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RETROSPECTIVE REVIEW OF INDICATIONS FOR EMERGENCY OBSTETRIC REFERRALS FROM MOFOLO COMMUNITY HEALTH CENTRE TO CHRIS HANI-BARAGWANATH HOSPITAL.

Gerald Levin

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the degree of Master of Science in Medicine in Emergency Medicine



11 May, 2016

Declaration

I, Dr Gerald Levin, student number 7602678 hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong
- I confirm that this retrospective review work submitted is my own work.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own work, or that I have failed to acknowledge the source of the ideas or words in my writing.

Signed:

Date: 11 May, 2016

Dedication

To my family.

Publications and presentations during this research

- Retrospective review of indications for emergency obstetric referrals from Mofolo Community Health Centre to Chris Hani Baragwanath Hospital. Levin G, van Bogaert DK, Ndlela T, Manda K, Buchmann EJ, Basu J, Rubel D. Poster presentation at 35th National Congress of the South African Society of Obstetricians and Gynaecologists.(SASOG), 6-10 May 2012, Champagne Sports Resort, Drakensburg, KwaZulu-Natal. Abstract in S Afr J OG. April 2012, 18(2):77.
- World Health Organization (WHO) suggestion for universal voluntary testing for HIV with immediate ARV therapy in South Africa. Levin G, Basu J, van Bogaert DK, Goosen J. Oral presentation at 35th National Congress of the South African Society of Obstetricians and Gynaecologists.(SASOG), 6-10 May 2012, Champagne Sports Resort, Drakensburg, KwaZulu-Natal. Abstract in SAJOG April 2012, 18(2):60.
- Retrospective Review of Indications for Emergency Obstetric Referrals from Mofolo CHC to CH Baragwanath Hospital. 7th Public Health Association of South Africa Conference (PHASA), 29-30 November 2011, Gauteng. Levin G, van Bogaert DK, Ndlela T, Manda K, Buchmann EJ.
- World Health Organization (WHO) Suggestion for Universal Voluntary Testing with "Immediate ARV Therapy" in South Africa as a strategy for elimination of HIV transmission. Wits Faculty of Health Sciences Research Day & Postgrad Expo 22/09/2010 (oral presentation). Levin G, van Bogaert DK.

Abstract

Retrospective review of indications for Emergency Obstetric referrals from Mofolo Community Health Centre to CH Baragwanath Hospital.

Objectives: To determine the referral rate, clinical indications, and ambulance response time for Emergency Obstetric Care referrals from Mofolo maternity obstetric unit (MOU) to CH Baragwanath Hospital (CH-B).

Method: A retrospective comparative study of the admission book records of women in labour who presented to Mofolo during the first 3 months of 2010 was conducted. Data from 624 presentations in the admission book were allocated into referred and non-referred groups with Excel spreadsheets.

Results: There were 317 deliveries at Mofolo MOU, of which 44 (13.9%) were transferred to CH-B after delivery. Referred neonates numbered 21 (6.5%), as 23 neonates accompanied their mothers who were referred. Women in labour that were referred to CH-B numbered 303. Thus, of 624 patients, there were 347 (55.6%) referred to CH-B. Sixty nine women were referred for pregnancy induced hypertension (19.9%). Prematurity referral was 17.7% (31.5 for premature rupture of membranes, 25 for preterm labour and 5 underweight babies; thus 61.5 / 347 = 17.7% of referrals). Partogram delay was the referral reason for 51 women (14.7%), and for meconium- stained amniotic fluid for 14.7%. Average ambulance response time was 48.2 minutes and 55% went by ambulance.

Conclusion: Neonatal referral rate at Mofolo MOU was 6.5%; down from the 33% at Chiawelo. The combined referral rate was similar; 55.6% at Mofolo MOU and 58.4% at Chiawelo MOU. This rise may be related to ease of referral process together with the increase in litigation. Mofolo MOU integration into the health district is facilitated by accessible referral path and the choice of transport as 55% went by ambulance.

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ABBREVIATIONS

ANC	Antenatal Clinic
APH	Ante partum haemorrhage
ARV	Anti-retroviral treatment
BBA	Born before arrival
CH-B	Chris Hani-Baragwanath Academic Hospital
CHC	Community Health Centre
CPD	Cephalo-pelvic disproportion
CS	Caesarean section
DHS	District Health Service
EmONC	Emergency Obstetric and Neonatal Care
EMS	Emergency Medical Services
FHNH	Fetal heart not heard
HIV	Human Immunodeficiency Virus
IMR	Infant Mortality Rate
IUGR	Intra Uterine Growth Retardation
KZN	Kwa Zulu-Natal
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio per 100 000 live births
MOU	Maternity Obstetric Unit
MRC	Medical Research Council
MSL	Meconium stained liquor
NCCEMD	National Committee for Confidential Enquiry into Maternal Deaths
NPRI	Non-pregnancy related infections
PCP	Pneumocystis Jiroveci pneumonia
PHC	Primary Health Care
PIH	Pregnancy induced hypertension & eclampsia
PPH	Postpartum Haemorrhage
PremROM	Premature rupture of membranes
RPOC	Retained products of conception
SGA	Small for gestational age or preterm
USA	United States of America
WHO	World Health Organisation

Chapter 1. LITERATURE REVIEW

In South Africa, the Department of Health has stated that the outcomes of maternal and child health care should be better. This is substantiated because the government invests relatively more on health care than other countries with similar outcomes (1). This study is of indications for emergency obstetric referrals from a midwife staffed obstetric unit [MOU] within the Soweto Health District, as well as the rate of referral and ambulance response time.

In the United States of America [USA] during the 20th century the maternal death rate reduced by 99% (2). Chang et al state that in1900 there were 850 maternal deaths per 100 000 live births [MMR]. However, by 1982 the MMR in USA had been reduced from 850 to 7.5; where it has remained subsequently (2).

In a 2007 study from within Nigeria, Igberase and Ebeigbe (3) reported a MMR of 2 232 during the 10 years reviewed. Main causes of maternal mortality were puerperal sepsis (33%), abortion complications (22.6%), preeclampsia/eclampsia (17.4%), prolonged obstructed labour (13.0%) and obstetric haemorrhage (7.8%). Mortality among patients who had not attended antinatal clinic [ANC] was 10 times higher than for patients who had attended ANC (3).

The South African Department of Health (4) is committed to lowering both MMR and the child mortality rate. As strategy, the Department of Health (5) has recently repeated a goal of changing from a curative to a preventative

approach, called a primary health care [PHC] model. PHC is planned to be more easily accessible to the community because there will be more clinics within communities. The PHC model will deliver early, quality ante-natal and post-natal health care, with the aim of reducing high maternal and child mortality rates (4,5). In South Africa, health care is delivered by 3 077 clinics and 313 Community Health Centres [CHC] at PHC level (6).

The District Health Service [DHS] is an important part of healthcare delivery because it links PHC within the community to a higher level care, when appropriate (5-8). National Health Act 61 of 2003 deals with the formation of health districts and their role in the delivery of health services. Provision is made to link PHC and DHS within an integrated health care service (4), including midwifery and emergency medical services [EMS]. PHC facilities are planned as the entrance level to DHS, through the referral process with EMS, if indicated by protocol (6-8).

The implementation of the referral protocol requires monitoring, to facilitate the DHS functioning. This is compatible with a 2014 meta-analysis by Salam et al (8), which included 47 systematic reviews on pre-defined district level interventions. They report that at district level, monitoring with feedback can improve compliance with protocol (8).

Challenges with protocol implementation were identified by Afari et al (9) in Ghana. They conducted interviews with staff in a region where 1 district hospital and 10 health centres serve 171 499 people. For improvement their suggestions included standardised referral protocol implementation (9).

Problems are associated with pregnant women avoiding the referral protocol to a referral hospital. For example, Mashishi (10) performed a retrospective study at Dilokong district maternity hospital in Limpopo during 2008. Within the sample of 400 women, 85% were self-referred. As most women were self-referred, 57% of women could have delivered with a lower level of care (10). Furthermore, Mashishi (10) reports that 67% of self-referred women arrived at Dilokong hospital with an ambulance and that when referral protocol adherence is low, there is a risk of overloading the hospital maternity unit (10). Thus, non-adherence to referral protocol on a large scale can weaken health care delivery.

Das et al (11) stated that the majority of both maternal and neonatal deaths happen at birth or during the next 24 hours. As obstetric care during this period is critical, Das et al (11) used meta-analysis with 32 systematic reviews. They conclude that social support within the community for pregnancy and labour significantly reduces antenatal hospital admission, intra-partum analgesia, labour duration, dissatisfaction, caesarean section delivery [CS] and instrumentally assisted vaginal birth (7,11).

1.1 Referral from a Maternity Obstetric Unit (MOU) to CH B Academic Hospital

Dumont et al (12) suggest that a shift from the traditional risk assessment approach to providing Emergency Obstetric and Neonatal Care services appears appropriate to reduce MMR (12). Maternal deaths are reduced with implementation of eight interventions identified by WHO, and are known as Emergency Obstetric Care (13), delivered by comprehensive Emergency

Obstetric and Neonatal Care [EmONC] centres. Health facilities providing the first seven interventions are basic EmONC centres and include midwife staffed obstetric units [MOU], compared to complete Emergency Obstetric centres that can provide all nine interventions listed below (13);

1. Assisted vaginal delivery,
2. Parenteral oxytocic drugs,
3. Parenteral anticonvulsants,
4. Removal of retained products of conception,
5. Parenteral antibiotics,
6. Basic neonatal resuscitation with bag and mask
7. Surgery,
8. Blood transfusion.

As MOU's in the Soweto Health district do not have a blood bank on site, the need for urgent blood transfusion is a referral reason. For example, blood transfusions are indicated for postpartum haemorrhage [PPH], retained products of conception [RPOC] and vaginal lacerations (14,15). In addition, anaemia is common as 42.9% of maternal deaths appear to be associated with anaemia (16). Protocol development is compatible with World Health Organisation [WHO] policy of monitoring and investigating how the number of deaths may be reduced (17). Protocol development includes appropriate management of the third stage of labour to reduce morbidity and mortality, by standardizing an optimal approach (17). Therefore protocol indications for referral are important for communication, training, monitoring and evaluation.

Dlakavu (18) writes that in 2004, 33% of deliveries at CH-B were self-referred and low risk. Dlakavu (18) then reports that in 2008, triaging self-referred women was introduced at CH-B and women with low risk were down-referred back to midwife obstetric units [MOU]. In a random sample study at CH-B between 1 May 2010 and 31 May 2010, Dlakavu (18) extracted data from 182 deliveries. Only 35 of these women (19%) were self-referred. During the same month, the triage team at CH-B triaged 171 women who presented and down-referred 83 back (49%) to MOU level (18). Thus CH-B reduced the number of self-referred women by 14%, possibly to match capacity with demand.

Chaturvedi et al (19) report that the process of referral of a pregnant woman involves moving or transferring her from a lower level health facility to a higher level health facility to receive comprehensive obstetric care. Mirkuzie et al (20) state that basic EmONC alone can prevent 40% of neonatal deaths associated with birth, as well as a significant amount of maternal deaths. Based on this statement, clinical assessment, triage and referral are essential components of basic EmONC duty (20).

At the first African Federation for Emergency Medicine consensus conference during November 2011 in Cape Town, it was stated that an integrated approach to triage, resuscitation, and stabilization of pregnant patients is needed (21,22). Acute care referral systems, facility–based acute care and emergency nursing were prioritised (21). The “Nurse Practice Guidelines” state that Emergency nursing requires working with a multidisciplinary team (23), including emergency personnel. The emergency nurse can identify life threatening problems, grade or prioritise the urgency of care needed and provide appropriate resuscitation and management. Emergency nursing

is not confined to the emergency centre, and includes the pre-hospital emergency treatment of patients (23)**.** Terry (24) writes that the contribution of nurses is the strongest numerically within the sub-Saharan health care sector (24).

DiFazio and Vessy (25) list nurse midwifery (obstetric nursing) as one of four fields offering nurses advanced training and the opportunity to be registered as advanced practice registered nurses in the USA, facilitating collaborative practice (25). Waldman and Kennidy state that there are many examples of collaborative practice in the USA, formed by certified nurse-midwives partnering with obstetricians to provide good, efficient, cost-effective health care (26). DeJoy et al (27) write that there are 3 examples in the USA where the certified nurse midwives deliver health care to low and medium risk patients with the supervision of obstetricians (26, 27).

The referral rate of a health facility is the proportion of pregnant women that are referred to other facilities. Chaturvedi et al (19) report that only 30% of deliveries in India occurred within health facilities in 2005 when cash incentives for women delivering in health facilities was introduced (19). By 2010, deliveries in health facilities rose to 81%. In addition, during a 5 day study period at 96 health facilities, there were 126 referrals from 1 182 pregnant women. Thus, the referral rate was 10.7% (19).

In an Australian study by Schultz et al (28) that was carried out in 2010, all expected deliveries were referred from a remote, rural area. The strategy of Schultz et al (28) was to refer all 99 pregnant women from the Barkly region in Australia's Northern Territory province to a town with comprehensive EmONC (28). Thus, if a

complication developed, high care was available without having to plan a transfer flight. Hence, all expected deliveries were “emergency referrals” and flown to Alice Springs Hospital, which is about 500 km away. A referral rate of 100% was desired in this study (28).

Médecins sans Frontièrs started a comprehensive EmONC in rural Burundi during 2006. Within the district 9 900 deliveries a year were expected and there were 9 basic EmONC units. A linking ambulance service and referral system was started. Tayler-Smith et al (29) collected data from ambulance call log books and crosschecked with registers within the comprehensive EmONC. During 2011, there were 1 406 women being transferred in by ambulance. As 9 900 deliveries were expected, the referral rate was 1 406 ÷ 9 900; thus the apparent district referral rate was thus 14.2% (29).

In Angola, Strand et al (30) counted the number of births within and referrals to hospital from 3 peripheral basic EmONC units. From May to July 1996, there were 2 443 births and 395 referrals from the 3 basic EmONC units, which gives a referral rate of 16.3% (30).

For example Admasu et al (31) report that over 50% of basic EmONC presentations were referred in Ethopia, but only 7% of deliveries occurred in health facilities during 2008 (31). This high referral rate should be assessed together with the low proportion of deliveries that occurred within health facilities.

In China, Sun et al (32) report that 10% of all deliveries have birth complications, 70% of which were delivered at Level 2 and 3 hospitals with a higher proportion of neonatal death and preterm birth (32). It can be deduced that 7 out of every 10 deliveries with complications were referred (32).

Iyengar and Iyengar (33) conducted a study at 2 basic EmONC units in rural India. During 2000 to 2008, there were 2 771 labour presentations. Among these presentations 21% had life-threatening complications, most of which (76.2%) were advised for referral. Among the women who were advised for referral, two-thirds complied (33). Thus, 23.8% of women needing referral were not referred, and 33% of those referred did not comply even though the referral system provided for arranging transport (33).

Salam et al (8) assessed the effectiveness of district level interventions by reviewing 47 publications and found that engaging community opinion leaders to promote evidence based medical practice improved compliance (8). Buchmann wrote that a midwife-managed clinic, with a supportive referral hospital, can provide an acceptable level of care (34).

1.2 Referral reasons

1.2.1 Pregnancy induced hypertension (PIH), caused 14 % of maternal deaths in South Africa during 2008-2010 (35). In rural Bangladesh, Sikder et al reported that among 27 241 births, over 75% of births were at home, with 328 (1%) having eclampsia (36). This apparent difference may be resolved with definition sub-groups.

Moodley (37) states high blood pressure is diagnosed when blood pressure is 140/90 mmHg or above on two serial measurements separated by 1at least 6 hours and may be:

- Hypertension when measured before week 20 of pregnancy
- Gestational hypertension when measured after week 20 without proteinurea
- Pre-eclampsia is hypertension after week 20 with proteinurea.
- Superimposed pre-eclampsia is diagnosed in hypertension after week 20 when either (1) Spot urine protein or renal compromise with creatinine ≥100µmol/L (2) Neurological symptoms like headache or convulsions (3) Liver disease with aspartate transaminase >40 IU/L (4) Haematological abnormalities like haemolysis or thrombocytopenia or (5) Decreased fetal growth (small fetus) is present (37).

Buchmann's study (34) at in Soweto was undertaken to audit the referral system from Chiawelo clinic to CH Baragwanath Hospital. Between October 1994 and May 1995, reported that 373 women were referred to CH-B in labour, of which 136 (36%) had PIH as the referral reason.

However, a bigger proportion of PIH was reported in the study conducted by Litorp et al (38) from Tanzania. They reported that PIH caused 42% of 467 near-misses and 77 maternal deaths in a study of 13 121 deliveries (38).

Strand et al (30) reported that of 157 who were referred from basic EmONC to hospital in Luanda during 1996, 28 (17.8%) were referred for PIH (30). After interventional training, the records from an additional 97 emergency obstetric

referrals from the same basic EmONC units to Luanda were compared after 20 months. After intervention, there were 10 referrals (10.4%) for PIH (30).

Recently, Sun et al (32) reported a greatly reduced incidence of PIH in hospital. Their study included 60 445 deliveries in China. They (32) counted 1 016 hypertensive women (1.7%) and 277 pre-eclampsia patients (0.4%). This lower proportion of PIH was also reported in Sikder's study of 27 241 births from Bangladesh, where 328 women (1%) were reported with eclampsia (36).

Although the frequency of PIH was relatively low in the above two studies at 1.7% (32) and 1% (36), the high referral rate for PIH of 36% reported by Buchmann appears appropriate in South Africa, as 14% of maternal mortality is associated with hypertension and pre-eclampsia (6).

Thus, measurement of the proportion of PIH referrals from a MOU to hospital is of interest, as the diagnostic rates differ in this literature review.

1.2.2 Prolonged labour as a referral reason, includes both maternal and neonatal complications. Abraham and Berhan (39) write that abnormal or prolonged labour is a frequent obstetric problem, and complicates about 20% of deliveries. Gifford et al (40) report that 68% of unplanned caesarean section deliveries are because of delayed labour occurring with vertex presentations (40). A South African study (41) reported that 73% of women with prolonged labour had not yet delivered their first baby (nulliparous). Failure of cervical dilatation was the main cause and referral for caesarean section was 4 to 6 times more frequent (41).

Olierhead and Osrin (42) describe the partograph as a chart display of the progress of labour on a chart, where some progress measurements are plotted graphically. The partogram is recommended by WHO, as it helps childbirth healthcare workers to recognise potential problems, and to take appropriate action with a standardised approach (42). The aim is to manage obstructed labour with less maternal and fetal death and injury (43). In an analysis of 74 publications, partograph application was reported to assist with monitoring labour, continuity of care, staff involvement, monitoring and supervision. Monitoring and evaluation were also facilitated, thus national policy and medico-legal duty are assisted with implementation. Problems with its use in some developing countries include many different partograph versions as well as staff graphing skills (42).

The Soweto MOU referral protocol (14,15) defines poor progress in the latent phase of first stage of labour as occurring when cervical dilatation is less than 4 cm after 8 hours. Abraham & Berhan (39) write that this occurs in 4% to 7% of women with spontaneous labour (39). These newborn neonates will have a higher risk for neonatal intensive care admission (33,35).

Poor progress in the active phase of labour can also be detected with the partogram chart (42). When the cervix is 4 cm dilated, the active phase starts. Subsequent cervical dilatation is plotted against time, and 1 cm dilatation per hour is required. The action line on the partogram is placed 2 hours to the right, and if the cervical dilatation is slow, this “action line” is crossed and transfer to hospital is required (14,15,42). Poor progress in the second stage of labour is present if the fetal head has not descended onto the pelvic floor after 2 hours of full (10 cm) cervical

dilatation. Referral to hospital is indicated when the “action line” of the plotted partogram is crossed (14,15,42).

Blix et al (44) combined the data from 215 257 women in a meta-analysis of 15 studies on home childbirth. The referrals from home to hospital ranged from 9.9% to 31.9%. The most common referral reason was prolonged labour with an incidence between 5.1% and 9.8%. The majority of transfers to hospital were before the planned home birth, however transfer of women and neonates after birth ranged from 1.7% to 7.3% (44).

Chaturvedi (19) writes that prolonged labour caused 40% of referrals, and maternal referral had a 4 times higher risk for intrapartum neonatal death (19). Breech presentation is the most frequent malpresentation, occurring in about 3% of term pregnancies (45). As breech presentation can be associated with delay or arrested labour, the protocol states immediate transfer to hospital if there is not full cervical dilatation or if the presenting fetal part is at the Ischial spines or above (14,15). In the In the Chaiwelo district of Soweto, Buchmann (34) reported that of 1 209 women in labour, 373 (31%) were referred to CH-B during labour. Referral reasons were 49 for 1st stage poor progress (13.1%), 12 for preterm labour (3.2%), 11 for long latent phase (2.9%), 10 for 2nd stage prolonged (2.7%), 78 for MSL (20.9%), 21 fetal distress (5.6%) and 10 (2.7%) for fetal heart not heard [FHNH]. Buchmann (34) reported that of 253 CS, 95 (38%) were done for cephalopelvic disproportion [CPD].

A retrospective study by Sikder et al (36) reported that of 27 241 births, obstructed labour ocurred in 2 950 (11%). However, there are different versions of the partogram

in use, with different time stages. The referral protocol (14,15) is interpreted as referral for the age extremes (<17 and >35 years) and with parity ≥5 before labour. As this may not be policy in all national health policies, it may thus be of assistance to determine the proportion of referrals due to delayed labour.

1.2.3 Prematurity causes 33% of childhood blindness, about 50% of cerebral palsy in addition to being a major cause of perinatal death, reports Spong (46). Lloyd & de Wit (47) wrote that the average proportion of low weight births is 14%, but that low birth weight is associated with disproportionately more neonatal deaths as 60-80% of deaths result from prematurity (47).

Low birth weight refers to birth weight below the tenth percentile of gestational age (48), and is estimated birth weight under 2 kg. It can include pre-term, small for gestational age and intrauterine growth restriction (IUGR) babies. Intrauterine growth restriction (IUGR) is when fetal growth is under expectation, usually caused by placental insufficiency (48).

- In symmetrical IUGR, the size of the fetal head is in proportion to abdominal size. Early placental insufficiency, genetic abnormalities and uterine infections are most likely causes (48).
- In asymmetrical IUGR, the head is disproportionally bigger than the abdomen. The growth problem usually starts after 20 weeks with brain blood flow maintained when there is placental insufficiency (48).

In China, a prospective study on 61 227 birth registries was conducted by Sun et al (32) during 2010. Deliveries were at 151 hospitals (level 1-3), and complications

included 5.4% premature rupture of membranes (N = 3 290), Theron (49) states that there is a high risk of ascending infection with prolonged rupture of membranes, and that chorioamnionitis is the biggest cause of pre-term deliveries (49).

Continued antibiotics with ANC screening for infections is needed as Webb et al (50) found that of women that delivered prematurely, 57% had urogenital infections and 59% had periodontal disease. In the United States during the 1970's, Tudela et al (51) did a study of 143 384 live born neonates. They reported that Group B streptococcus sepsis was associated with a significant increase in preterm delivery and chorioamnionitis often starts before birth (51). In 1988, Briggs (52) reported from Nigeria in this study of 10 665 deliveries, 17% of booked and 66% of unbooked patients presented after fetal death in utero respectively (52).

At Chiawelo clinic (34), 837 neonates were born, of which 274 were referred to CH-B (33%). Neonatal referral reasons included 191 for MSL (70%), 17 for prematurity or weight less than 2 000g (6.2%), 17 for asphyxia (6.2%) and 49 (17.9%) for other reasons. The infant mortality rate [IMR] for clinic deliveries was 6 per 1 000 (34). After 15 years of Health System strengthening, it is of interest investigating if the neonatal referral rate from a MOU in Soweto to hospital has changed.

As prematurity is multifactorial (49), determining the proportion of prematurity could help future policy at the 5 MOU's in Soweto.

1.2.4 Haemorrhage as a referral reason

The National Committee for Confidential Enquiry into Maternal Deaths, [NCCEMD] began in South Africa after the introduction of compulsory notification of maternal deaths during October 1997 (35). A report for 20082010 found 14.1% of maternal deaths for the period 2008 to 2010 were caused by obstetric haemorrhage (35).

Basu et al (16) write that haemorrhage in pregnancy causes 34% of maternal deaths in Africa (16). Obstetric haemorrhage can occur both before and after delivery. Antepartum haemorrhage [APH] is bleeding from the genital tract after 22 weeks of pregnancy (53). Causes of APH include abruptio placenta (premature separation of a normally placed placenta with bleeding between the placenta and the uterine wall). Usually there is both vaginal bleeding and retroplacental bleeding. Measured blood loss is difficult because of the retroplacental clot and the women may be in shock with hypotension and tachycardia. If proteinurea is found, then PIH may be present. Risk factors for abruption placenta include PIH, premature rupture of membranes, blunt abdominal trauma to mother, cigarette smoking and cocaine abuse (53). Other causes of APH include ruptured uterus, for which previous caesarean section or uterine surgery are predisposing factors (53).

Post-partum haemorrhage [PPH] is a referral indication from the 5 MOU's in Soweto to CH-B (14,15). A retrospective review study of 28 women with PPH at CH-B hospital was done by Hassim (54), who defined PPH as blood loss of 500ml or more after vaginal delivery (54). PPH is caused by bleeding from the uterus where the placenta was attached or from trauma to the genital tract and perineum. Retained

placenta was present in 37%, previous caesarean section in 40% and uterine atony was associated with 70% (54).

In the Chiawelo study (34), there were 836 mothers who delivered at Chiawelo clinic from which 59 (7.1%) were referred to CH-B after delivery. These post-delivery referrals comprised 23 for postpartum haemorrhage (39%) and 5 for retained products of conception (8.5%). In Bangladesh (36), a retrospective study on data from 42 214 pregnant women reported haemorrhage in 12% (N = 5 232).

1.3 Ambulance response time.

London Ambulance Service (55) defines management of an obstetric emergency as fast, clinical assessment of the pregnant women to determine complications, provide emergency care followed by transport to an appropriate health facility (55). Specialised equipment and staff are required to provide appropriate care to obstetric and neonatal patients (56). This can be vital as, if a mother starts haemorrhaging, she may die within 2 hours without appropriate treatment (57).

In South Africa, the Department of Health (58) has introduced specialized ambulances for obstetric emergencies. In Gauteng there were 343 ambulances, of which 13 were obstetric ambulances (58). KwaZulu-Natal was reported as having 40 obstetric ambulances (58).

In Africa, morbidity and mortality is relatively high for emergency patients, including both obstetric and neonatal emergencies (59). The reasons for this are multifactorial, including transportation problems. Nkyekyer reports that a descriptive study from

Ghana found that 72.9% of peripartum referrals arrived at hospital without an ambulance (60). As ambulance response time only applied to 27% of obstetric referrals in this study, assessment of transport method is relevant in addition to measuring ambulance response time.

The main aim of Emergency Medical Service transport is to reduce both morbidity and mortality from medical emergencies as time is critical (61). Anest et al (61) reviewed data from 6 months of ambulance records in Ruhiira, Uganda. They report that of 193 calls, 137 were for obstetric emergencies. Of the obstetric calls, 93% were transfers to access surgery or transfusion services (61).

David et al (62) undertook a study in Mozambique from August to December 2008. There were 27 916 live births, which included 564 women who had life-threatening obstetric complications (near- miss). Most of these near- miss women (70.7%) were referred from a peripheral health facility to Maputo Central Hospital, and only 29.3% were self-referred from home. David et al (62) conducted interviews to analyse the events with emphasis on the 3 phases of delay as described by Thaddeus and Maine (63):

- First delay is at the community level and includes delay in deciding to seek health care. This was associated with 360 (63.8%) of near-miss cases (62).
- Second delay includes time taken to reach an obstetric facility and is influenced by distance, cost of transport and method of transport. This was associated with 120 (21.3%) of near-miss cases (62).

- Third delay includes receiving inadequate care after arrival at the health facility. Thus delay caused by equipment shortage, staff and the referral system are included. This included 393 (69.7%) of near-miss cases (62).

Ambulance transport time has many sub-components including waiting time, transport time and offload time (64). Offload delay may occur when the ambulance crew hands the patient over to the ED staff (64). Ambulance response time is the time elapsed between calling for an ambulance and the ambulance arrival.

Transport delay between health institutions was associated with 6.9% of maternal deaths in the Orange Free State province (34). Afterwards, the South African Department of Health deployed 18 ambulances for transport between facilities during December 2011 (65).

Schoon undertook a retrospective study comparing maternal mortality for 12 months before the deployment of 18 ambulances (65). Schoon reports a drop in deaths associated with referral; from 67 in 2011 to 24 in 2012. Thus MMR among transferred patients decreased from 279 in 2011 to 152 in 2012 (45%), after ambulance deployment (65). Schoon reports that the 45 % decrease in MMR corresponded with improvements in:

- "Register dispatch interval", time between receiving the call for an ambulance and ambulance departure for ordering site, decreased from 32 minutes to 22.5 minutes

- Ambulance dispatched within 1 hour increased from 84.2 % to 90.7 %

However, Pattinson (66) argues that lowering maternal deaths in the Free State was multifactorial including strategic improvements (concentrating services in strategic areas) and improving the training and skills of healthcare providers; in addition to 18 new ambulances (66). An additional superimposed variable that probably contributed to the decline in deaths following the introduction of 18 ambulances, is the extensive antiretroviral rollout with immediate access for all pregnant women (67). This is supported by a mata-analysis that reported HIV-infected pregnant women had 8 times greater risk of death (68). This very high risk of death with pregnancy if HIV +ve drops from 8 times to 2 times with ARV (Personal communication, Dr A and V Black at Wits Health and Reproductive institute, February 2015).

Response time of ambulances to calls in the Western Cape was assessed by Marcus and Clow (70). They measured ambulance response time, the time from call to time of ambulance arrival at 5 MOU's in the Cape Peninsula (70). The mean response time was 106.67 minutes (N = 48). A reasonable urban response time was considered to be within 1 hour (70).

Govender (71) measured the ambulance response time within the Ugu Health District of KwaZulu Natal The mean response time was 101 minutes, with 64.5% of ambulance response times being over 1 hour. However, the Department of Health had a target of 70% of ambulance responses arriving within 1 hour (71).

In East London, Mangesi (72) interviewed women who had nearly died during pregnancy or delivery (near-misses). Administration, long referral procedure and inadequate transport were identified as contributing to near-misses (72). With some

causes of near-misses identified, the risk of repeat near-misses can be reduced if corrective action is implemented.

In Gauteng, 5.1% of avoidable deaths were caused by transport problems between facilities (34), and so it could be important to monitor inter-facility transport time. Thus, ambulance response time from the 5 MOU's in Soweto to CH-B is of relevance. The proportion of obstetric referrals that arrived at hospital with or without an ambulance is also of interest for DHS monitoring and planning.

1.4 Problem statement, Aim and Objectives of this study

To audit Mofolo MOU so that results can be compared with external studies and the Chiawelo study (35) within the Soweto DHS conducted 15 years earlier.

Aim:

This research report compared records of deliveries at Mofolo MOU with records from referred patients.

Objectives:

1. To calculate the referral rate from Mofolo MOU for women presenting in labour, as an index for protocol compatibility.
2. To determine clinical indications for referrals from Mofolo MOU to Chris Hani-Baragwanath Academic Hospital.
3. To calculate ambulance response time and transport method for the referred group.

Chapter 2. METHODS

Within the DHS, data is collected, reported, analysed and interpreted for evidence-based decision making (73). Gauteng has 36 MOU'S, one of which is located in Mofolo (34). Within Mofolo MOU, a Maternity Admission record book of patient data is collected on a daily basis. Data from each patient is written across two pages and includes a sequential presentation number for that month. Additional data includes age, parity, gravidity, outcome with referral reason if appropriate, birth weight and ambulance response time.

At Mofolo MOU, Midwife management is based on a written protocol from the Hospital which is the referral centre. The referral protocol (14,15), together with ongoing training, guides midwives to triage appropriately with evidence-based maternity care. If appropriate, an ambulance is called for transportation of referred women to Hospital. for specialist opinion, with theatre and blood transfusion facilities (13-15)**.** The patient outcome of birth or transfer before or after birth is written in the Maternity Admission book.

2.1. Study design

This is a retrospective, cross-sectional descriptive study that reviewed the record book for patient presentations and deliveries performed at Mofolo MOU during the first three months of 2010. The researcher accessed the Maternity Admission book containing data from 15/10/ 2009 to 2/4/2010. Data recorded from midnight on 1/1/2010 to midnight on 31/3/2010 was accessed.

2.2. Site

Mofolo MOU was the study site and is situated within Mofolo CHC in Soweto. Two professional midwives and auxillary nurses attend patients, without doctors. The pre-labour ward has 6 beds. Labour ward has 2 beds and 2 neonatal incubators. Post-delivery ward has 8 beds. After admission or delivery, if referral is indicated to CH-B, an ambulance is called to transport the patient to CH-B, if required. Ambulance response time is the time between ordering an ambulance and the ambulance reporting at Mofolo MOU reception.

Referral rate, referral reasons and ambulance response time and transport rate were determined. The protocol for referral from Mofolo MOU to CH-B is (14,15) and is undergoing continuous oral and written development. The 2nd edition was printed in 2001 (74), and updated on an ongoing basis (14,15).

2.3. Study population

The criteria of inclusion in this study consisted of all presentations of women to Mofolo MOU during the first three months of 2010 who were examined in labour, documented and recorded in the unit Admission Book. This included women who were examined, found not yet to be in active labour and discharged to go home, but only for demographic variables (age, parity, gravidity).

- Non-referred group included deliveries at Mofolo MOU without subsequent referral.
- Referred group will include all referrals to CH-B, both before and after delivery.

2.4. Data collection

Permission was obtained from both Mofolo CHC (Appendix 1), and from Gauteng Department for Health (Appendix 2). The DHS admission book (record book), written by staff was the source document for this study. Data from admissions and examinations was transcribed onto 60 data sheets, with records from 14 patients included on each page (Appendix 3). Writing data sheets and electronic data capture into Microsoft-Excel™ was undertaken by the researcher.

Data was initially entered into two Microsoft-Excel™ spreadsheets; referred and non-referred women. After completion, data from the referred group was transferred onto a second pair of Microsoft-Excel™ spreadsheets on a second computer. Thus the referred group was subdivided into referral before delivery and referral after delivery. Ambulance response time was filled into data sheets.

2.5. Measuring tool

The Microsoft-Excel™ spreadsheets were utilized for data analysis and comparison of the two groups. Thus, data from consultations was allocated into 2 groups. Data was categorised into the referred and non-referred groups**.** The data of these two groups was compared. Spreadsheet columns include:-

Maternal age in years,

Fundal height/ gestational age on examination,

Haemoglobin concentration (G/dl),

HIV categorical group (0 –ve, 1 +e),

Parity,

Gravidity,

Referral in labour,

Fetal heart rate in beats per minute prior to delivery,

Referral after delivery,

Delivery birth weight, in Kilograms,

Neonate sex, male (M) and female (F),

Referral reason, 15 categories,

Ambulance response time, in minutes.

Mofolo MOU practised the 6 BEmOC elements (page 3), not surgery or blood transfusions. The referral rate was calculated as the proportion (%) of women who presented in labour to Mofolo MOU that were referred. Thus women who were examined, found not to be in labour and discharged were excluded.

The Microsoft-Excel™ statistical program was applied for data analysis. Variables listed on spreadsheets included; age (years), parity, haemoglobin (g/dl), birth weight (kg) and time (minutes) from ambulance called to reporting at Mofolo MOU. Statistical analysis was expressed as mean with standard deviation. The Student's unpaired T-test was applied to compare groups at the 5% level of significance.

Reasons for referral were grouped by number and included:

- Delayed labour
- Pregnancy induced hypertension/eclampsia [PIH]
- Antepartum haemorrhage [APH]
- Anaemia

- Cephelo-pelvic disproportion [CPD]
- Fetal heart not heard [FHNH]
- Fetal distress
- Preterm
- Premature and prolonged rupture of membranes [PremROM]
- Postpartum haemorrhage [PPH]
- Retained products of conception [RPOC]
- Possible meuconium aspiration [MSL]
- Neonatal reasons (low birth weight and neonatal distress)
- Other (vaginal warts, epilepsy, asthma, diabetes, shock or blood transfusion, condylomata and cardiac problems).

“Referral reasons”, were allocated into 15 groups, to count the leading referral reasons, both before and after delivery. The number and names of referral reasons were counted manually on paper for both maternal and/or neonatal referrals.

Each variable was allocated a number, for statistical processing. For presentations that had 2 or more referral reasons, a value one of ½ or 1/3 was allocated as appropriate, to reduce a source of bias. Results were calculated as a percentage (%) of the total sample and frequencies. Microsoft- Excel™ statistics was applied for mean ± standard deviation. Histograms and a Box-and-whisker diagram of birth weight was drawn with R software. A flow chart of ambulance response time were drawn with Microsoft Word™. The Student’s unpaired T-test was applied; at the 5% level of significance.

The referral group (N=347) was then divided into two sub-groups; pre-delivery (N=303) and post-delivery (N=44), within a separate spreadsheet on a second computer. The proportion (%) of referrals was calculated.

After the total number of transfers was calculated, the percentage of transfers by ambulance was counted. Ambulance response time is the time elapsed between calling for an ambulance and the ambulance reporting arrival to the reception at Mofolo MOU for fetching the patient for transportation to CH-B hospital. The average ambulance response time was calculated and a histogram was constructed with R software (www.r-project.org), with 20 minute periods. The percentage of transfers to CH-B with either ambulance or private transport was calculated. The average ambulance response time was also calculated for transfers taking 60 minutes or longer.

2.6 Ethical issues

The University of the Witwatersrand Research Ethics Committee clearance certificate was obtained on 28 January 2011, Number M110126 (Appendix 4). Revised protocol approval was obtained from the Division of Emergency Medicine Research Assessor Group (Appendix 5).

Chapter 3. RESULTS

3.1 Objective 1: Rate of referral from Mofolo MOU to CH-B

Of the 834 women presenting, there were 210 (25.1%) non-labour consultations who were discharged after being acknowledged as their attendance was encouraged to reduce 2nd stage delay. Four women in labour were transferred out because of staff shortages.

Data from 620 presentations was reviewed and consisted of:

- There were 317 deliveries at Mofolo MOU (50.6% of labour presentations).
- There were 347 referred patients (347 ÷ 620 x 100) = 56%. ; 303 patients (87.3%) were referred to CH-B before delivery, and 44 after delivery (12.7%).
- Of the 44 neonates transferred to CH-B after delivery, 21 were referred and 23 accompanied their referred mothers. The neonatal referral rate was thus: 21 ÷ 317 x 100 = 6.6%

3.2 Objective 2: Referral Reasons

Table 1 below shows referral reasons for pre-delivery and post-delivery groups.

Pre-delivery	**(N=303)**	**%**	**Post-delivery**	**(N=44)**	**%**
			Neonatal reasons	**21.5**	**(50%)**
PIH	69	(22.8%)	PPH	6	(13.6%
Partogram delay	51	(16.8%)	Preterm & SGA	5	(11.3%)
MSL	44.5	(14.7%)	RPOC	3	(6.8%)
PremROM	31.5	(10.4%)	Big baby (≥4 kg)	3	(6.8%)
Preterm & SGA	25	(8.2%)	MSL	2.5	(5.7%)
CPD	15.5	(5.1%)	Anaemia	2	(4.5%)
FHNH	14	(4.6%)	Maternal Tachycardia	2	(4.5%)
Anaemia	12.7	(4.2%)	Maternal Respiratory distress	2	(4.5%)
Infection	7.7	(2.6%)	Maternal Pyrexia	1	(2.2%)
APH	7.3	(2.4%)	Perineal tear	1	(2.2%)
Other	25	(7.6%)	Maternal bradycardia	1	(2.2%)

PIH Pregnancy induced hypertension & eclampsia
PPH Postpartum Haemorrhage
PremROM Premature rupture of membranes
RPOC Retained products of conception
SGA Small for gestational age or preterm
APH Ante partum haemorrhage
MSL Meconium stained liquor
CPD Cephalo-pelvic disproportion
FHNH Fetal heart not heard

Table 2 below shows comparative data of the two groups (Mean ± SD).

- Referred women were significantly younger, with lower parity and gravidity,

- In the 44 referrals for neonatal reasons, both birth weight and fetal heart rate were significantly lower.

	Non-referred	**Referred**	***p value<0.5%**
Birth weight (Grams)	3071.08±366.18 [N = 271]	2864.88±711.94 [N = 43]	* p<0.05
Fetal heart rate (per minute)	137.14±3.94 [N = 388]	135.45±12.47 [N = 294]	** p = 0.0061
Parity	0.889±0.93 [N = 467]	0.593±0.867 [N = 332]	* p < 0.05
Gravidity	1.994±0.959 [N = 465]	1.72±0.90 [N = 329]	* p<0.05
Age (years)	25.86±5.66 [N = 490]	24.97±5.98 [N = 344]	* p <0.05

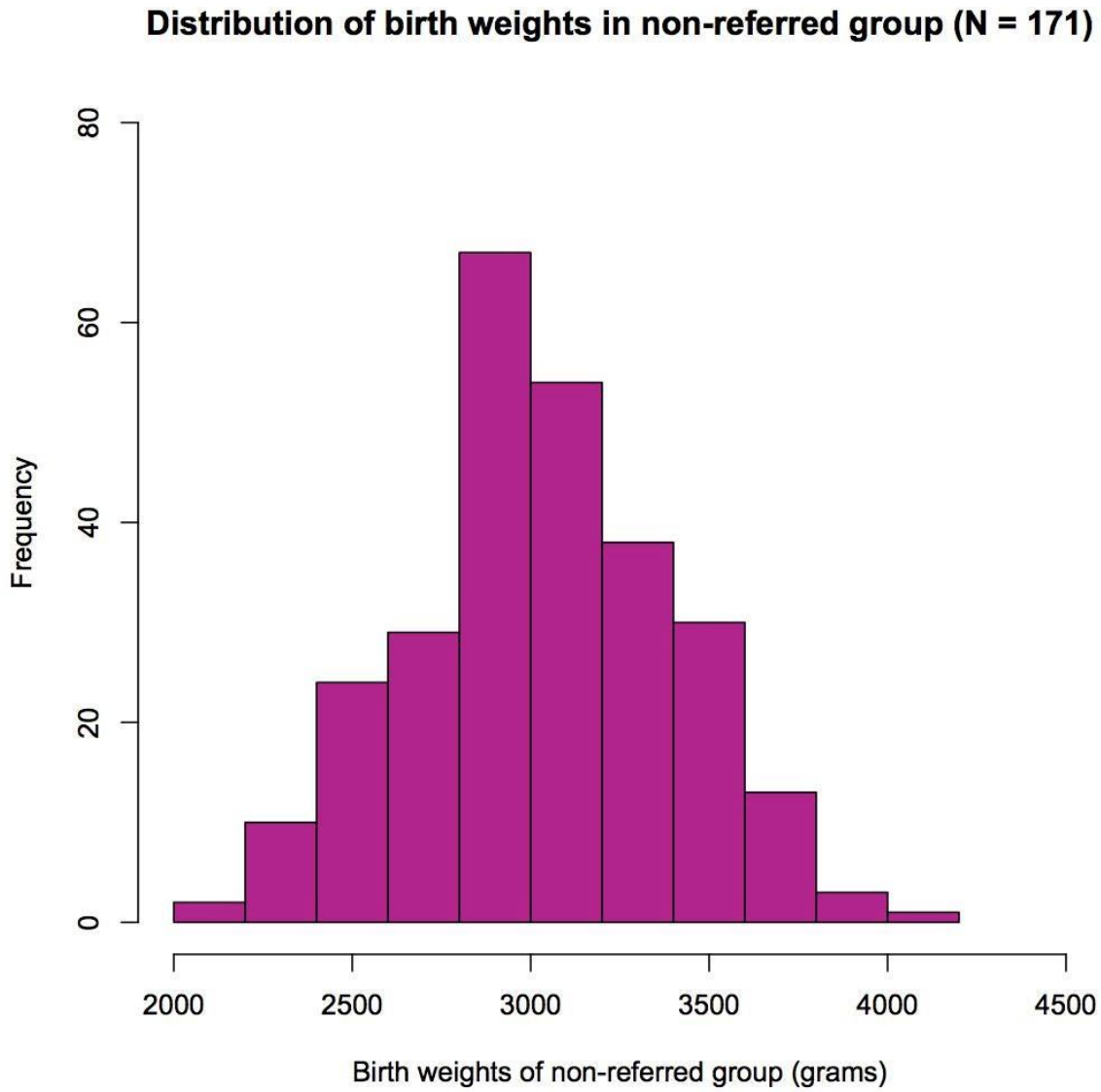


Figure 1: Histogram illustrating birth weight for non-referred neonates (grams);

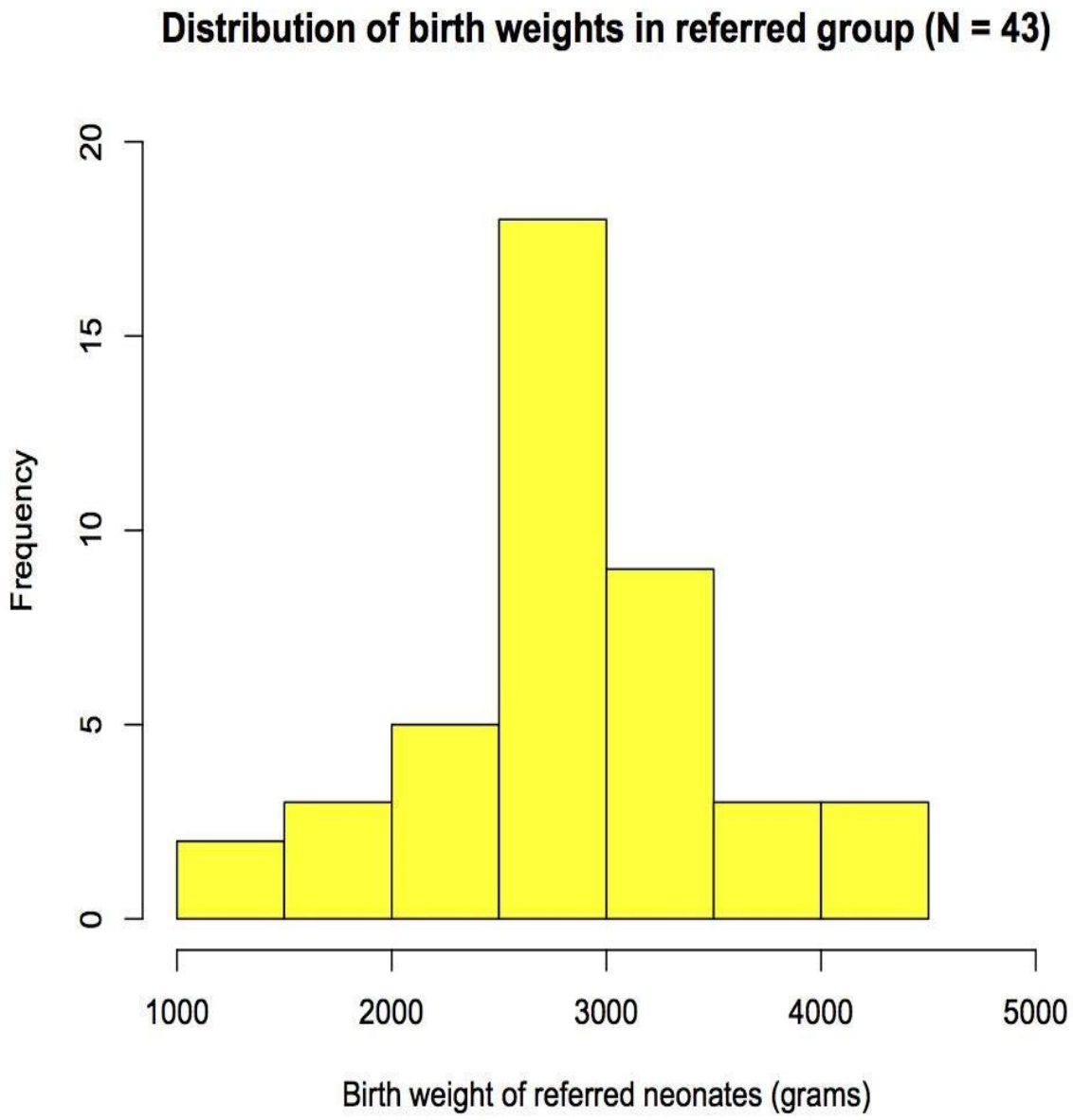


Figure 2: Histogram illustrating birth weight for referred neonates (grams);

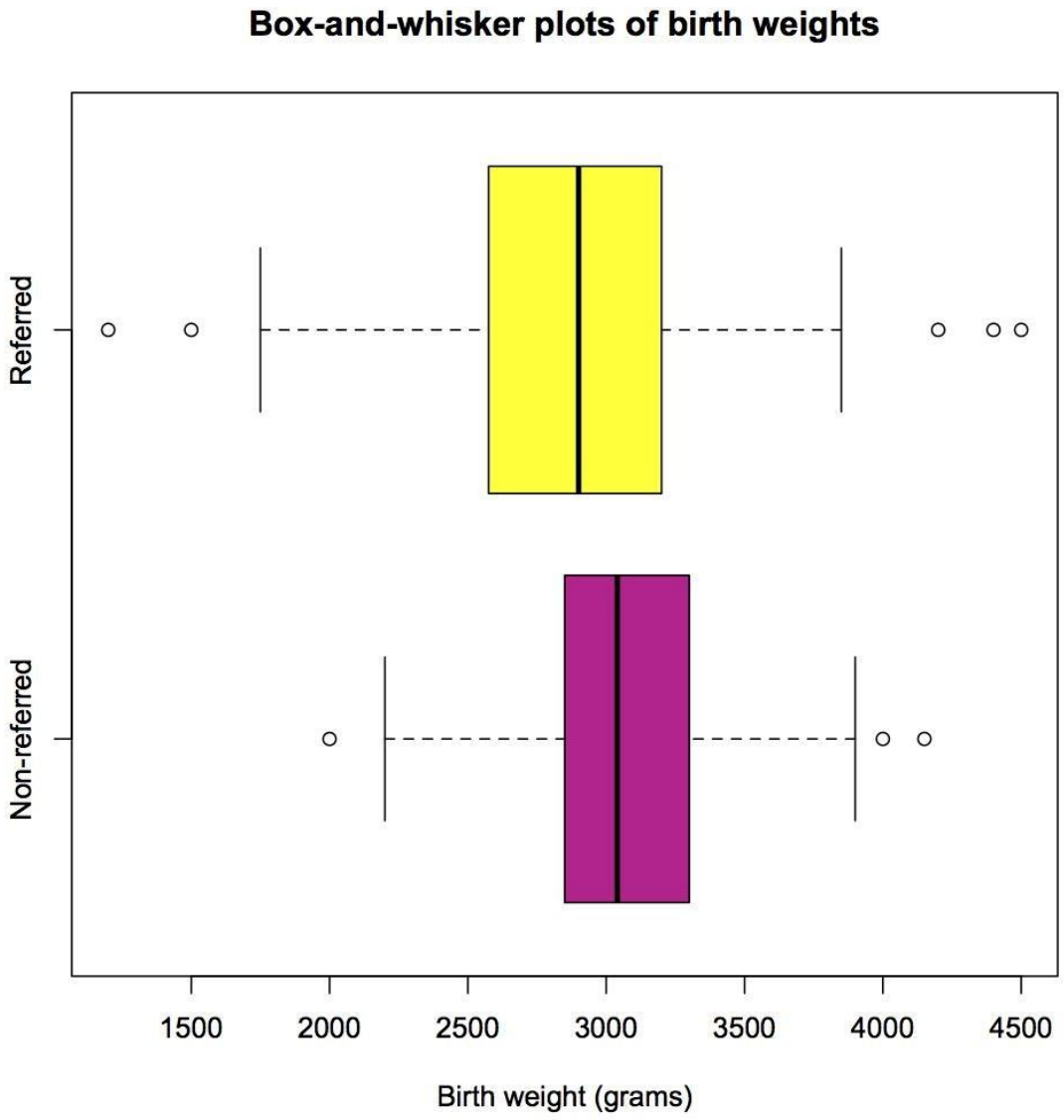


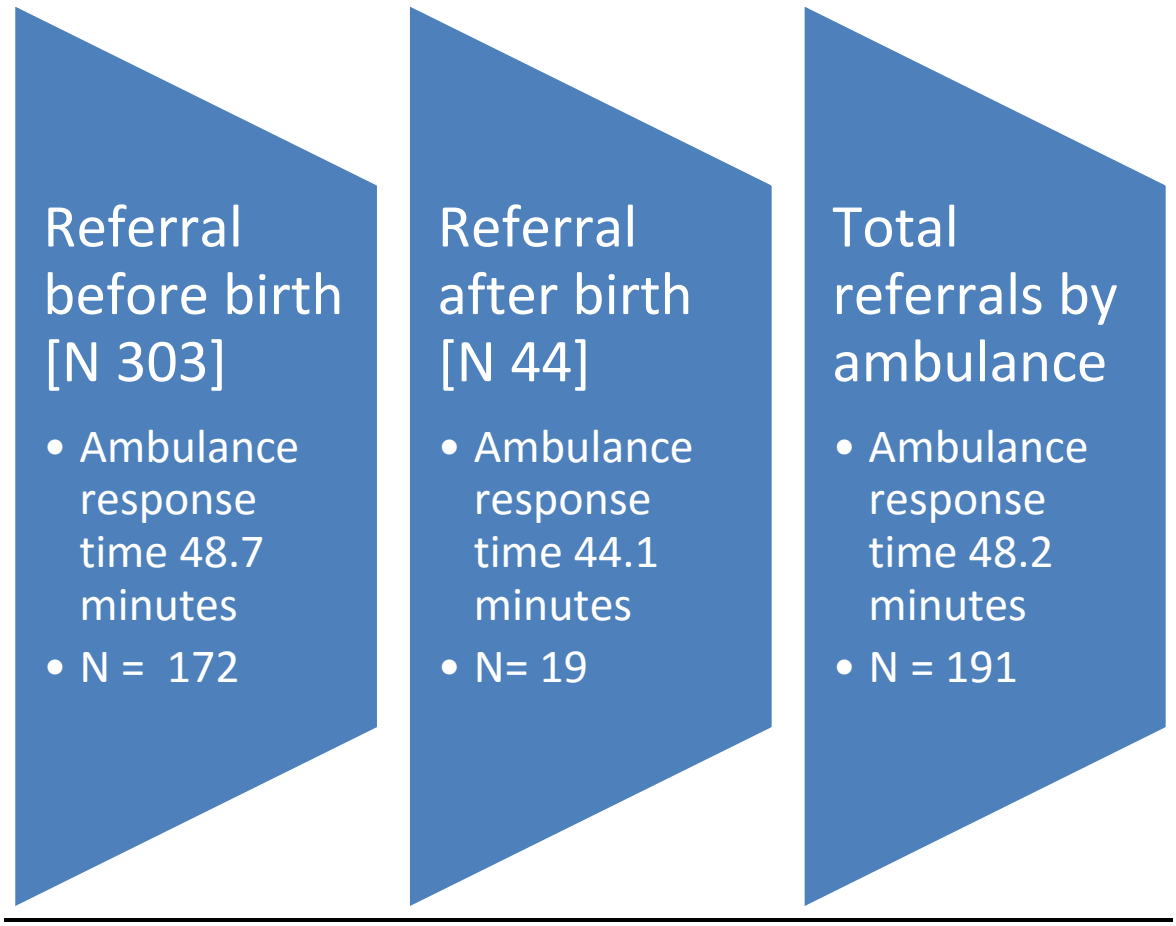
Figure 3: Box and whisker plot of non-referred and referred groups

Box-and-whisker plots of birth weights showing the median, interquartile range (IQR) and the lowest and highest datum within 1.5 IQR of the quartiles respectively.

3.3 Objective 3: Ambulance response time for transfer

Ambulance response time results were:

- The Mean ambulance response time was 48.2 minutes [N=191].
- Ambulance response time was under 60 minutes for 77% of ambulance transfers.
- For the 23% of ambulance responses which took 60 minutes or longer, the average response time was 105.4 minutes.
- Ambulance response time was recorded for 55%. Mofolo MOU is one block walk from a main road. It was reported to the researcher that many transferred women chose private transport. Thus it appears that 45% of patients for transfer chose private transport from Mofolo MOU to Chris Hani-Baragwanath Academic Hospital.
- Response time for 172 pre-delivery referrals was 48.74±45.3 minutes.
- For the 19 post-delivery referrals with recorded ambulance response time, the time was 44.1±22.1 minutes. This was 4 minutes shorter, suggesting an element of triage but was not statistically significantly different from the total ambulance response time.



Referrals Before birth [N=303] +After birth [N=44]" = Total referrals [N=347].

Figure 4: Ambulance response time chart.

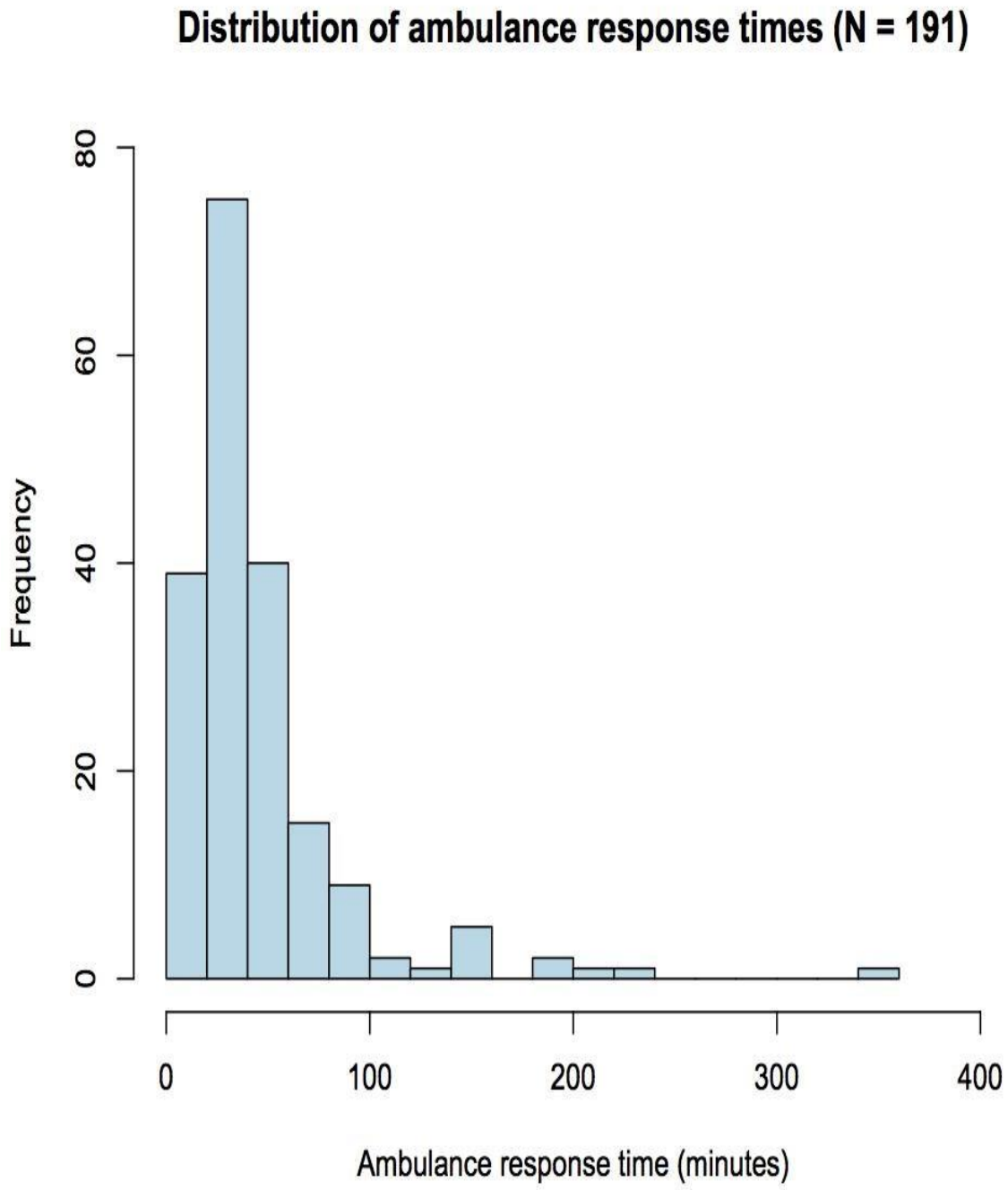


Figure 5: Histogram of ambulance response time (Call to Presentation time) for referred group (N = 191)

Chapter 4. DISCUSSION

Of the 7 MOU's in Soweto Health District, only Chiawelo MOU has been reported on (34). As DHS integration is essential, Mofolo MOU was chosen for this research because:

- It is representative of the 7 MOU's in Soweto DHS,
- Mofolo MOU had not been reported on before,
- Evaluating Mofolo MOU could assist with Soweto DHS monitoring and evaluation strategy,
- The researcher was a PEPFAR fellow with Wits Health Consortium for 1 year based at Mofolo CHC from August 2009.

4.1 Objective 1: Referral Rate.

At a MOU (basic EmONC), it is important to assess the referral rate as this impacts on both the demand side (pregnant women), and the supply side (Referral hospital like CH-B).

Among the 620 women who presented to Mofolo MOU in labour, there were 317 deliveries (51%). There were 347 referred women; 303 before delivery and 44 after delivery. Thus, the referral rate was 347 ÷ 620 = 56% from Mofolo MOU.

It is of interest to compare the Mofolo MOU referral rate in 2010 with Chiawelo MOU in 1995 as they are in the same DHS. At Chiawelo MOU (34), the total referral rate from 1 209 labour presentations was:

(373 pre-delivery women + 59 post-delivery women + 274 neonates) ÷ 1209 =

58.4% referral rate.

In addition, the neonatal referral rate was 33% as 837 neonates were born in the Chiawelo study (34) of which 274 were referred to CH-B.

Thus, the referral rates from Mofolo MOU in 2010 was similar to Chiawelo MOU in 1995, but the portion of neonates referred from Mofolo MOU was 6.5%; down from the 33% at Chiawelo MOU.

This referral rate is higher than the study in rural Burundi by Tayler-Smith et al (29), which suggests a district referral rate of 14.2% (31). The rural district had mountains and 1 paved road connected to dirt roads. The distance of the 8 basic EmONC units from the comprehensive EmONC varied from 1 to 70 km, with the furthest being a 3 hour ambulance drive one way (29).

In comparison to rural Burundi (29), Mofolo MOU is 6 km from CH-B. In addition, as Mofolo CHC is 1 block from a main road, referred patients can choose between ambulance or private transport. Thus, Mofolo MOU functioned as the delivery facility for 51% of women, and as the entry level facility for 56% of referred women. Quality PHC is delivered, and integration within DHS facilitates referral with both EMS and private transport, on tarred roads.

Strand et al (30) evaluated the combined referral rate from 3 peripheral EmONC units to hospital in Luanda, Angola. During 3 months in1996, there were 398 referrals from 2 443 births, giving a referral rate of 16.3%. Education about partogram use followed together with discussions about possible referral process improvements (30). From December 1998 to February 1999, there were 429 referrals from 1 752 births; a referral rate of 24.5%. The results from the 1st study were discussed and solutions were implemented which improved health care for obstetric emergency referrals (30), in keeping with collaborative practice (24-27).

In India (19), deliveries within health facilities rose from 30% in 2005 to 81% in 2010. During a 5 day study at 97 health facilities, there was a 10.7% referral rate (19). The average referral distance from basic EmONC to complete EmONC was 47 km. With increasing road distance and transfer time, a high referral rate like the 56% at Mofolo requires more transport resources.

In response, Buchmann (75) reflects that WHO suggested the ideal referral rate is 15%, as studies of referral rate have reported that both maternal and perinatal deaths reduce only up to a certain referral rate (75).

In Ethiopia, Admasu et al (31), report that the referral rate appears to be 43%, but only 7% of deliveries were in health facilities, and only 3% in comprehensive EmONC facilities. Thus, the referral rate should be assessed together with the proportion of deliveries within health facilities. Within the Mofolo suberb, over 90% of deliveries occur within health facilities (T Ndlela, personal communication).

Buchmann deduces that a referral rate of below 15% is sub-optimal, however stating the optimal upper referral rate is multifactorial and more complex (75). For example, a 100% referral rate was targeted in an Australian study (28). The policy was to fly all deliveries from remote Northern Territory 500 km to a comprehensive EmONC unit. Thus, if an obstetric emergency develops, the pregnant women will benefit from better risk management. With this proactive policy, of 99 Barkly women, 93 were flown before delivery and 6 immediately after (28).

In the1994 Chiawelo study (34), the the total referral rate from 1 209 labour presentations at Chiawelo was: (373 pre-delivery women + 59 post-delivery women + 274 neonates) ÷ 1209 = 58.4%. However neonatal referral rate to CH-B (33%) from Chiawelo clinic was 33%; 837 neonates were born, of which 274 were referred (34). At Chiawelo, Neonatal referral reasons included 191 for MSL (70%), but at Mofolo only 5.7% of 44 neonates were referred for MSL. Buchmann reports that after the Chiawelo study in 1997, the high rate of neonatal referral was discussed with the paediatric department and interventions were implemented (Buchmann; personal oral communication 6-17 July 2015).

The referral rate at Mofolo was 56%, which is similar. As Mofolo and Chiawelo are in the same health district (DHS), it is important to consider why total referral rate was similar, when the referral rate for neonates was lower at Mofolo MOU (21 neonates referred ÷ 317 deliveries) = 6.6%, excluding 23 neonates that accompanied their mothers who were referred post-delivery. Thus the neonatal referral rate at Mofolo MOU was 6.6% compared to 33% neonatal referral rate at Chiawelo (34), but with a

similar combined referral rate. What are possible causes for increased maternal referral, and could the trend continue?

Thus, the maternal referral rate has risen from 35.7% in 1994. Why? In a review from Discovery health, a private medical aid administrator which has 2.1 million members in South Africa, Kula et al (77) report that a referral rate of 71% was calculated in 2011. Clinical data from over 200 000 deliveries was included during the 2005-2011 period (77).

Howarth reports that during the last 10 years in the United Kingdom, 49% of all insurance claims paid were for obstetrics. This appears to reflect the situation in South Africa (78). It is possible that an early referral policy may have been adopted to avoid litigation.

The present referral rate may have decreased with:

- Additional training as well as a new National referral protocol (15)
- The drop in MMR South Africa now is observing. The National department of Health Annual Report for 2013/14 states on page 14 that MMR was reduced from 304 in 2009 to 269 in 2012 (69).

4.2 Objective 2: Referral Reasons.

PIH was the single biggest referral reason with 69 (19.8%) of 347 referred women from Mofolo MOU. At Chiawelo (34), 373 women were referred to CH-B in labour, of which 136 (36%) had PIH as the referral reason. Thus, the 19.8% of referrals from

Mofolo for PIH in 2010 is significantly less than the 36% of referrals with PIH reported by Buchmann during fifteen years earlier (34).

As Buchmann was subsequently associated with district protocol development (14,15) and training, the lower PIH referral rate observed at Mofolo in 2010 may be from feedback within the DHS to reduce PIH referrals after the Chiawelo study (34). Greatly reduced PIH referrals were reported by Sun et al (32), whose study included 60 445 deliveries in China. They counted 1 016 hypertensive women (1.7%) and 277 eclampsia (0.4%) patients (32). This lower proportion of PIH was also reported in Sikder's study (36) of 42 214 pregnant women from Bangladesh, where 328 (1%) reported eclampsia (36). The large difference between the higher Soweto DHS referral rate for PIH could be due to different protocol criteria for diagnosis.

In the interventional study of Strand et al (30), the proportion of referrals for PIH was 17.8% in 1996 and was reduced to 10.4% of referrals in 1998/9. This is compatible with the proportion of PIH being reduced in the Soweto (Chiawelo-Mofolo) DHS after interventional training with protocol modification.

A bigger proportion of eclampsia was reported in the study conducted by Litorp et al (38) from Tanzania. They reported that eclampsia caused 42% of 467 near-misses and 77 maternal deaths in a study of 13 121 deliveries (39). The leading clinical signs for near-miss diagnosis were fits (35%) and shock (24%). The diagnosis was made on arrival for 43% and after arrival for 56%. There were 180 of 222 women (82%) with eclampsia who met the near-miss criteria on arrival (38). This suggests

that the clinical diagnosis of eclampsia is much more specific than that of PIH, with raised blood pressure and proteinurea.

Pattinson (66) suggests the challenge of predicting PIH could be assisted with the availability of uterine artery Doppler ultrasound in South African MOU units. He confirms that definitive treatment is delivery, but implies that more accurate diagnosis is needed (66). If available, more accurate screening could reduce referrel numbers for PIH.

Thus, the PIH referral rate from Mofolo MOU was 19.8%, and this appears to be midrange between 1% (32,36) to 42% (38).

Prematurity, described as decreased gestational age and/or size, was the second highest referral reason from Mofolo MOU to CH-B. Combined prematurity referral reasons caused 17.7% of referrals (31.5 for PremROM, 25 for Preterm and 5 underweight babies; thus 61.5 / 347 = 17.7% of referrals). As can be expected, the neonates referred from Mofolo to CH-B were significantly lighter ($P<0.05$). Hund et al (79) writes that PIH is associated with increased prematurity and greater need for neonatal admission. Thus, the high proportion of PIH referrals from Mofolo could increase the proportion of prematurity, as combined prematurity was the 2nd highest referral reason.

The risk of infection rises with premature/preterm rupture of membranes (Prem ROM) and increases with time (71). In this study PremROM accounted for 31.5 referrals (10.4%) from Mofolo MOU to CH-B and infection was the referral reason for

7.7 women (2.3%). Thus, of the 624 women in the Mofolo study, 5% had PremROM and infection was frequently a joint referral reason. Tayler-Smith et al (29), reported rupture of membranes for over 12 hours in 116 of 406 referrals (28%). This rate of PremROM with infection is compatible with the report of Faksh et al (80), who writes that 30-40% of preterm births occur after PremROM (80).

Anaemia was the referral reason for 15.7 women (4.5%). Like PIH and infection, anaemia also predisposes to both prematurity (16) and maternal death (16). Basu et al (16) extracted data on all anaemic women who delivered during May 2010 at Charlotte Maxeke Johannesburg Academic Hospital. There were 689 deliveries, from which 26 women were transfused (4%). ANC records were examined and 18 of the 26 women (86%) had anaemia at the 1st ANC visit (Haemaglobin <11 gm/dl). Basu et al (16) state anaemia screening twice during ANC with iron supplementation is important.

As blood transfusions are not given at Mofolo MOU, women requiring a blood transfusion are referred to CH-B according to referral protocol. At Mofolo MOU, 4.2% of women were referred for anaemia pre-delivery and 4.5% of post-delivery women were referred for anaemia

In a study of 5 997 births, Fouelifack et al (81) found that adolescent births were 9.3% but were associated with 29.3% of preterm deliveries. Maternal age data is available at Mofolo MOU, and the determination of adolescent births could be determined in a following study, linked with lowering the prematurity rate (81).

Similarly, the preterm rate was higher in the Australian study by Schultz et al (28), as 16% of deliveries were preterm and 21% had low birth weight. The proportion of mothers under 20 years was 29%. This study (28) and the Mofolo study, both have high preterm rates.

DeFranco et al (82) report that women who get pregnant within 18 months of giving birth have a higher risk for a preterm birth. The effect of birth intervals on preterm delivery is of interest where PremROM is high, like Mofolo. This could also be assessed, but within a prospective study, as this data is not in the record book at present (82).

Partogram delay in labour was the third highest referral reason from Mofolo, and was the referral reason for 51 women (14.7%). This is lower than the Chiawelo study (34), where 70 of 374 (18.7%) women were referred for partogram reasons.

Tayler-Smith (31) reported that 216 women with prolonged labour over 24 hours (15%) included in 1 406 referrals. These 3 studies have similar referral proportions for partogram delay.

Furthermore, an additional 15.5 women (4.5%) were referred from Mofolo MOU to CH-B for CPD. Similarly, 95 Women (4.7% of all deliveries) were referred from Chiawelo for CPD (34). The combined partogram and CPD referral proportion of 19.2% from Mofolo is close to the 18.7% from Chiawelo (34).

Strand et al (30) conducted an interventions study within Angola during 1996. Data from 157 women who were referred from 3 MOU's was reviewed. The distance to hospital was between 2 and 6 kilometers away and maternal mortality was 17.8%. After partogram education and additional changes at both MOU's and Hospital, data from 92 referrals was compared with the earlier study. Maternal mortality was 0 in the secoud study, and was associated with a significant improvement in partogram quality and decreased waiting time. Of referred women, 28.7% were referred for prolonged labour in 1996 and 29,2% in 1998/9 after intervention. As partogram delay caused 16.8% of referrals from Mofolo MOU, the referral rate for partogram delay appears 84% lower (30). Less referrals for CPD earlier, could account for this larger proportion.

Pattinson (66) states that assisted deliveries in the United Kingdom are 13% of lowrisk deliveries whereas the South African assisted delivery rate is under 1%. Consequently, the skills for assisted delivery are not as well developed in South Africa and this opportunity could be developed (66).

From a meta-analysis of 15 studies, Blix et al (44) report that the proportion of emergency transfers to hospital from home births varies from 0% to 5.4% (44). Pattinson states that a low figure suggests good screening for low risk births together with assisted delivery skills (66).

Haemorrhage was the referral reason for 13.3 of 347 referrals (3.8%) from Mofolo. Of 303 pre-delivery referrals, there were 7.7 APH referrals and of 43 post-delivery referrals, 6 were for PPH. The Chiawelo study (34) had a much higher rate of PPH as this was the indication for 23 of 59 (39%) of all post- delivery referrals.

Basu et al (16) report that the indications for blood transfusion for 26 women during May 2010 included 21 for PPH (80%) due to atonic uterus and 2 for retained products of conception [RPOC], being 4%. At Mofolo, 6 of 347 referrals were for PPH (1.7%) and 3 were for RPOC (0.86%).

In the same study, Basu (16) reported 2 women had vaginal lacerations (8%) as the cause of haemorrhage, and 1 had abruption placenta (4%). Packed red cells were transfused for 24 women (92%), 1 received packed red cells and platelets (4%) and 1 received packed red cells, platelets and fresh frozen plasma (16). For 20 of 26 women the number of units was written, and was 2 units on average (16). Basu et al (19) report that multiparity and late ANC booking were associated with haemorrhage. HIV status was documented for 24 women, and 13 were positive (54%).

In this study at Mofolo, infection was counted only as the referral reason for 7.7 women (2.2%), which may be underestimated because infection causes 44% of maternal deaths in South Africa (35).

4.3 Objective 3: Ambulance response time.

For the 191 referred women (55%) who went by ambulance to CH-B, the average ambulance response time was 48.7 minutes. Mofolo DHS is urban and can be compared with the Cape Peninsula (70). Urban response time of ambulances to calls was assessed by Marcus and Clow (70). They measured ambulance response time; the time from call to time of ambulance arrival, at

5 MOU's in the Cape Peninsula (70). The mean response time was 106.67 minutes (N = 48).

Govender measured the ambulance response time within the rural Ugu Health District of KwaZulu Natal (71). The mean response time was 101 minutes, with 64.5% of ambulance response times being over 1 hour. However, the Department of Health had a target of 70% of ambulance responses arriving within 1 hour (71). However, a reasonable urban response time in South Africa was considered to be within 1 hour (70). A response time of 2 hours is suggested as adequate (57) for obstetric emergency referrals within a first –world urban setting.

Chaturvedi et al (19) write that two hour travel time is the acceptable standard for transfer time to EmONC. During a 5 day study on travel time for inter-facility referrals in rural India, 1 182 pregnant women presented at 96 health facilities. Women arriving directly from home numbered 1 071 (90.1%) and 111 (9.4%) were referred. The average inter-facility travel time was 1.25 hours. Obstructed labour was the most frequent referral reason (40%), with "Time to Death" of 12 hours without adequate treatment compared to 2 hours for haemorrhage (19). A 2 year maternal death review found that the average time of death was 6.75 hours after arrival (19).

Pembe at al (83) applied the 3 stage delay model of Thaddeus and Maine (63) to analyse 155 maternal deaths in Tanzania. Stage 1 delay (before MOU or hospital arrival) of pregnant women seeking care was most frequent (73.3%). Stage 3 delay in receiving treatment was rated was 18.3% (83).

Strand et al (30) reported on an interventional study in Angola on referrals from peripheral obstetric units to 2 hospitals in Luanda. Data from 157 obstetric emergency referrals was studied. The average transport time from the MOU' was 54 minutes (stage 2), but the waiting time (stage 3) from admission in the referral hospital until first doctor examination was 13.7 hours. After interventional improvements in hospital admission and partogram education, data from 92 admissions was compared. Waiting time was reduced from 13.7 hours to 1.2 hours (30).

Kaye et al (84) conducted a prospective study on referrals to Mulago Hospital in Kampala. Within 983 referrals there were 104 near-misses and 17 maternal deaths. They found stage 1 delay important as personal, family and community problems led to stage 1 delay in 23% of near-misses and 43% of maternal deaths (84).

At Mofolo, the ambulance response time is one component of stage 2 delay, another being Ambulance transport time. In addition to stage 2 delay, stage 1 and stage 3 delay are also very important.

Pacagnella et al (85) undertook a study at 27 referral obstetric facilities in Brazil. During 2009, the research team screened of 82 144 births in a prospective trial. Potentially life-threatening conditions were present in 9 555 deliveries (11.6%) and delay occurred in 52% of these deliveries, but delay in transfer occurred in 3.3%. There were 140 maternal deaths (0.17%) and delay was found to occur in 84%, but

transfer delay occurred in 26.4% of these deaths. Pacagnella et al found an increase in delay was associated with a more severe outcome (85).

Pattinson (66) suggests that the decrease in maternal deaths after the addition of 18 ambulances (68) was multifactorial In this study at Mofolo MOU, 214 women who presented were assessed as not being in labour and discharged. Encouraging early screening can be expected to lower stage 1and 2 delay for participating women. Reducing stage 1 and 2 delay was possibly a factor in the Free State.

Furthermore the ARV rollout at that time was also associated with lowering maternal mortality. This is supported by a mata-analysis that reported HIV-infected pregnant women had 8 times greater risk of death (68). As South Africa has 300 000 pregnant HIV +ve women annually (86), ARV treatment is vital to prevent rising MMR (87).

Within the Soweto DHS, PHC facilities are planned as the entrance level to DHS, through the referral process with EMS if indicated by protocol (6-8). At Mofolo MOU the ambulance response time was within the desired 70% response rate within 1 hour. In addition, private transport assisted with linking Mofolo MOU to CH-B. Thus within the Soweto DHS (4), the 5 MOU's are integrated; with a referral process to CH-B.

Chapter 5. CONCLUSION

Objective 1: The total referral rate (56%) appears comparable to that of the Chiawelo study (58.4%), which is part of the same DHS (34). However, as the referral rate for neonates has dropped to 6.6% at Mofolo MOU from 33% at Chiawelo, the apparent referral rate for women has increased at Mofolo MOU. **Objective 2:** The maternal referral reasons appears compatible with protocol and the literature review. **Objective 3:** Ambulance response time appears fast in comparison to other studies and integrates Mofolo MOU within the District Health Service. Staff within Mofolo MOU feel this is appropriate as alternative transport is usually faster. Follow-up reports from CH-B would assist in answering this question. The proportion of referrals that did not travel by ambulance was 45%.

Limitations: The number of ANC visits attended was not written in the record. Outcomes from CH-B could be helpful for triage and treatment. Feedback from CH-B on referrals was not documented in the record book, including no feedback from CH-B was obtained about the arrival rate among the 45% of referred women who undertook to go with private transport. Post-delivery referral reasons are not all included newly diagnosed HIV and born before arrival, not all of which were referred. Some scored ½ or 1/3.

Recommendation: A follow-up study measuring the referral rate and ambulance transport form is suggested, as 45% of transferred patients appeared not to have been transported by ambulance.

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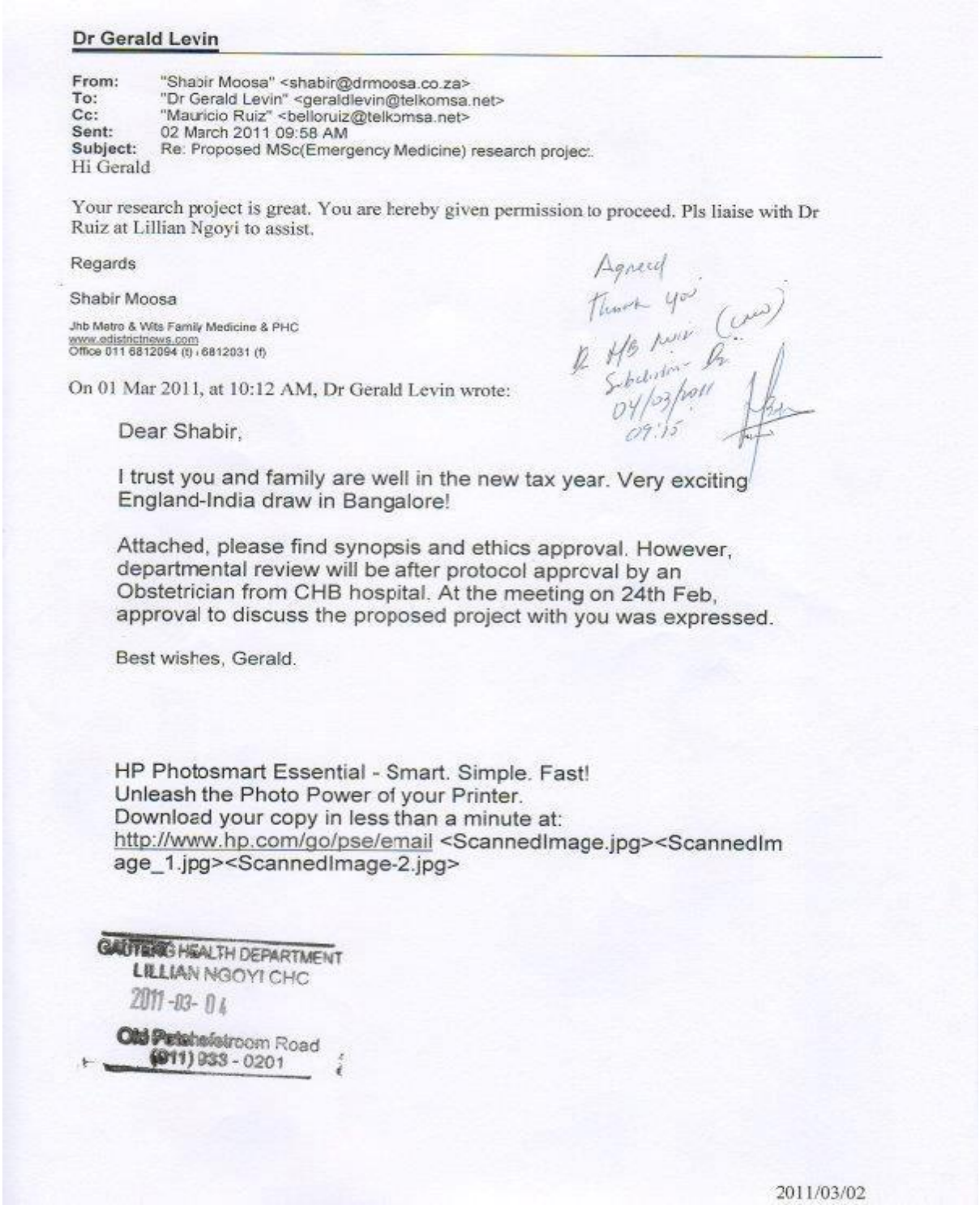
7. APPENDICIES

Appendix 1: Approval for study within Mofolo CHC



Dr Gerald Levin

From: "Shabir Moosa" <shabir@drmoosa.co.za>
To: "Dr Gerald Levin" <geraldlevin@telkomsa.net>
Cc: "Mauricio Ruiz" <belloruiz@telkomsa.net>
Sent: 02 March 2011 09:58 AM
Subject: Re: Proposed MSc(Emergency Medicine) research projec:

Hi Gerald

Your research project is great. You are hereby given permission to proceed. Pls liaise with Dr Ruiz at Lillian Ngoyi to assist.

Regards

Shabir Moosa

Jhb Metro & Wits Family Medicine & PHC
www.edistrictnews.com
Office 011 6812094 (t) · 6812031 (f)

Agreed
Thank you
Dr HS Moosa (MMed)
Substitute Dr
04/03/2011
09:15

On 01 Mar 2011, at 10:12 AM, Dr Gerald Levin wrote:

Dear Shabir,

I trust you and family are well in the new tax year. Very exciting England-India draw in Bangalore!

Attached, please find synopsis and ethics approval. However, departmental review will be after protocol approval by an Obstetrician from CHB hospital. At the meeting on 24th Feb, approval to discuss the proposed project with you was expressed.

Best wishes, Gerald.

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2011/03/02

Appendix 2: Gauteng Department of Health approval

Attach: Research guideline-0001.pdf
Subject: EmOC at Mofolo study
Dear Dr Levin

Please find send to you are research guidelines from the department to guide you in strengthen your protocol.

The purpose of the study as per my understanding is to look into reasons for EmOC referrals to Bara. Therefore I have the following questions/comments:

1. Rationale for the study
    a. What is the problem statement? Is the criteria for referral not adhered to? A majority of cases that are referred could have been treated at Mofolo? In short from the retrospective study what are you hoping to show/learn that will improve the manner which EmOC are handled or could be prevented?

    b. The indications for referral should show a certain trend based on your observations and it warrantees that you do an investigation either to prove or disprove the current theory you have as informed by your experience in Mofolo?

    c. Yes in the broader scheme of things we want to contribute to MDGs but it is fundamental that we identify problems and find solutions to them locally so as to improve the manner in which we handle/treat our patients and we hope such as study will be able to identify short-comings in our health care systems and suggest solutions and generate knowledge that is scientifically driven. for their

2. The research guidelines should help in you terms of other expectations form the DoH.

3. If we have 32 admissions per week, how many of these were EmOC referred to Bara during the period that you want to look at (January to March 2010)? An answer to this questions might influence your sample size for a meaningful conclusion made regarding reasons fro EmOC referrals. If there were very few EmOC referrals during this period you might want to consider how far back you go in your retrospective study?

4. Based on the main objective of the study you will not be able to make recommendations on improving the EmOC services as your study focuses on reasons/indications for referral. Unless the reasons for referrals point to poor obstetric service in Mofolo

Hope this is helpful

Regards

Mr. Benny Sikhakhane
Deputy Director: Monitoring and Evaluation
Address:
JHB Metro Health District
Conner Klein and Smith Streets Hillbrow
Room 125 Admin Block Hillbrow CHC

Appendix 3: Data sheet

[page 61 for February 2010]

	Date, Time	Fundus Height (week)	Fetal H Rate (BPM)	Age (yrs)	Hb g/dl	Parity	RPR 0,1+	baby m/f weight	DART 0-,1+	Meds 0,1,2 0/pills/S	Clin Delive N1,Y2,H3 LN4	Neonate Ref B N 1,Y2	Mater Ref B N1,Y2	Ref Reason 1-22		Ambul Δ time
	253															
	254															
	255															
	256															
	257															
	258															
	259															
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	266															

Appendix 4: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Gerald Levin

CLEARANCE CERTIFICATE	**M110126**
PROJECT	Retrospective Review of Indications for Emergency Obstetric Referrals from Mofolo Community Health Centre to CH Baragwanath Hospital
INVESTIGATORS	Dr Gerald Levin.
DEPARTMENT Medicine	Department of Family Medicine/Emergency
DATE CONSIDERED	28/01/2011
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 28/01/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Prof Donna K van Bogaert

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix 5: Protocol approval

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL
Department of Emergency Medicine
Enquiries: Prof. R. Dickerson
Tel. #: (011) 933-0339 Fax #: (086) 528 9678 E-mail: Roger.Dickerson@wits.ac.za

24 October 2012

The Chair
Division of Emergency Medicine Research Assessor Group
Division of Emergency Medicine
University of the Witwatersrand

To Whom It May Concern:

Re: Submission of Revised Protocol – Dr Gerald Levine

Thank you for the comments made during the initial protocol presentation and the constructive criticism provided.

I can confirm that the amendments made to the protocol are in accordance with the recommendations made during the meeting, and on the DRAG report.

I am satisfied that the corrections have been made to the best of the student's ability.

Yours faithfully

Prof Roger Dickerson

Principal Specialist and Head
Department of Emergency Medicine
Chris Hani Baragwanath Academic Hospital

Adjunct Professor
Division of Emergency Medicine
University of the Witwatersrand

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2013