# A Review of Maternal Deaths at Douala General Hospital, Cameroon: The Referral System and Other Contributing Factors

**Gregory Edie Halle Ekane[1,2*], Fulbert George Nkwele Mangala[2], Thomas Egbe Obinchemti[1,2], Charlotte Tchuente Nguefack[2,3], Theophile Nana Njamen[1,2], Jacques Tsingaing Kamgaing[2] and Eugene Belley Priso[2,4]**

[1]*Department of Surgery and Obstetrics / Gynecology, Faculty of Health Sciences, University of Buea, Buea, Cameroon.*
[2]*Department of Obstetrics and Gynecology, Douala General Hospital, Douala, Cameroon.*
[3]*Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Douala, Cameroon.*
[4]*Faculty of Medicine, Pharmaceutical Sciences and Stomatology, University of Yaoundé 1, Cameroon.*

*Authors' contributions*

*This work was carried out in collaboration between all authors. Authors GEHE and FGNM did the study design and wrote the protocol and manuscript. Authors TEO, CTN, TNN, JTK and EBP did the statistical analysis, literature searches and managed some of the patients while analyses of study was by authors GEHE and FGNM. All authors read and approved the final manuscript.*

| *Original Research Article* |
|---|

## ABSTRACT

One of the objectives of the fifth Millennium Development Goal [MGD] is to decrease annually by 5.5% the maternal mortality so as to attain a three- quarter's reduction of the world's burden by the year 2015. The health care referral system has been shown to play an important role if this objective is to be attained. The aim of this study was to evaluate the referral system and other

---

*Corresponding author: Email: hallegregory@yahoo.fr;*

contributing factors to maternal deaths. This was a retrospective, descriptive study carried out in the Douala General Hospital, a tertiary referral hospital in Douala, Cameroon.  The records of cases of maternal deaths that occurred between 1st January, 2002 and 31st December, 2011 were reviewed. Patients who died on arrival at the hospital were excluded from the study.  Data was collected using pre-structured questionnaire and analyzed with EPI-Info version 3.5.1. There were 25 maternal deaths during this period with a maternal mortality ratio of 275 per 100.000 live births.  Sixteen (64%) maternal deaths were referred cases from; government health institutions 4 (25%) and private 12 (75%) hospitals in Douala. Most of the patients were between 30-40 years 12 (48%), married 17 (68%), primigravida 12 (48%). The triad of hemorrhage 12 (48%), hypertensive disease in pregnancy 10 (40%) and infection 3 (12%) was responsible for the maternal deaths. Using two indicators to evaluate the referral system, it was observed that only 3 (18, 8%) exploited the referral information system and barely 4(25 %) were transported to the hospital by an ambulance. Maternal mortality remains high in our setting. Most of the causes of maternal death are due to direct obstetric causes which are preventable. The role of referral system in providing health care is poor. Therefore, this aspect of providing health care has to be properly implemented if it is to make an impact in reducing maternal morbidity and mortality.

## 1. INTRODUCTION

Maternal deaths and disabilities are leading contributors in women's disease burden with an estimated 275,000 women dying each year in childbirth and pregnancy worldwide [1]. These deaths and morbidities can be attributable to factors that occur separately or in combination [2].

In Cameroon, the maternal mortality ratios were 669 and 690 per 100.000 live births in 2004 and 2010 respectively [3,4]. This evolution of maternal mortality ratio in Cameroon doesn't tie with the programs at the national level and worldwide in view of decreasing maternal deaths [5].

It has been shown that a substantial reduction of the maternal mortality can be achieved by implementing a good system of referral in the provision of health care [6]. However, the existence and follow-up of the effectiveness of a system of this nature with its prerequisites remains a challenge in a low income country like Cameroon. The aim of this study was to have an overview in every case of a maternal death that occurred during the period of study, the contributory role of the referral system and other factors.

## 2. METHODS

### 2.1 Study Area

This was a retrospective descriptive study that reviewed cases of maternal death that occurred between 1st January, 2002 and 31st December, 2011 in the Douala General Hospital (DGH), Cameroon. This tertiary hospital serves as a referral centre for Douala with a population 3 million and the Central African sub Region. It has facilities and trained personnel for critically ill patients. It's 0bstetric and Gynaecology department has 6 obstetrician-gynaecologists, a 40 bed capacity, two surgical theatres with an average of 1100 deliveries annually.

### 2.2 Data Collection and Management

All registers of the obstetrics and gynaecology, intensive care, general and emergencies services of the DGH were reviewed and cases notes of maternal deaths were identified in the archives. Those that fulfilled the recruitment criteria were subsequently considered for review. Case files of patients who died on arrival at the emergency department were excluded.

From the files obtained from the aforementioned services that fulfilled the inclusion criteria, data were collected using a pretested structured questionnaire. Information was obtained on the following variables; socio-demographic characteristics, follow-up of pregnancy, sequence of the events and actions preceding the death and probable cause(s) of maternal death. Furthermore, information was also obtained on the modes and conditions of transfer of the patients referred to the hospital, continuation of management of the condition that prompted referral and content of referral letter when available.

The data were entered using EPI Info version 3.5.1 (CDC/WHO, Atlanta, USA) and systematically checked for errors during data entry by using legal values and specified ranges in Epi-info. In addition, 50% of the questionnaires were doubled-checked by a co-investigator, different from the original data entry person. Prior to proper analysis, the frequencies and ranges of every variable were verified for consistency with the study population. Three maternal deaths that occurred before arrival of the patients at the emergency service were excluded from analysis. Data were analyzed with EPI info version 3.5.1. For descriptive analysis of socio-demographic data quantitative variables were summaries by means and standard deviations, categorical ones by proportions.

## 2.3 Limitation of Study

This being a retrospective study meant that important information on the causes of maternal death were missing in some case files. The small number of maternal deaths did not permit an exhaustive review or a comparative analysis between the referred and non-referred patients to help elucidate whether the cause of death was linked mainly to referral and not to contributory factors like management protocols in the hospital.

## 3. RESULTS

## 3.1 Maternal Mortality

During the study period, there were 9104 live births in DGH. Twenty-five maternal deaths occurred during the same period giving a maternal mortality ratio of 275 per 100, 000 live births. There was much variability in the annual maternal death toll, no maternal death occurred in 2007. The maximum number of maternal deaths was recorded in 2010 (Fig. 1).

## 3.2 Socio-demographic and Obstetric Characteristics

Seventeen (68%) patients were married women. Concerning the level of education, 21 (84%) of the women had at least a secondary level and none of the patients was illiterate. The age group of 30-40 years recorded 12 (48%) maternal deaths. Nine (36%) deceased patients' initial treatment was pre-financed by the hospital. Other socio-demographic characteristics are shown in (Table 2).

The majority of the patients 12 (48%) were at their first pregnancy. Nine (36%) of the twelve nulliparous patients had intrauterine foetal death during current pregnancy. The two others died from abortion related complications. Fourteen (56%) reviewed left orphans (Table 2).

Two patients (8%) had pneumonia and pyelonephritis during their present pregnancy. Six (12%) of the deceased patients were Rhesus negative. Twenty-two (88%) maternal deaths occurred during the third trimester of pregnancies.
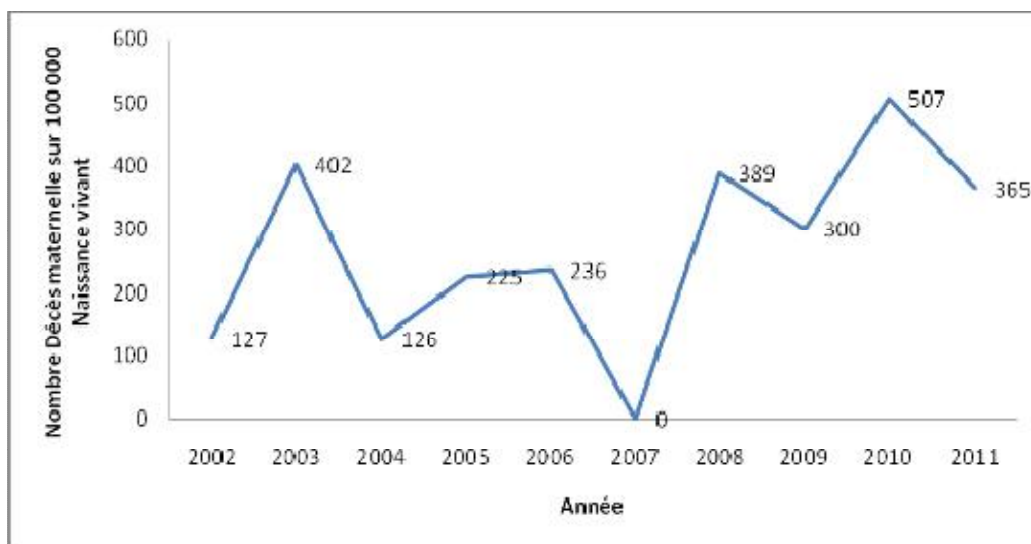


**Fig. 1. Yearly maternal mortality ratio at the DGH**

## 3.3 Causes of Maternal Deaths

The causes of maternal mortality in the DGH were haemorrhage 12(48%), complications of hypertensive diseases in pregnancy 10 (40%) and infections 3 (12%) (Fig. 2 and Table 3).
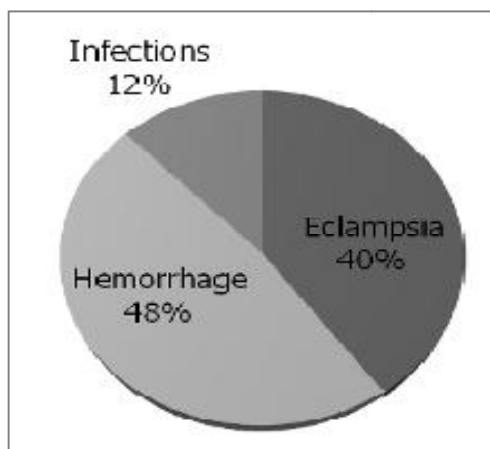


**Fig. 2. Causes of maternal deaths in DGH**

Among those patients who died as a result of haemorrhage, 6 (50%) had a coagulopathy secondary to PPH and abruptio placenta, while 6 (50%) others were due uterine atony 2 (16.7%), retention of placenta secondary to placenta accreta and on a molar pregnancy 2 (16.7%), uterine rupture 1(8.3) and placenta praevia 1(8, 3%). Eight of the twenty five cases died of renal insufficiency after eclampsia.

## 3.4 Referral of Patients

Sixteen (64%) of the deceased patients had been referred by other health institutions in Douala or from the neighbouring cities (Table 2). Of the 16 referred patients, three were from government health institutions, 13 from 9 private health facilities among which five were authorized health facilities and 4 unauthorized at the level of the health districts concerned.

Of the 14 referred patients who had prenatal consultations, 6(42.9%) were by nurses. The majority however, had their antenatal visits and evaluation in health centres or clinics. Nine patients (64.3%) did not undergo the minimum of the four antenatal evaluations recommended by W.H.O (Table 4). One patient had been referred for a high risk pregnancy; the others were all emergency referrals (Table 4).

Twelve (75%) of the referred patients had not been transferred to the Douala General hospital by ambulance. Furthermore, none of the patients received any form of treatment during their transfers even the 4 (25%) that were transported by ambulance (Table 5).

## 3.5 Delay in Referral, Management on Arrival and between Arrival to Death

Seven patients (43.8%) out of 16 arrived the DGH in the first 6 hours from the moment the decision for referral was made, 7 (43.8%) others arrived between the sixth hour and the twenty fourth, while 2 (12.4%) arrived after 24 hours.

All the deceased patients were treated on arrival as there are no financial barriers as a prerequisite for treatment in cases of emergencies in DGH. Eight (50%) maternal deaths occurred beyond 24hours after admission of the patients in one of the aforementioned services after referral.

Four of the six indicators used to assess the efficiency of the referral system (initial communication, adequacy of the initial management, existence of the letters of counter referral and monitoring of the referring structures) were not exploited by the referring health facilities and the DGH. For the two other indicators used, only 3 (18, 8%) exploited the information available before referral while only 4 (25%) used the ambulance services (Table 5).

## 4. DISCUSSION

### 4.1 Maternal Deaths

The maternal mortality ratio (MMR) was 275 per 100,000 live births in DGH. This ratio is lower than those found during the demographic health surveys of 2004 and 2011 were maternal mortality ratio were 669 and 876 per 100,000 live births respectively [3,7]. Most maternal deaths in our study population occurred in 2010 (MMR of 507 per 100,000 live births) but this figure remains lower those cited in recent studies in Cameroon [8-10]. Our MMR are also lower than those obtained in similar tertiary hospitals in Cameroon and other Africans countries [11,12]. However, a long strive has to be made when MMR in our setting is compared with that documented in Egypt. This country is now considered an African model concerning the fight against maternal mortality with a ratio of 45/100,000 live births in 2008 [3].

**Table 1. Socio-demographic characteristics of deceased patients 2002 to 2011 at DGH**

| Variables | Categories | Number | Frequency (%) |
|---|---|---|---|
| Matrimonial status | Single | 8 | 32 |
| | Married | 17 | 68 |
| Total | | 25 | 100 |
| Level of education | Primary | 4 | 16 |
| | Secondary | 10 | 40 |
| | University | 11 | 44 |
| Total | | 25 | 100 |
| Women's profession | Merchant | 3 | 12 |
| | Student | 7 | 28 |
| | Private Employee | 7 | 28 |
| | Civil servant | 3 | 12 |
| | Housewife | 5 | 20 |
| Total | | 25 | 100 |
| Modality of payment | Insurer interested party | 4 | 16 |
| | Emergency cash voucher (unpaid) | 5 | 20 |
| | Emergency cash voucher (paid) | 4 | 16 |
| | Cash prepaid | 12 | 48 |
| Total | | 25 | 100 |
| Age ranges (years) | ≤19 | 3 | 12 |
| | 20-29 | 8 | 32 |
| | 30-40 | 12 | 48 |
| | >40 | 2 | 8 |
| Total | | 25 | 100 |

**Table 2. Clinical characteristics of deceased pregnant women at DGH**

| Variable | Categories | Number | Frequency (%) |
|---|---|---|---|
| Gravidity | 1 | 12 | 48 |
| | 2- 5 | 11 | 44 |
| | > 5 | 2 | 8 |
| Total | | 25 | 100 |
| Parity | 0- 1 | 15 | 60 |
| | 2 à 5 | 10 | 40 |
| | >5 | 00 | 00 |
| Total | | 25 | 100 |
| Number of living children | 0 | 11 | 44 |
| | 1- 2 | 6 | 26 |
| | ≥3 | 8 | 30 |
| Total | | 25 | 100 |
| Existence of underlying pathologies | Yes | 2 | 8 |
| | No | 23 | 92 |
| Total | | 25 | 100 |
| Rhesus factor | Positif | 22 | 88 |
| | Negative | 3 | 12 |
| Total | | 25 | 100 |
| Was the patient referred | Yes | 16 | 64 |
| | No | 9 | 36 |
| Total | | 25 | 100 |
| Age of pregnancy at death | < 28 | 3 | 12 |
| | 28-36 | 10 | 40 |
| | ≥37 | 12 | 48 |
| Total | | 25 | 100 |

**Table 3. Frequencies of the aetiologies of maternal death in DGH**

| Direct causes | Specific causes | Number | Frequency (%) |
|---|---|---|---|
| Haemorrhage | Coagulopathy (secondary to Abruptio/PPH) | 6 | 50 |
| | Uterine atony | 2 | 16,7 |
| | Placenta retention* | 2 | 16,7 |
| | Uterine rupture | 1 | 8,3 |
| | Placenta prævia | 1 | 8,3 |
| Total | | 12 (48%) | 100 |
| Infection | Post-abortum infection | 2 | 66,7 |
| | Post-partum infection | 1 | 33,3 |
| Total | | 3 (12%) | 12 |
| Eclampsia | Renal failure | 8 | 80 |
| | CVA | 1 | 10 |
| | APO | 1 | 10 |
| Total | | 10 (40%) | 40 |

*\* Placenta accreta plus molar pregnancy; CVA = Cerebro-vascular accident;*
*APO = Acute pulmonary oedema*

**Table 4. Clinical characteristics of referred patients to DGH**

| Variable | Categories | Number | Frequency (%) |
|---|---|---|---|
| ANC consultation | Yes | 14 | 87,5 |
| | No | 2 | 12,5 |
| | Convulsions | 7 | 43,8 |
| | Vaginal bleeding | 5 | 31,3 |
| | Hypertension | 4 | 25,0 |
| Reason for consultation | Infection | 3 | 18,8 |
| | Intrauterine foetal death | 2 | 12,5 |
| | renal Insufficiency | 1 | 6,3 |
| | High risk pregnancy | 1 | 6,3 |
| *Provider of ANC | Gynaecologist/obstetrician | 4 | 28,6 |
| | General practitioner | 4 | 28,6 |
| | Nurse | 6 | 42,9 |
| | General practitioner/Nurse | 2 | 14,3 |
| *Site of ANC | Private Clinic | 5 | 35,7 |
| | Dispensary/health Centre | 6 | 42,9 |
| | House | 1 | 7,1 |
| *Number of ANC | <4 | 9 | 64,3 |
| | ≥4 | 5 | 35,7 |

**Table 5. Appreciation of the indicators of the system of referral and counter referral**

| Indicators of referral system | Yes | % | No | (%) |
|---|---|---|---|---|
| Initial communication | 0 | 0 | 16 | 100 |
| Adequacy of initial management | 0 | 0 | 16 | 100 |
| Exploitation of information in referral letter | 3 | 18,8 | 13 | 81,2 |
| Transportation by ambulance | 4 | 25 | 12 | 75 |
| Existence of letters of counter referral | 0 | 0 | 16 | 100 |
| Monitoring of referring structures | 0 | 0 | 16 | 100 |

The years 2007 and 2010 are peculiar in our study because the MMR reached it's peak (507/100,000 live births) during this period. A possible explanation for this marked increase in the MMR, was the drastic drop in the number of anaesthetists and specialists in emergency medicine who left the hospital for academic or administrative reasons. Since most of the patients who had severe complications in pregnancy or in the immediate postpartum period were managed in the intensive care unit, it can be readily understood why the lack of trained

staff during this period resulted in an increase MMR.

## 4.2 Socio-demographic and Obstetric Characteristics

Patients' mean age was 33, 1 years (SD 3.4). This age range is superior to the 28,2 years reported by Fomulu et al. [9] in CHUY and 30,8 years by Kouatchouang at Hopital Laquantinie Douala (HLD) in 2011[10].

Teenage and pregnancies in patients above 40 years constituted 20% of the maternal deaths. The greatest number of deaths 12(48%) occurred in the 30-40 year age group. These values are different from those obtained during the national demographic survey in 2011 where extreme ages (<19 and >40 years) and women between 30-40 years constituted 46, 9% and 39, 9% of maternal deaths respectively [7].

Sixty eight percent of deceased patients were married. This finding differs from that of Nafissatou in his study in Hopital General de Yaoundé (HGY) were 71, 4% of the deceased were unmarried [8]. Like Nafissatou [8] most studies in Africa reveal that, the risk of maternal mortality in the unmarried woman is higher because of her psychological and financial instability [13]. Our findings were probably due to selection bias because this DGH is not readily accessible to patients of a low socio-economic status on the erroneous basis that it is too expensive.

Eighty four percent of the patients who died had at least a secondary school level of education. This value is a paradox in comparison to most surveys which show that the maternal death is greatest in the uneducated woman [8,9]. According to the latter, education allows the woman to have a greater spending power and is better informed on the management of their pregnancy. The association between and the level of education was not analysed in our study. However, 44% of deceased patients were well educated while 48% were either students or uneducated housewives. In the latter group, their social status probably didn't allow them to have any substantial economic independence, so they probably had to rely on their partners and family members before seeking medical assistance.

Concerning the mode of payment, 9 (36%) of the patients needed an emergency voucher from the hospital to have access to the first line of treatment, while 4 (16%) were insured (Table 1). The necessity of a system of mutualisation and financing of care is certainly an aspect to improve in the fight against maternal mortality. This is documented in Huntington et al study [14], where the allowance and the better management of the finances allocated to the maternities of the province of Sorgon in Philippine improved on the MMR compared to the neighbouring provinces where this facility did not exist.

## 4.3 Causes of Maternal Deaths

Direct obstetric causes were responsible for all the maternal deaths in our study population. In similar studies in Cameroon, direct causes of maternal deaths were documented in 75% - 89, 7% of cases [9,10,15].

Haemorrhage was the first cause of maternal death in 12 (48%) patients. This is lower than 56,4% in Fomulu et al. [9] study in CHUY, higher as compared to 32% in South Asian study by Aurin et al. [16]. However it is similar to 51% by Keita and Hizozy in Donka, Guinea [17].

As shown in Table 3, in the majority of cases that culminated with coagulopathies 6 (50%), this was due to poor management like; underestimation of blood loss, delayed diagnosis of placenta retention, lack of platelet concentrates and fresh frozen plasma. This poses the problem of the follow-up, assessment of the basic obstetric care and a functional blood bank which are the essential aspects in the management of post-partum haemorrhage.

Hypertensive disorders in pregnancy especially when complicated by eclampsia were responsible for 40% of maternal death in our survey, unlike in a study carried out in South Asia where it was the second cause of maternal deaths in 17% of cases [16]. On the contrary, Fomulu et al. [9] found that it was the third direct obstetric cause of maternal mortality after infection in 15,4% of deceased patients.

Infections were the third cause of deaths in 3(12%) patients, 2(8%) died from abortion related complications. This value is close to the one reported in South Asia (9%), but lower than 13% reported in low income countries [18]. Therefore, putting in place appropriate management strategies for abortion related complications will reduce maternal morbidity and mortality.

In our survey, we did not find indirect causes of maternal deaths contrary to similar studies where these accounted for 10,3% - 25% of maternal deaths [10,16,17]. This is because all the cases were obstetric emergencies. The notion of indirect and direct causes of maternal mortality deserves to be reviewed. Indeed from the remarks of a committee that reviewed the WHO classification of the maternal morbidity and mortality in 2009 [2] and in comparison to the article published lately by a team from the centre of maternity and neonatology in Tunisia [18], it is evident that it would be necessary in addition to the direct and indirect reasons, to take into consideration, a third group which is the unforeseen complications of the management or the iatrogenic causes of maternal deaths. In our study, we identified a case where complications developed due to the management strategies used, this in addition to the direct cause contributed to the death of the patient. We were therefore not able to dissociate these complications from the initial direct cause and give an appropriate classification. This explains why all our cases of maternal deaths were considered as being due to direct causes.

### 4.4 Referral of Patients

Sixty four percent of the deceased patients had been referred from health institutions in Douala and the neighbouring towns (Table 2). Twelve (75%) patients were referred from private health institutions. This predominance of referred patients from private health institutions was reported by Kouatchouang [10] at the HLD where they constituted 60% of cases in the same city. In our survey four of these nine health institutions were not legalised health facilities in the District health service. This raises the question of the still unclarified situation of the creation and the functioning of the health centres in the city of Douala, Cameroon where there is a plethora of 'health facilities' which carry out unauthorized curative health activities that account for an important percentage of late referrals in moribund state or who died before arriving the emergency service.

Among the deceased referred patients, 87, 5% had a document showing that they had some form of antenatal care. However, this antenatal care was provided in 42, 9% of cases by mainly nurses and 28, 6% by general practitioners (Table 4). One of the most important principles of a prenatal consultation is its quality. If a good number of our patients referred came from

unconventional centres (four out of the nine health institutions), it was difficult for us to appreciate whether the norms were respected by the practitioners in these centres. Nevertheless, we noted that 64, 3% of the patients had less than four recommended antenatal visits. This is indicative of the quality of care these patients received. This suboptimal care could be attributed to patients' non respect for appointments or providers' competence in evaluating the risks factors to permit timely referral.

Vangeenderhuysen et al. [19] reported that the risk of mortality is 14 times higher in patients referred to tertiary because these are the most serious cases of the city and its vicinities. However, it is clear that the time decision taken to refer, lack of good surveillance of labour and non-use of partographs in good number of health institutions [9,13] and conditions of transfer which did not respect the norms in our study worsened the prognosis of these patients on arrival. Most of our patients 12 (75%) resorted to the public transportation after referral, implying that there was no adequate care during the transfer. Nine (56.3%) patients arrived DGH more than six hours after the decision to transfer was taken probably because of the difficulties the families or those assisting them had in organising for transportation.

Independent of their financial status, all our deceased referred patients were managed on arrival. However, lateness in management was often attributed to the lack of finances in other studies [10], but this assertion cannot be justified in our case where patients could be managed as emergencies and be allowed to pay their bills subsequently. It certainly explains why in most studies [10,11,17], the referred patients died in the first three hours unlike 50% of maternal deaths that occurred 24 hours after admission in our hospital (Fig. 3). The technical facilities that are available in the DGH, it being a tertiary centre rated among the best in Cameroon could also account for this finding.

### 4.5 Management of Referred Patients

None of the four indicators used to evaluate the system of referral [6]; communication, adequacy of initial management, exploitation of information and monitoring of the referring health institutions was used as a guiding principle for better management in all cases that culminated in a maternal death (Table 5). This highlights the
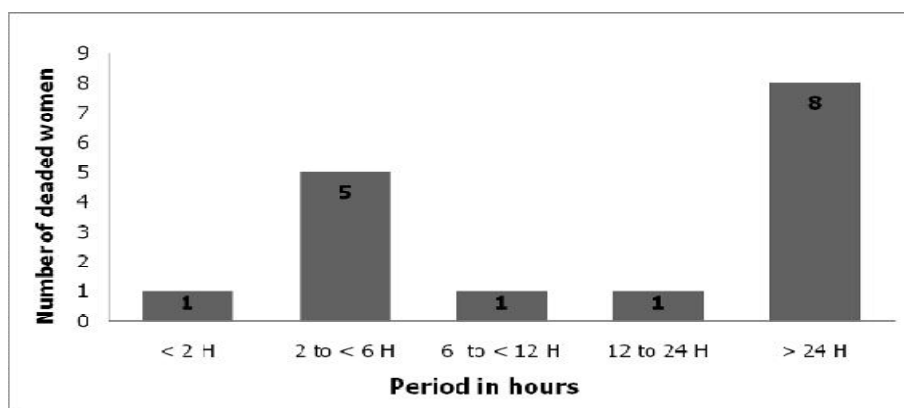
**Fig. 3. Time between arrival and death of referred patients at the DGH**

problem of effective monitoring of the neighbouring first category hospitals and health centres in our health system. Indeed, although recommended, the implementation and assessment of the activities of the district hospitals and other health institutions by the tertiary hospitals has not been effective. It partly explains the lack of coordination as regards the timing of referral of patients and their subsequent management thus culminating in an increase maternal morbidity and mortality.

## 5. CONCLUSION

The maternal mortality ratio at the DGH is low when compared to other tertiary institutions in the country. However, it remains high if the objectives of the fifth MDG are to be attained. The triad of haemorrhage, hypertensive disorders in pregnancy and infection were the causes of maternal death. The referral system is non-functional between peripheral structures of lower categories and DGH. There is need for an indebt evaluation of the referral system in our health system between first category and tertiary hospitals. The improvement of the system of collection of blood and its derivatives for transfusion and their utilisation as most maternal deaths are caused by haemorrhage. Furthermore, appropriate management strategies should be put in place to decrease mortality associated with infections and hypertensive disorders in pregnancy. There is need in setting up of commissions of maternal mortality audit and the implementation of their resolutions.

## ETHICAL ISSUES

Ethical approval and administrative clearance for the study were obtained from the ethical committee of the Douala General hospital and the medical directors of the referring hospitals.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Koblinsky M, Chowdhury ME, Moran A, Ronsmans C. Maternal morbidity and disability and their consequences: Neglected Agenda in Maternal Health. J Health Popul Nutr. 2012;30(2):124–130.
2. UNFA. Maternal mortality: 2002 Update in 2003.Available:apps.who.int/gb/archive/PDF files/EB117/B117_13-fr.pdf (Accessed 16/04/2014)
3. Regional Conference on Safe Motherhood for Francophone Africa South of the Sahara. Available:www-s.worldbank.org/external/default/WDSContentServer/WDSP/IB/2000/04/05/000/17 (Accessed 16/04/2014).
4. Maternal Mortality in 2005. Estimates developed by WHO, UNICEF, UNFPA and World Bank. 2007;2-241997:23-33
5. United Nations. The Millennium Development Goals Report. Available:www.un.org/millenniumgoals (Accessed 16/04/2014)
6. Susan F, Sarah D, Rosemary KP, Yusuf A. Tools for monitoring the effectiveness of district maternal referral system. Health Policy and Planning. 2001;16(4):353-361.
7. Institut National de la Statistique (INS) et ICF. Demographic and health survey and

multiple indicator of Cameroon in 2011. Calverton, Maryland, USA: International; 2011.

8. Naffissatou AB. Maternal mortality at the Yaounde general hospital: Retrospective study 1996-2005. MD Thèse, Université de Yaoundé 1, Faculté de Médicine et Science Biomédicale; 2013.

9. Fomulu JN, Tchana TM, Nana NP, Mbu R, Kasia JM. Maternal mortality at the Yaounde general hospital: Retrospective study of five years (2002-2006).Health Sciences and Dis. 2008;10(1):86-92.

10. Kouatchouang F. Maternal mortality in hospital in Douala Laquintinie January 2006-May 2012. MD Thèse: Université de Douala, Faculté de Médicine et Sciences Pharmaceutique. 2013.

11. Horo A, Toure-Ecra F, Mohamed, Adjoussou S, Kone M. Dysfunction and maternal mortality analysis of 35 cases in the maternity of the CHU of Yopougon (Abidjan, Ivory Coast). Médecine d'Afrique noire.
Available:www.cat.inist.fr/?aModele=affich eN&cpsidt=20781578
(Accessed 24/04/2014).

12. Wright EA and Disu FR. Maternal mortality in Jos university teaching hospital. Nig Med Pract. 1988;15(3):57-59.

13. Lena VC. Maternal mortality at the Queen Elisabeth central teaching hospital. Blantyre, Malawi. East African Medical Journal. 2005;82:1.

14. Huntington D, Banzon E, Zenaida DR. System approach to improving maternal health in Philippines. Bull World heath Organ. 2012;90(104):110.

15. Nkemayang F. Maternal mortality: A year by year analysis of the causes of maternal death over a period of five years at the central maternity –Yaoundé. MD Thèse, Université de Yaoundé 1, Faculté de Médicine et Science Biomédicale; 2012.

16. Celia SA, et al. Maternal, neonatal and child health in south East Asia: towards great regional collaboration Lancet. 2011; 377:516-25.

17. Keita N, Hizozy Y. Study of maternal mortality at Donka hospital (Conakry Guinea). J Gynecol Obstet Biol Reprod. 1986;18:849-855.

18. Dellagi RT, Belgacem I, Hamrouni M, Zouari B. Evaluation of the maternal mortality surveillance system in public facilities in Tunisia (1999-2004). East Mediterr Health J. 2008;14(6):1380-90.

19. Vangeenderhuysen C, Banos JP, Mahaman T. Preventable maternal mortality in urban areas in Niamey (Niger). Cahiers d'études et de recherches francophones / Santé. 1995;5(1):49-54.