005;103:645-53.
22. Ali Y. Analysis of caesarean delivery in Jimma Hospital, south-western Ethiopia. *East Afr Med J* 1995;72(1):60-3.