

Factors contributing to maternal mortality in relatively resource-endowed urban contexts of developing countries: the case of Nairobi, Kenya

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Abstract

This paper examines factors contributing to maternal mortality in Nairobi County of Kenya. Data are from a study that involved a review of 93 records of maternal deaths at health facilities as well as verbal and social autopsy interviews with 71 caregivers of women who died of maternal-related causes in the community. Results showed that most maternal deaths occurred to women who were young, married, with low levels of education and those having at least two births. In addition, maternal deaths in the County were mostly due to poor health-seeking behaviour, delays at the household level in seeking care, poor referral mechanisms between facilities, poor provider attitudes, and lack of skilled human resources. The findings suggest that programs aimed at improving maternal health in the County need to focus on empowering households to recognize danger signs early, improving referral mechanisms, and enhancing the capacity of providers to offer quality services.

Keywords: Maternal mortality; contributing factors; urban contexts; developing countries; Kenya

Résumé

Ce papier examine les facteurs qui contribuent à la mortalité maternelle dans le comté de Nairobi au Kenya. Les données proviennent d'une étude qui a procédé à une revue de 93 dossiers de décès maternels survenus dans les établissements de santé ainsi que sur des entretiens d'autopsie verbale et sociale auprès de 71 personnels soignant ayant traité des femmes qui sont mortes de causes maternelles au sein de la communauté. Les résultats ont montré que la plupart des décès maternels sont survenus chez des femmes jeunes, mariées, avec de faibles niveaux d'éducation et ayant eu au moins deux naissances. En outre, les décès maternels dans le comté étaient pour la plupart liés à des comportements inadéquats de recherche de soins, au retard dans la recherche de soins au niveau des ménages, au système d'orientation-recours inefficaces entre les établissements, aux attitudes inappropriées des prestataires, et au manque de ressources humaines qualifiées. Les résultats suggèrent que les programmes visant à améliorer la santé maternelle dans le comté devraient se focaliser sur la capacitation des ménages à reconnaître de façon précoce les signes de danger, sur l'amélioration des mécanismes de référence et le renforcement des prestataires à offrir des services de qualité.

Mots-clés: Mortalité maternelle; facteurs contributifs; contextes urbains; pays en voie de développement; Kenya

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Introduction

Maternal mortality refers to deaths to women during pregnancy, childbirth or within 42 days following delivery (Hogan *et al.* 2010). However, maternal deaths are mostly clustered around labour, delivery, and the immediate postpartum period (Ronsmans and Graham 2006). Maternal deaths also largely result from preventable causes including haemorrhage, hypertensive disorders, sepsis, eclampsia, HIV, obstructed labour and unsafe abortion (Goodburn and Campbell 2001; Khan *et al.* 2006; Ziraba *et al.* 2009a). Some of the most cost-effective interventions to prevent maternal deaths in developing countries include the provision of antenatal care (including tetanus toxoid vaccination, screening for pre-eclampsia, as well as screening and treatment of asymptomatic bacteriuria and syphilis); skilled attendance during delivery; provision of postnatal care services; and emergency obstetric care in case of complications (Adam *et al.* 2005). These interventions require a well-functioning health care system that ensures that appropriate services are available, accessible, and of good quality (Goodburn and Campbell 2001). However, well-functioning health care systems are virtually non-existent in many developing countries and this has contributed to persistent high levels of maternal mortality in these regions (Goodburn and Campbell 2001; Rogo *et al.* 2001; World Health Organization [WHO] 2014).

Besides a well-functioning health care system, health-seeking behaviours are also important for the prevention of maternal deaths. Studies have, for instance, shown wide socio-economic, demographic and regional variations in the use of maternal health care services in developing countries (Magadi *et al.* 2003, 2007; Say and Raine 2007). In Kenya, for instance, studies have found low use of maternal health services among the poor in urban areas, those living in rural areas, young women, those whose pregnancies were unintended, those with low levels of education, and those of higher parity (Fotso *et al.* 2008, 2009; Magadi 2004; Magadi *et al.* 2000, 2001; Rogo *et al.* 2001). Health-seeking behaviours are further shaped by a number of factors including available household resources, ineffective decision-making at the household level, distance to care, and perceived quality of care at health facilities (Audo *et al.* 2005; Essendi *et al.* 2010; Kyomuhendo 2003; Montagu *et al.* 2011). These factors may exacerbate poor health-seeking practices especially in settings that lack proper functioning health care systems.

Studies further show that urban women in many developing countries have better access to maternal health care services and have better health indicators compared to their rural counterparts, a factor that has been attributed to greater availability of services

in urban than in rural areas (Matthews *et al.* 2010; Ronsmans *et al.* 2003; Say and Raine 2007; Tawiah 2011). However, the so-called “urban advantage” masks disparities in access to maternal health care services and health outcomes within urban settings. There is a growing body of literature that shows wide disparities in maternal health care utilization and health outcomes between the urban poor and non-poor in many developing countries (APHRC 2014; Essendi *et al.* 2010; Fotso *et al.* 2008; Magadi *et al.* 2003; Magadi 2004; Ziraba *et al.* 2009a). In addition, studies show that the urban poor do not have better access to maternal health care despite having greater proximity to services compared to their rural counterparts (Fotso *et al.*, 2008; Ziraba *et al.* 2009b). These disparities imply that maternal mortality in urban settings may be higher than what it should be if there was equitable access to services. In addition, given the greater availability of maternal health care services in such settings, it is likely that the factors contributing to maternal mortality are different compared to rural areas. There is, however, limited understanding of the factors contributing to maternal mortality in relatively resource-endowed urban settings of developing countries.

This paper examines the health-seeking and facility-level factors contributing to maternal mortality in Nairobi County of Kenya. The paper was informed by a number of factors. First, Kenya adopted a new constitution in 2010 that outlined a system of government comprising the national and county governments (Republic of Kenya 2010). With devolution, some key functions that were previously performed by the national government were transferred to counties. The devolved system of government has necessitated the need for county-level indicators in order to inform planning and programming at the devolved units. Second, the 2009 Kenya Population and Housing Census showed that Nairobi was among the 15 counties with a high burden of maternal deaths in the country although it has historically been the most favoured in terms of allocation of resources compared to other urban or rural areas given that it is the capital city (Otiso 2005). For example, major health facilities are located in the County including public referral hospitals and private outlets. In addition, although the County is entirely urban, it is estimated that between 60% and 70% of its population live in informal settlements which are characterised by poor access to health care services (APHCR 2014). The County therefore presents an interesting opportunity to examine factors contributing to maternal mortality given its unique setting.

Study Context

Sub-Saharan Africa experiences the highest levels of maternal deaths compared to other developing regions of the world. As of 2013, for instance, it was estimated that the maternal mortality ratio (MMR) in the region was 510 maternal deaths per 100,000 live births, which was much higher than the levels recorded in Asia and Latin America (WHO 2014). There were, however, wide variations in maternal mortality levels in the region ranging from 73 maternal deaths per 100,000 live births in Mauritius to 1,100 maternal deaths per 100,000 live births in Sierra Leone (WHO 2014). In Kenya, the maternal mortality ratio remained at over 400 maternal deaths per 100,000 live births during the 2000 – 2010 decade (Central Bureau of Statistics [CBS] *et al.* 2004; Kenya National Bureau of Statistics [KNBS] and ICF Macro 2010; WHO 2014).

Over the years, the Government of Kenya initiated a number of strategies aimed at improving maternal health, reducing maternal mortality and morbidity, and achieving the Millennium Development Goals (MDG) related to maternal health. For instance, the Government adapted the focused antenatal care (FANC) package that was developed by WHO with the aim of promoting interventions that address health issues of mothers and newborns (Birungi and Onyango-Ouma 2006). The Government further established the Health Sector Services Fund (HSSF) in 2005 as part of its ongoing health sector reforms to improve the delivery of essential health services by providing direct cash transfers to health facilities (Opwora *et al.* 2010). In 2006, the government began implementing an output-based aid reproductive health vouchers program aimed at enabling economically disadvantaged women to access essential reproductive health services (EPOS Health Management 2011; Hagenmeyer *et al.* 2005; PricewaterhouseCoopers 2008). In 2011, the Government initiated the performance-based finance (PBF) as one of the strategies to improve coverage and quality of health services through results-focused and motivated health workforce. In 2013, the Government abolished user fees for safe motherhood services at public health facilities (Ministry of Health 2014).

In spite of the Government's initiatives to improve maternal health, questions remain as to why maternal mortality remained high over the years. In addition, it is likely that there are wide variations in maternal mortality between different regions of the country due to differences in socio-economic and socio-cultural practices that may affect access to services and health-seeking behaviours. For instance, the importance of the major causes of maternal deaths

(haemorrhage, sepsis, hypertension, eclampsia, HIV, obstructed labour and unsafe abortion) may vary by region depending on the socio-economic conditions; availability, access and quality of health services; and the prevailing health-seeking behaviours (Goodburn and Campbell 2001; Khan *et al.* 2006; Mills *et al.* 2007; Ronsmans and Graham 2006). A 2012 study in Kenya found that the number of women that were treated for complications resulting from induced abortion—one of the major causes of maternal mortality—varied from about 7,000 in Eastern to over 38,000 in the Rift Valley region of the country (Republic of Kenya 2013).

With respect to maternal health care service utilization, available data from national and localized surveys conducted between 2008 and 2012 show that the proportion of births for which mothers made four or more antenatal care visits was lower in Nairobi County (53%) compared to rural areas (57%), other urban areas (58%), the national average (57%), and Nairobi slums (66%; APHRC 2014; KNBS and ICF Macro 2010). However, the proportion of births for which mothers made the first antenatal care visit within the first trimester was higher in Nairobi County (22%) compared to other urban areas (21%), Nairobi slums (18%), the national average (14%), and rural areas (12%; APHRC 2014; KNBS and ICF Macro 2010). Similarly, the proportion of births for which mothers received antenatal care from a skilled provider was higher in Nairobi County (99%) compared to other urban areas (97%), Nairobi slums (96%), the national average (92%), and rural areas (90%; APHRC 2014; KNBS and ICF Macro 2010). A similar pattern existed for the proportion of births delivered in a health facility (90% in Nairobi County, 83% in Nairobi slums, 68% in other urban areas, 43% for the national average and 36% in rural areas) and the proportion of births delivered under skilled care (91% in Nairobi County, 83% in Nairobi slums, 69% in other urban areas, 45% for the national average, and 38% in rural areas; APHRC 2014; KNBS and ICF Macro 2010).

Data and Methods

Data

Data are from a cross-sectional study that involved a review of facility records (patient files and notes) as well as verbal and social autopsy interviews. The facility records were reviewed between March and April 2015 to capture information on the level of maternal mortality and the factors contributing to maternal deaths in the County. A total of 28 health facilities were targeted for inclusion in the study out of which 27 were randomly sampled from the master health facility list for Nairobi County. The sampling frame was health facilities that provide delivery care

given the existing evidence that most maternal deaths occur during labour, delivery and the immediate postpartum period (Ronsmans and Graham 2006). The sampling was stratified by level of facility (hospital and health centre/maternity/nursing homes) as well as type of sector (public, private-for-profit and private-non-profit). The sample size comprised 9 hospitals (3 from each sector) and 18 health centres, maternity and nursing homes (6 from each sector). The sample size was purposively determined based on available health facilities that could be sampled from and the desire to obtain an equal number of facilities stratified by level from each sector. One additional public facility was purposively identified for inclusion in the study based on the fact that though located in Nairobi, it serves clients who are referred from any part of the country.

Out of the 28 facilities that were identified for inclusion in the study, one private-for-profit outlet declined to grant consent for the study while one public facility was excluded because of administrative challenges with accessing records. In each participating facility, trained research assistants obtained information on the monthly number of births and maternal deaths that occurred during the three calendar years preceding data collection (2012, 2013 and 2014). In addition, the research assistants reviewed a total of 93 records of maternal deaths that occurred at the facilities in the three years preceding data collection using a structured checklist that was adapted from the *National Guidelines for Maternal and Perinatal Death Notification and Review* (Ministry of Public Health and Sanitation and Ministry of Medical Services 2009).

Verbal and social autopsies were, on the other hand, conducted with a total of 71 caregivers of women who died from maternal causes aged 15-49 years to capture information on the factors contributing to maternal mortality at the community level. The interviews were conducted by research assistants with training in qualitative data collection using tools adapted from the WHO standard verbal and social autopsy questionnaire (WHO 2012).¹ The maternal deaths and the caregivers were purposively identified through community health units in all the 18 sub-counties of Nairobi with the help of Community Health Strategy Coordinators (CHSC) and Community Health Volunteers (CHVs). About half (51%) of the caregivers interviewed were aged below 40 years while about three-quarters (73%) were female. Nearly half (45%) of the caregivers were close relatives of the deceased women (mother, spouse, sibling, son or daughter). Information was collected on the socio-demographic characteristics of the deceased; essential elements of care-seeking process such as recognition of

symptoms and signs associated with illness; whether adequate care was provided; whether and what type of outside-the-home care was sought (informal, formal, or both), cause and place of death. The interviews were audio-recorded with the consent of participants.

The Institutional Review Board (IRB) of the Population Council (Protocol number 679) and the Ethics and Research Committee of Kenyatta National Hospital/University of Nairobi (Protocol number P62/02/2015) granted ethical approval for the study while the National Commission for Science, Technology and Innovation (NACOSTI) granted the research permit (Reference number NACOSTI/P/15/6280/5260). In addition, written informed consent was obtained from health facility in-charges and caregivers before conducting record reviews and interviews respectively. The interviews with caregivers were conducted in Kiswahili or English depending on the preference of informants.

Analysis

Analysis of quantitative data from record reviews and verbal autopsies was conducted using Stata[®] and involved computing frequencies and percentages. Verbal autopsy data were first coded by two people with medical training using the International Classification of Disease (ICD)-10 to determine the causes of maternal deaths based on caregivers' descriptions. In cases where the coders did not agree on the cause of death, they sought consensus among themselves. There were no cases where the coders did not agree on the cause of death. Social autopsy data were, on the other hand, transcribed, typed in Word, translated into English for interviews conducted in Kiswahili and analysed for content. Analysis entailed identifying patterns across caregivers' narratives regarding the causes of deaths and care-seeking behaviours during the period prior to the deaths.

Results

Characteristics of deceased women

Findings from facility records and verbal autopsies showed that in both cases, the majority of maternal deaths occurred to women aged 20-29 years (57% and 49% of cases from facility records and verbal autopsies respectively; Table 1). Both sources of data further showed that the highest proportion of maternal deaths occurred to women with primary or lower levels of education (38% and 56% of cases from facility records and verbal autopsies respectively). Most of the women were married or living with a man at the time of death (63% and 54% of cases from facility records and verbal autopsies respectively). In addition, although most of the

women were young at the time of death, a substantial proportion had given birth at least twice (51% and 45% of cases from facility records and verbal autopsies respectively).

Table 1: Percent distribution of deceased women by background characteristics and data source

Characteristics	Facility records (N=93)	Verbal autopsies (N=71)
Age group (years)		
<20 years	6.5	18.3
20-24	21.5	29.6
25-29	35.5	19.7
30-34	18.3	9.9
35 and above	16.1	18.3
Don't know/missing	2.2	4.2
Education level		
Primary or lower	37.6	55.7
Secondary and above	32.3	41.4
Don't know/missing	30.1	2.9
Marital status		
Never married	23.7	29.6
Married/living together	63.4	53.5
Divorced/separated/widowed	1.1	17.9
Don't know/missing	11.8	0.0
Parity		
0	17.2	32.4
1	28.0	22.5
2	25.8	18.3
3 and above	24.7	26.8
Don't know/missing	4.3	0.0
All women	100.0	100.0

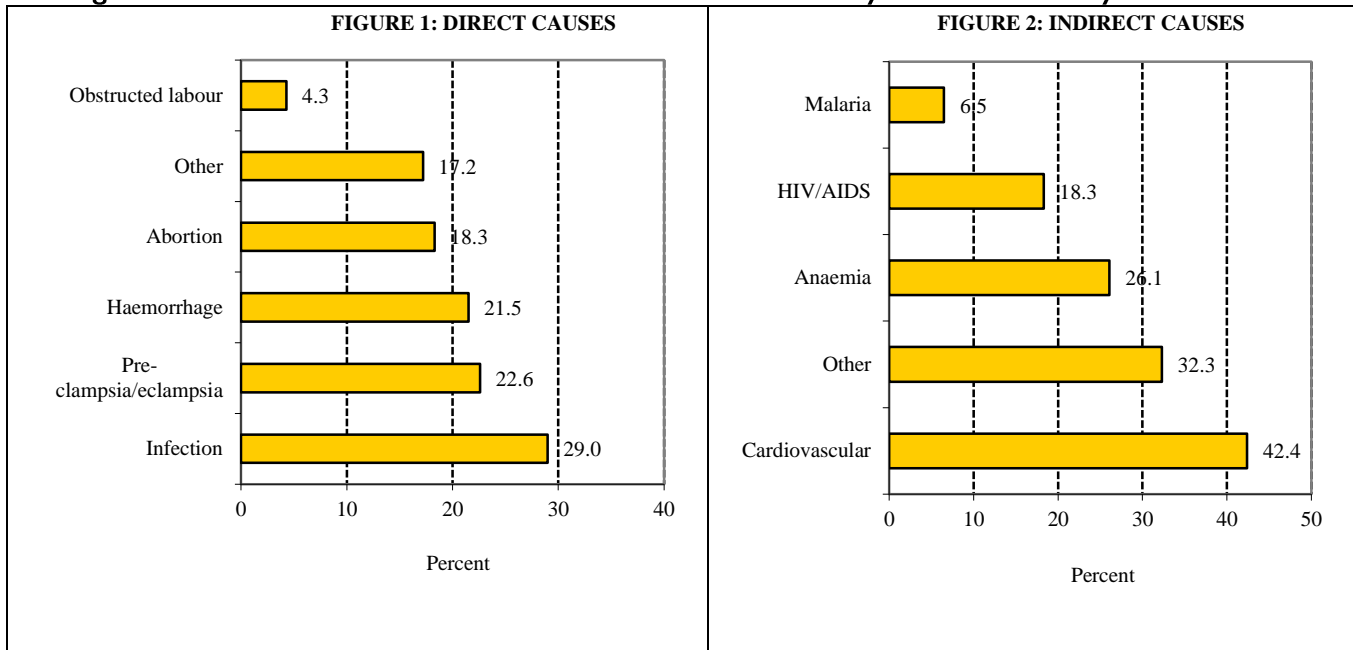
Source: Facility records and verbal autopsies.

The results in Table 1 further show that the proportion of mothers who died aged below 20 years was more than two times higher among those identified in the community than in the facility (18% compared to 7% of cases). Similarly, the proportion of those who were never married at the time of death was higher among those identified in the community than in the facility (30% and 24% of cases respectively). A similar pattern was noted for the proportion of deceased women who had never previously given birth, which was nearly twice as high among those identified in the community compared to those identified in the facility (32% and 17% of cases respectively).

Direct and indirect causes of maternal deaths

Data from facility records showed that the most common direct causes of maternal deaths in the County were infection (29%), pre-eclampsia/eclampsia (23%), haemorrhage (22%), and abortion (18%; Figure 1). Obstructed labour was less common accounting for 4% of maternal deaths while other causes included embolism, bipedal oedema, ectopic pregnancy, and placenta abruption altogether contributing to 17% of the deaths. The most common indirect causes of maternal deaths included cardiovascular conditions (42%), anaemia (26%), and HIV/AIDS (18%; Figure 2). Other indirect causes included kidney failure, meningitis, puerperal psychosis and pulmonary tuberculosis altogether contributing to 32% of the deaths.

Figures 1 and 2: Direct and indirect causes of maternal mortality in Nairobi County



Source: Facility records.

Data from verbal and social autopsies showed that the most common direct causes of maternal deaths were similar to those identified from facility records although of varying degree. These included haemorrhage (41% of the cases), infection (16% of the cases), and abortion (9% of the cases) while pre-eclampsia/eclampsia and obstructed labour each accounted for 3% of the cases (not shown). The most common indirect causes identified from the community, on the other hand, included anaemia and HIV/AIDS accounting for 14% and 7% of the cases respectively while cardiovascular conditions accounted for 4% of the deaths (not shown).

Health-seeking behaviours of deceased women

Among the maternal deaths identified from facility records, more than half (53%) of the deceased women sought antenatal care, 18% did not while information was missing for the remainder of the cases (not shown). Slightly more than a third (35%) of the deceased women who sought any antenatal care made less than four visits, a third (33%) made four or more visits while information was missing for another 33%. Verbal autopsy interviews with caregivers of women who died from maternal-related causes, on the other hand, showed that 68% of the women received treatment for the illness that led to death, 20% did not while the remaining informants did not know whether treatment was received. In addition, 9% of the caregivers reported that the deceased women used traditional medicine (not shown). Findings from social autopsy interviews indicated that some of the maternal deaths were due to poor health-seeking behaviours of the deceased including not seeking antenatal or delivery care from

qualified personnel as exemplified by the following excerpts:

Yes [she was the one who refused to go to hospital] and she was a difficult person to reason with. When you enquired if she was okay, she used to say she was not very ill and when you give her directions to where she would be assisted, she used to come back and say that she did not have the money to pay the bills but I think she refused to deliver in the hospital because she had not been attending the [antenatal care] clinic (Female, 39 years old, neighbour to deceased).

On the first day she did not tell me the truth but said she had malaria. On the second day is when I noticed she was bleeding. I insisted to know the truth and she said she had gone to [name of place] and someone inserted a tube inside her vagina as she was pregnant and wanted to abort. When the tube was inserted she was told to go home and the abortion will take place. When that didn't work she bought some medicine and overdosed ... The following day she got worse and we took her to the nearest private health facility where she was put on drip and we were given a note and told to go to [name of] hospital. While on the way the abortion took place, she bled a lot and died before arrival at the hospital (Male, 31 years old, neighbour to deceased).

Delays in seeking and receiving care

Data from facility records showed that nearly three-quarters (71%) of the cases were in critical condition at the time of admission indicating delays in seeking care (not shown). In addition, at the household/family level (first delay), the most common factors

contributing to maternal mortality included failure to recognize danger signs (44%), poverty (40%), high cost of treatment (29%), and ignorance of available services (14%; Table 2). Other factors included unspecified delay in seeking care, non-adherence to antiretroviral treatment, and failure to take up referral to higher level facility altogether contributing to 13% of the deaths. Lack of communication/transport between health facilities was the most common factor contributing to delay in accessing skilled care beyond the household/family level (second delay) accounting for 15% of the maternal

deaths while lack of communication/transport from home to health facility or long distances/poor roads accounted for 7% of maternal deaths each (Table 2). At the health facility level (third delay), poor provider attitudes, low morale or poor interpersonal relationships and lack of skilled human resources were the two most common factors contributing to maternal deaths (44% and 26% respectively). Other factors included lack of intensive care unit (ICU) facilities, lack of computerized tomography (CT) scan, and work load altogether accounting for 15% of the deaths (Table 2).

Table 2: Distribution of maternal deaths according to delays in seeking and receiving care

Indicator	Percent (N=93)
First delay: household/family level	
Failure to recognize danger signs	44.1
Poverty	39.8
High cost of treatment	29.0
Ignorance of available services	14.0
Other	12.9
Cultural/religious reasons/objections	1.1
Second delay: between household and facility	
Lack of communication/transport between facilities	15.1
Lack of communication/transport from home	6.5
Long distances/poor roads	6.5
Other	2.2
Third delay: at health facility	
Poor provider attitudes/low morale	44.1
Lack of skilled human resources	25.8
Other	15.1
Lack of blood transfusion	7.5
Lack of expertise	6.5
Lack of skills	4.3
Lack of emergency/essential drugs	2.2

Source: Facility records; Note: Questions allowed for multiple options.

Availability of adequate resources emerged from the verbal autopsies as a major barrier to seeking quality care. Nearly two-thirds (61%) of the caregivers reported that there was lack of adequate financial resources to allow for seeking quality care during illness (not shown). More than half (56%) of the caregivers reported that additional financial resources would have made a difference in the outcome of the illness while 55% indicated that the cost of care prohibited other household payments (not shown). Social autopsy interviews further showed that lack of adequate financial resources hampered seeking appropriate care as shown by the following quotes:

We did not have enough money but if we did, things would have been different. You know, she started feeling pain but would just stay quiet ... We took her to the herbalist so that she could massage

her stomach, but would have taken her to a better facility if we had money (Female, 38 years old, other relative to deceased).

When she was in labour, we took some time trying to raise money for paying for the means of transport that was to be used to take her to hospital and her condition continued to get worse (Female, 44 years old, other relative to deceased).

Besides availability of adequate resources, findings from social autopsy interviews showed that inability to recognize danger signs at the household/family level and thus seek timely care also contributed to maternal deaths as the following quotes indicate:

She was very close to me such that she could tell me everything. She started complaining of her neck. It went on for two days and then she told me headache had started. This was followed by nose

bleeding. It was then I took her to the hospital and upon examination, I was told she was suffering from meningitis which had advanced. I was told that I should have taken her early enough (Male, 29 years old, sibling to deceased).

Even the time she had started feeling sick they would have taken immediate action and taken her to hospital. The elderly people who were with her just thought it was the normal one, so when she started saying that she was dying that is when they would have taken action even before her starting to vomit blood. If she had vomited while at the hospital she would have been given the help that was needed (Female, 53 years old, mother to deceased).

Some caregivers further reported during social autopsy interviews that there were delays with respect to referrals (second delay). A key theme emerging from the narratives was that the deceased and their caregivers first sought care at nearby mostly private clinics. However, the caregivers realized that the quality of care at such clinics was wanting. They then experienced difficulties securing referrals to higher level facilities either due to non-responsiveness by providers at the clinics where the patients were first admitted or lack of means of transport to the referral facility. The following quotes highlight these experiences:

It was a forced referral. After delivery the doctor just kept her there despite her deteriorating condition. He was just giving her injections. The husband was called and on reaching there he found the wife had bled a lot. He took his wife from the clinic by force and took her to [name of hospital]. The clinic doctor was forced to write a referral letter to [name of hospital] (Female, 36 years old, other relative to deceased).

She was received and they checked her condition before referring her to [name of hospital] but there was a problem with the ambulance ... They were saying there was no ambulance (Male, 36 years old, sibling to deceased).

Other caregivers reported that mothers died because of poor quality of care at health facilities where they were admitted (third delay). The narratives suggested that poor quality of care was characterized by lack of expertise/skills to identify high-risk deliveries, poor provider attitudes, lack of adequate human resources, long waiting times, and lack of blood for transfusion. The following excerpts highlight some of these challenges:

Those who were near where [name of patient] was admitted told us that she delivered well and was brought to the bed with her child but after a while she started experiencing pain and was taken back to the theatre where she delivered the second child but didn't come back. They had not identified she was

expecting twins (Female, 43 years old, neighbour to deceased).

We went together to [name of facility] and she was taken straight to labour ward. I called her husband and told him to follow us to [name of facility]. It was late in the evening so she was admitted and we left. She stayed in hospital before giving birth and on the fourth day I visited her since she had requested that I take to her some cooked bananas and potatoes. When I got there ... she had given birth on her own, no health provider to assist her. She was still on the floor with the baby and the baby was dead. She had bled a lot and was on the floor, weak with eyes looking up. The other patients said the doctors didn't assist her and that she suffered a lot (Female, 39 years old, other relative to deceased).

Discussion

The major finding of this paper is that maternal deaths in Nairobi County are largely due to poor health-seeking behaviour on the part of the deceased women, delays at the household level in seeking care, poor referral mechanisms, poor provider attitudes, and lack of skilled human resources. Poor health-seeking behaviour was characterised by not seeking professional care at all or seeking care from unqualified personnel. Delays at the household level were, on the other hand, due to failure to recognize danger signs early, poverty, high cost of treatment, and ignorance of available services. Ideally, poverty should not be a major barrier to seeking care following the introduction of free maternity services in the public sector in June 2013 (Ministry of Health 2014). However, the findings of this paper showed that individuals still needed money to cover transport costs to health facilities. Although distance to health facilities did not emerge as a major contributor to maternal mortality in the County, the need for transport could be due to the tendency to seek care when it was too late with a high proportion of women being admitted in health facilities in critical conditions. Poor health-seeking behaviour and delays in seeking care at the household/family level suggest that programs aimed at improving maternal health in the County should focus on empowering households to appreciate the importance of professional care and to recognize danger signs early.

Beyond the household/family level, poor referral mechanisms were either due to lacklustre response from providers in lower level facilities where the deceased women first sought care or lack of means of transport to the referral facilities. Available evidence indicates that lack of proper referral linkages between health facilities affects the uptake of services even in the presence of subsidies such as use

of vouchers to access care (Njuki *et al.* 2012). The implication is that even with free maternity services, mothers in the County are likely to continue dying if there are no proper referral linkages between lower level facilities where most women first seek care and higher level ones which are better equipped to handle maternal-related complications. In the public sector, poor provider attitudes and lack of skilled human resources could largely be due to high workload against the backdrop of limited financial and human resources (Saksena *et al.* 2012). In the private sector, the issue could be about limited availability of personnel with appropriate technical skills (Brugha and Zwi 1998). Regardless of the circumstances, delays in providing appropriate care that occur between and within health facilities in the County suggest the need for improving referral linkages and enhancing the capacity of providers to offer quality services through skills updates and ensuring adequate maternal health supplies.

Another finding of the paper is that most maternal deaths in the County occurred to women who were young, married, with low levels of education and those that had at least two births. The finding is consistent with existing literature that indicates that without appropriate care, pregnancies to young women can have adverse outcomes which can result in long-term morbidity or even death (Becher *et al.* 2004; Reynolds *et al.* 2006). Moreover, higher proportions of deaths among very young women (aged below 20 years), those who had never married, and those who had not previously given birth were identified in the community than in the facilities. This could be an indication that most deaths to adolescent mothers (aged below 20 years and unlikely to have ever married or previously given birth) could be occurring outside of health facilities. Studies show that young people's access to sexual and reproductive health services in developing countries is affected by several factors including contradictory socio-cultural norms in some communities that on the one hand promote early marriage and on the other discourage adolescent sexuality and early pregnancy; weak health care systems; and reproductive health services that are in most cases not oriented towards adequately meeting their needs (Katz and Naré 2002; Tylee *et al.* 2007; Varga 2003; Warenius *et al.* 2006; Wood and Jewkes 2006; Wright *et al.* 2006). Improving young people's access to health care services therefore requires interventions at the individual, household and provider levels.

The above findings might be influenced by the limitations of the study that provided the data used in the paper. The first limitation is the incompleteness of information obtained from facility records. This was evident from the proportion of cases with

missing information on some of the socio-demographic characteristics and health-seeking behaviours of deceased women. Completeness of mortality data is a major challenge facing many developing countries where there are no comprehensive systems of registering deaths and ascertaining the causes (Hill *et al.* 2006). The implication is that factors associated with maternal mortality might be grossly under-estimated. The second limitation is that depending on how far back deaths occurred, information from verbal and social autopsies might be affected by recall bias or the nature of the relationship of the caregiver to the deceased. Information obtained soon after death occurrence from close family members may, for instance, be more reliable compared to that gathered long after death from individuals who are not related to the deceased. However, conducting verbal and social autopsies soon after death occurrence may not be ethically appropriate as this may be insensitive to the feelings of affected persons. Third, the study was limited to Nairobi County; the findings might not be generalizable to all urban areas or rural settings of the country. In spite of these limitations, the findings of the paper provide some indications of the factors that contribute to maternal mortality in a relatively resource-endowed urban context.

Notes

Verbal autopsy is a research method that helps determine probable causes of death in cases where there is no medical record or formal medical attention given and involves conducting interviews with next of kin or other caregivers (WHO 2012). Social autopsy, on the other hand, refers to an interview process with a next of kin or other caregivers of deceased individuals aimed at identifying social, behavioural, and health systems contributors to deaths in the community (Kalter *et al.* 2011). Both verbal and social autopsies provide information that informs the design and implementation of initiatives aimed at improving maternal and child health (Kalter *et al.* 2011; WHO 2012).

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