

# Prevalence of anaemia in pregnancy in the Uthungulu health district of KwaZulu-Natal, South Africa

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## Abstract

### Background

An estimated 30% of the world's population is affected with anaemia. Anaemia in pregnancy is a leading cause of maternal and perinatal deaths in developing countries. In developing countries, anaemia affects almost two thirds of the pregnant population. It is also estimated that anaemia is responsible for as much as 20% of all maternal deaths in sub-Saharan Africa. Maternal anaemia is a risk factor for infant iron deficiency anaemia and, if left uncorrected, can be associated with adverse behavioural and cognitive development in children. The prevalence of anaemia in pregnancy is estimated at between 35% and 75% in sub-Saharan Africa, however, the area-specific health problems during pregnancy are not known. In order to improve maternal health and the health of the foetus during pregnancy, knowledge of the prevalence or incidence of pregnancy-related conditions would be useful for district management teams, as well as for provincial and national maternal, child and women's health programme development. The objectives of this study were to describe haemoglobin levels and estimate the prevalence of anaemia among pregnant women at their booking visit.

### Methods

A retrospective cross-sectional descriptive study was conducted using the antenatal clinic registers of primary healthcare (PHC) clinics in the Empangeni subdistrict of the Uthungulu Health District from July to December 2003. Data were gathered from 1 214 consecutive pregnant women who attended for antenatal care at three randomly selected primary healthcare clinics during the study period. We examined the distribution of Hb values to determine the percentages of women with anaemia (Hb < 10 gm/dL) and severe anaemia (Hb < 7 gm/dL), and compared this with the prevalence of anaemia according to the WHO definition (Hb < 11 gm/dL).

### Results

In terms of the South African National Department of Health definition of anaemia in pregnancy, (haemoglobin < 10 gm/dL), 30.1% of the attendees were anaemic. According to the World Health Organisation (WHO) criteria (Hb < 11 gm/dL), the prevalence of anaemia was 57.3%. The difference in the prevalence of anaemia on the basis of the two different criteria was significant ( $p = 0.000$ ). This finding was comparable to studies conducted in other Sub-Saharan African countries.

### Conclusion

The prevalence of anaemia in pregnancy in this community is high. The prevalence of anaemia varied greatly when the WHO definition was used. The pregnant women of this community attend the healthcare facility very late for their booking visit, in spite of free maternity services at public health facilities. There is an urgent need for health education and health promotion programmes in this population for early booking for antenatal care. Further investigations are needed to establish the risk factors for, causes of and preventive interventions for anaemia in pregnancy.

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## Background

In South Africa (SA), the concept "anaemia in pregnancy" is defined as a haemoglobin (Hb) concentration of below 10 gm/dL, whereas it is 11 gm/dL (according to the WHO) internationally.<sup>1</sup> It is associated with either decreased erythropoiesis (production) or an excessive rate of haemoglobin or blood loss. Pregnant women are susceptible to this condition. Almost 600 000 women between the ages of 15 and 44 years worldwide are known to die each year as a result of complications arising from pregnancy and childbirth. The proportion of maternal deaths due to anaemia as estimated for the following countries is India (16%), Kenya (11%), Nigeria (9%) and Malawi (8%).<sup>2</sup> In developing countries, it is estimated that anaemia affects nearly two thirds of all pregnancies and about half of non-pregnant women.<sup>3</sup>

Anaemia in pregnancy, especially severe anaemia, is associated with an increased risk of maternal and perinatal mortality.<sup>4,5</sup> It is also estimated that anaemia is responsible for as much as 20% of all maternal deaths in Sub-Saharan Africa.<sup>6</sup> It is found that maternal anaemia is a risk factor for infant iron-deficiency anaemia and, if left uncorrected, can be associated with adverse behavioural and cognitive development in children.<sup>7</sup> It is also a known risk factor for low birth weight, which is one of the main risk factors for infant mortality.<sup>8</sup> Thus, anaemia in pregnancy remains a public health problem worldwide and in Africa in particular.

In Africa, the prevalence of anaemia is estimated to be between 35% and 75%.<sup>9</sup> A key component of a safe motherhood initiative is to reduce maternal mortality by half through the eradication of anaemia during pregnancy.<sup>10</sup> In a review of epidemiological criteria for the assessment of the severity and magnitude of anaemia in pregnancy, the following categories were proposed: mild anaemia (Hb 9.0-10.9 gm/dL) and severe anaemia (Hb < 7.0 gm/dL).<sup>11</sup> Most countries in Sub-Saharan Africa, including South Africa, have a national policy to prevent and treat anaemia in pregnancy. These include the provision of haematinics (ferrous sulphate and folic acid) to all pregnant mothers during pregnancy. In spite of efforts made nationally (developing policies, allocating resources, setting norms and standards for antenatal care) and locally at health institutional level (implementa-

tion of policies, standard protocols for treating common pregnancy-related conditions), a high rate of maternal and perinatal morbidity and mortality is still observed in KwaZulu-Natal (maternal mortality ratio (MMR) of 144/100 000 live births for the triennium 1999-2001 and perinatal mortality rate (PNMR) of 43/1000 births) and South Africa (MMR between 175-200/100 000 live births for the triennium 1999-2001 and PNMR of 38.6/1000 births for the city and town group hospitals).<sup>12,13</sup>

The management of anaemia in pregnancy has been recommended as a potentially feasible and cost-effective intervention to reduce maternal, foetal and perinatal mortality and other adverse outcomes. However, the actual prevalence rates of pregnancy-related conditions for many individual countries and communities are not known. Thus, it was recommended at the African Regional Consultation on the Control of Anaemia in Pregnancy of the WHO that simple studies of prevalence and etiology should be undertaken.<sup>14</sup> In order to improve maternal health and the health of the foetus during pregnancy, information on the prevalence or incidence of pregnancy-related conditions (anaemia in this case) would be useful for the managers of health institutions, and for district, provincial and national maternal, child and women's health programme development.

In this paper we examine the distribution of the Hb values of pregnant women at their antenatal booking visit. The percentage of women with anaemia (Hb < 10 gm/dl) and with severe anaemia (Hb < 7.0 gm/dL) were determined and compared with the prevalence of anaemia according to the WHO definition.

## Materials and Methods

### Study design

The study entailed a retrospective cross-sectional descriptive study conducted from July to December 2003.

### Sites and samples

Three PHC clinics (two public health clinics, Thokozani and Phaphamani, situated in the rural area, and one local health clinic, the Empangeni LC Clinic, situated in an urban setting) were randomly selected from a total of 14 for this study. All the PHC clinics in the sub-district were stratified on the basis of the administration of the clinics, i.e. whether by

the public health department or the local health authority. These clinics are the primary healthcare facilities for a population of approximately 450 000. The public health clinics are administratively supported and managed by the Empangeni Hospital. Umhlatzana Municipality manages the local government clinics. According to the national guidelines for antenatal care in South Africa and in the district, all pregnant women are to book at the PHC clinics for antenatal care. These services have been free since 1994, when South Africa's first democratic government came into power. Once pregnancy-related complications are identified at these PHC facilities, and if they are not manageable, they are referred to Empangeni Hospital, the only referral hospital for maternal care in the Empangeni subdistrict.

### Screening procedure and data collection

For every pregnant woman attending any of the primary healthcare facilities in the region for the antenatal booking visit, relevant histories were taken and examinations were conducted. Screening for anaemia, syphilis and rhesus factors were performed using venous blood samples, as a routine procedure. The blood samples were then transported to the laboratory at Empangeni Hospital. An estimation of haemoglobin was done in the laboratory using the standard cyanmethaemoglobin method with a COULTER HmX Hematology Analyzer, together with other full-blood counts (PVC, WBC differential counts, general film reading, etc.). A day later, the full blood counts (FBC) reports of all the tests were sent to the clinics for recording on the clinic register, together with the patient's name, age, parity and gestational age. The age and parity were obtained from the mother and the gestational age was estimated by an examination of the fundal height or from the women's last recorded menstrual period and recorded in the clinic register. A dedicated professional nurse (nurses) at the clinic who was responsible for antenatal care at the first visit recorded the Hb results in the antenatal clinic registrar. The original copy of the laboratory results were then attached to the patient's antenatal carrying card (ANC) during the second visit for appropriate intervention. Every mother attending a public healthcare facility receives stocks of ferrous sulphate (200 mg daily)

and folic acid (150 mg daily) for supplementation until the next appointment. Voluntary counselling and testing for HIV were offered to all pregnant mothers, for possible inclusion in the prevention of mother-to-child transmission of HIV programme. Prior permission was obtained from the Empangeni Hospital management team and the participating clinics to use the clinic register to conduct the study. No names of individual clients were used in the analysis and reporting of the results.

### Data analysis

The data were analysed using SPSS 11.5 for Windows. Frequency tables were produced and Pearson correlation tests were conducted to find the significant relationships between haemoglobin, age, parity and booking gestational age of the attendees. Multiple linear regression was carried out to find the

association between the haemoglobin level (dependent variable) and other independent variables of the study. Logistic regression analysis was performed to identify the risk factors for anaemia.

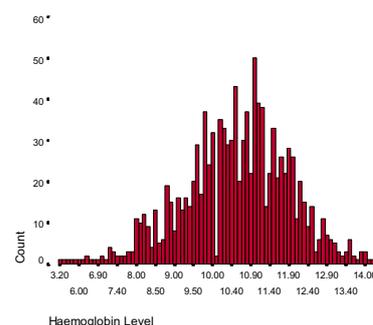
### Results

A total of 1 214 pregnant women formed the study sample (Thokozani Clinic – 272; Phaphamani Clinic – 657, and Empangeni LC Clinic – 285). Sixteen of them did not have Hb results, one had recorded zero Hb, three had an Hb of greater than 16 gm/dL (thus excluded from the analysis because of laboratory error), nine had missing gestational ages and 13 had missing ages of the mothers.

### Age of pregnant mothers

Teenage pregnancy (age < 18 years) amounted to 8.0% of all pregnancies (see Table I). Women aged 34 years

**Figure 1:** Distribution of haemoglobin values of the study population



and older totalled 6.7%. The majority of pregnant women (45%) were between the ages of 18 to 23 years.

### Gestational age at booking visit

Only 1.8% of the attendees were in the first trimester (gestational age less than 13 weeks). Over half (57.7%) of these women had attended healthcare facilities for antenatal booking during the second trimester (between 13 and 28 weeks of gestation). Similarly higher proportion (40.5%) of the pregnant women was in their third trimester when having a booking a visit for antenatal care. The different gestational ages at the booking visit are shown in Table I. The correlation between gestational age at booking visit and age and parity were not significant (see Table II).

### Parity of pregnant mothers

Women without a previous pregnancy (parity nil/primipara/primigravida) totalled 40.1%. More than a quarter (27.5%) had parity one and 17.3% had parity two. The distribution of parities for the pregnant mothers are shown in Table I.

### Prevalence of anaemia

The distribution of the haemoglobin values is presented in Figure 1. The ranges of values was 3.2 to 16.00 gm/dL, with a mean of 10.56 gm/dL and a median (25<sup>th</sup>, 75<sup>th</sup> centiles) of 10.60 gm/dL (9.8, 11.5). The prevalence of all anaemia on the basis of national criteria (Hb <10 gm/dL) was 30.1% and the prevalence of severe anaemia (Hb < 7 g/dL) was 1.2%.

In the analyses based on the WHO definition of anaemia in pregnancy (Hb <11 g/dL), the prevalence of anaemia was 57.7%. The difference in prevalence for overall anaemia based on South African National and WHO definitions of anaemia in pregnancy was statistically significant ( $p < 0.05$ ). Multiple linear

**Table I:** Age, gestational age and parity distribution of the sample population

Variables	Percentage
<b>Age (n = 1201)</b>	
< 18 years (teenage)	8.0
18–23 years	45.2
24–28 years	25.8
29–33 years	14.3
34–39 years	6.0
40–44 years	0.7
<b>Gestational age (n = 1205)</b>	
First trimester (before 13 weeks)	1.8
13–16 weeks	4.4
17–20 weeks	11.2
21–24 weeks	16.7
25–28 weeks	25.4
>= 29 weeks	40.5
<b>Parity (n = 1214)</b>	
0	40.1
1–3	52.9
4–5	5.4
>= 6	1.4

**Table II:** Correlation between age, gestational age and parity

		Age	Parity
Age	Pearson correlation	1	.783(**)
	P value		.000
Parity	Pearson correlation	.783(**)	1
	P value	.000	
Gestation age	Pearson correlation	-.039	.006
	P value	.180	.848

\*\* Correlation is significant at the 0.01 level (two-tailed)

\* Correlation is significant at the 0.05 level (two-tailed)

regression was carried out to determine the effect of age and trimester on the haemoglobin level. Age and parity were identified to be statistically significant determinants of Hb levels, as the *p* values were 0.021 and 0.031 respectively. Logistic regression analysis showed that the age and/or the gestational age of the mother were not risk factors for anaemia in this study population.

### Effect of age

Age was recorded for 1 201 women. Univariate analysis indicated an increased risk of anaemia for adolescents (age < 20 years), based on an Hb level < 11 gm/dL (WHO criteria). According to the criteria set out by the SA National Department of Health (Hb < 10 gm/dL), age was not a risk factor for anaemia and severe anaemia. However, when age was adjusted for gestational age, it was not found to be significant (Table III). The odds ratio for age was 0.981 (95% CI, 0.735–1.308), and the odds ratio for gestational age was 1.017 (95% CI, 0.998–1.037).

### Effect of gestational age at booking visit

Nearly 60% of the women booked in the first or second trimester. Trimester bookings were not found to be a risk factor for overall anaemia (WHO criteria of Hb < 11 gm/dL and SA National Department of Health criteria of Hb < 10 gm/dL) and for severe anaemia (Hb < 7 gm/dL).

### Discussion

This study was limited to those women who attended PHC clinics in this health district. In KwaZulu-Natal, it is estimated that over 95% of pregnant women attend health facilities for antenatal care on at least one occasion.<sup>15, 16</sup> Therefore, the assumption has been made that the participants in this study belong to this group of population.

The teenage pregnancy rate of 8.0% in this population was considered lower than the provincial estimated average of 10%.<sup>13</sup> The difference is significant ( $p < 0.05$ ). The criteria for overall anaemia in pregnancy were Hb < 10 gm/dL (SA National and WHO), and for severe anaemia were Hb < 7 gm/dL (both National and WHO), and these criteria were chosen purposefully to measure the difference in prevalence. However, it is currently not known to what degree anaemia is definitely associated with negative maternal and/or foetal outcome.<sup>17</sup> It has been suggested that, in areas with a high prevalence of anaemia, cut-off points for the diagnosis of anaemia should be lowered.<sup>18</sup> The overall anaemia in pregnancy using a Hb level of 10 gm/dL in South Africa therefore was considered appropriate. Studies have also shown that the prevalence of anaemia depends on the method used for assessing the Hb concentration. The prevalence of anaemia was estimated at double the level using the indirect cyanmethaemoglobin method in comparison to direct cyanmethaemoglobin.<sup>19</sup> In our setup, we used the gold standard direct cyanmethaemoglobin method, thus there was little or no bias in the estimation of anaemia.

The overall prevalence of anaemia in pregnancy, based on the WHO criteria (57.7%), and severe anaemia (1.2%) were found to be similar in this health district in comparison to other studies from countries in the region. In Mozambique, the overall prevalence of anaemia (using WHO criteria) was 58% and that of severe anaemia was 1%.<sup>18</sup> A study from rural Zaire reported a prevalence of 76% for overall anaemia and 3.7% for severe anaemia.<sup>20</sup> In rural Tanzania, it was reported that the prevalence of anaemia (Hb < 11 gm/dL) was 71.7% and that of severe anaemia was 4%.<sup>21</sup>

Iron-deficiency anaemia is the most prevalent nutritional deficiency problem affecting pregnant women.<sup>22</sup> Iron deficiencies may develop during pregnancy because of the increased iron requirements to supply the expanding blood volume of the mother and the rapidly growing foetus and placenta. The high prevalence of anaemia in pregnancy in sub-Saharan African women is likely due to the fact that women may enter pregnancy with seriously depleted iron stores.<sup>23</sup> When pre-pregnancy iron stores are low, the amount of iron required during the last half of pregnancy cannot easily be met by diet and the risk of iron deficiency anaemia could be high, especially toward the end of pregnancy.<sup>24</sup> Since most pregnant women in this area attend antenatal care late in pregnancy, a high prevalence of anaemia due to iron deficiency is likely.

The extent of iron deficiency anaemia and the effects on maternal and neonatal health are uncertain in this population. Nutrition, health education and iron supplementation are encouraged during antenatal care in SA. The effectiveness of such interventions should be evaluated. Parasitic diseases (helminthiasis and malaria) are known to be contributory to iron-deficiency anaemia in pregnancy. Malaria is not endemic in this population, and thus may not have an impact on pregnancy. However, it is clear that anaemia in pregnancy is still a very common problem in this Empanjeni sub-district.

### Initiation of first antenatal visit

In South Africa, free maternal and child-care are provided at public health facilities. Pregnant women are encouraged to book for antenatal care as soon as pregnancy is detected, even as early as four or five weeks of gestation. At the first visit, a history is taken and an

**Table III:** Output of logistic regression of risk factors for anaemia (Hb < 11 gm/dL)

	B	S.E.	df	Sig.	Exp(B)	95% CI for Exp (B)	
						lower	upper
Binary age	.095	.142	1	.506	0.981	0.735	1.308
Gestational age	.010	.009	1	.265	1.017	0.998	1.037
Constant	.041	.255	1	.872	0.900		

Variable(s) entered at step 1: binary age, gestational age

examination is done by the healthcare workers to identify the risk status of the pregnancy. Based on the risk scores, follow-up return visits are planned. Pregnant women of low risk should undertake at least five antenatal visits during her pregnancy. Early bookings in our population were found to be low; only 1.8% in the first trimester and 4.4% between 13 and 16 weeks. Over half of the women were found to have booked during the second trimester (57.7%). This is much lower than in the study conducted in rural Tanzania, where 87.6% booked in the first or second trimester.<sup>17</sup>

### Identification of risk groups for anaemia

In a review of maternal health during adolescent pregnancy (< 20 years), it was suggested that these subjects are at risk of anaemia.<sup>25</sup> In addition, the influence of age has often not been separated from the effect of parity. Most studies in Africa have confirmed the findings of this study, namely that age alone is not a significant determinant of haemoglobin values.<sup>17,18</sup> Women who booked during the second and third trimester of pregnancy had a significantly increased risk for overall anaemia on the basis of the WHO criteria (Hb < 11 gm/dL). Although the data is cross-sectional, this finding is in accordance with the expected decline in Hb levels due to plasma volume expansion in the course of normal pregnancy. In addition, it may be expected that foetal demand, underlying maternal diseases and untreated anaemia in early pregnancy are likely to worsen.

The prevalence of anaemia is high. Recent research has shown that the provision of iron and folic acid alone is insufficient to combat nutritional anaemia.<sup>25</sup> Other nutritional deficiencies, including vitamin A and vitamin B12, infection (HIV, parasitic) and parity, which may have varied impacts on the Hb status, as well as foetal and perinatal adverse outcomes, require further study. The effect of malaria in causing anaemia in pregnancy in other African countries has been documented and thus it is likely to vary from region to region.<sup>21,25</sup>

The causes of late bookings for antenatal care also need investigation, as antenatal care is the cornerstone in improving the maternal and foetal outcome of pregnancy and of free services at public health facilities in South Africa.

### Conclusion

The prevalence of anaemia was high among the pregnant women in this study. There is a need to identify the risk factors for anaemia. The effect of an Hb level of between 10 and 10.9 gm/dL on the outcome of pregnancy in South African context needs to be assessed. There is an urgent need for health education and promotion, especially to encourage this population to book early for antenatal care and to take appropriate intervention measures.

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