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The prevalence of Anemia and Malaria, and their association, among pregnant women attending antenatal clinics in Laghman province, Afghanistan

Dissertation Submitted in partial fulfilment of the Requirement for the award of the degree of Master of Public Health

Submitted by

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Certificate

Certified that the dissertation The prevalence of Anemia and Malaria, and their association, among pregnant women attending antenatal clinics in Laghman province is a record of the research work undertaken by Dr. Wahdat Alkozai in partial fulfillment of the requirements for the award of the degree of Master of Public Health under my guidance and supervision.

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Date: 8, SEP, 2018

Declaration

I hereby declare that this dissertation The prevalence of Anemia and Malaria, and their association, among pregnant women attending antenatal clinics in Laghman province is the bonafide record of my original field research. It has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Your signature

Dr. Wahdat Alkozai

Date: 06. Sep, 2018

Abstract

Background

Anemia in pregnancy is one of the commonest problems affecting pregnant women in developing countries and puts the mother and fetus at risk for death. In developing countries, anemia prevalence in pregnant women is reported to be between 40-60 %. Afghanistan Multiple Indicator Cluster Survey, 2000 shows that anemia (Hb<11g/dl) is widespread in all Afghanistan. Several factors contribute to anemia during pregnancy and due to complex etiology of pregnancy anemia the relative role of risk factors is difficult to estimate. In addition to nutritional deficiencies malaria, which is prevalent in Afghanistan, regarded as a major risk factor for anemia during pregnancy. The objective of the study was to estimate the prevalence of anemia and malaria in pregnant women, and to examine any relationship between anemia and malaria during pregnancy.

Method

The study was a cross-sectional survey with structure. This Survey of attending pregnant women to all (n=5) Comprehensive Health Centers was conducted during January – June, 2018 in Laghman province which is located in eastern part of Afghanistan and has 5 distracts Alingar, Alishang, Dawlatshah, Mehterlam, and Qarghaee having the overall population of 372,600(32). Pashton, Tajik and Pashaee are the major ethnicities. Laghman province was selected for the study, because of the high malaria endemicity with high proportion of anemic pregnant women. A sample of 830 pregnant women attending the CHCs between the ages 15 to 49 years was interviewed and tested for malaria and anemia. Clients attending for their first antenatal visits were included in the study regardless of the trimester of the pregnancy. Anemia, our dependent variable, was defined as per WHO criteria (hemoglobin level below 11g/dl in the first and third trimesters and below 10.5g/dl in the second trimester) and a mother was labeled with malaria parasitemia (the main exposure variable) if Plasmodium parasites seen by the direct microscopic visualization on the thick and thin blood smear slides. Thick smears were used to identify the parasites and thin smears for identifying the specific species. Mothers were considered as workers if working for last one year or more. Data were analyzed using SAS for windows version 9.1. Proportions of the anemia, malaria and other nominal variables were calculated. Binomial Logistic Regression and Linear Regression statistical methods were used in the univariate and multivariable levels to assess the relationship between the dependent and independent variables.

Results:

The overall prevalence of anemia in this population was 52.9 %, 95% CI = [49.5%-56.3%]. All anemic participants were moderately anemic and there were no severe anemic case. The prevalence of malaria parasitemia in the sample was 7.3%, 95% CI= [5.6%-9.1%]. All the malaria cases in this sample were

Plasmodium vivax. In multivariable analysis, we found that pregnancy trimester, living in a particular type of district, and working to earn money were significantly associated with anemia.

Conclusion:

We estimated high prevalence of anemia (52.9%) and malaria (7.6%) among pregnant women. Third trimester, living in the rural areas, and working to earn money for last one year or more are important risk factors for anemia in pregnant women. Thus, control and prevention measures against anemia should be directed to all pregnant women, especially targeting working, rural population and women in their third trimester of pregnancy. Rural areas must given more attention, because most of the women working to earn money are from rural areas. Since malaria and anemia are preventable, antenatal care services could serve as a pivotal entry point for simultaneous delivery of interventions for the prevention and control of malaria infection and anemia in pregnant women.

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Finally, I am sincerely grateful to all the participants in the study, who willingly give us time and shared their knowledge, and without whose consent this study would not be possible. It is my sincere hope that the results of the study may benefit them and their families.

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Introduction

Anemia in pregnancy is one of the commonest problems affecting pregnant women in developing countries and puts the mother and fetus at risk for death. In developing countries, anemia prevalence in pregnant women is reported to be between 40-60 %. Afghanistan Multiple Indicator Cluster Survey, 2000 shows that anemia (Hb<11g/dl) is widespread in all Afghanistan. Several factors contribute to anemia during pregnancy and due to complex etiology of pregnancy anemia the relative role of risk factors is difficult to estimate. In addition to nutritional deficiencies malaria, which is prevalent in Afghanistan, regarded as a major risk factor for anemia during pregnancy.

Furthermore, anemia in pregnancy is considered to be one of the commonest problems affecting pregnant women in developing countries and is a major risk factor for a poor outcome of pregnancy and has been associated with low birth weight, preterm birth and perinatal mortality in infants.

The definition of anemia in pregnancy is a hemoglobin concentration less than 11 g/dl during the first and third trimesters and less than 10.5 g/dl in the second trimester and severe anemia if Hb less than 7 g/dL, (3, 4). The World Health Organization (WHO) estimates that nearly half of all pregnant women worldwide suffer from anemia.

In developing countries, anemia prevalence rates in pregnant women are commonly estimated to be in the range of 40-60 %(5).

Malaria is one of the major tropical health challenges in the world and is considered to be endemic in 109 countries mostly in Africa, Americas and Eastern Mediterranean region(15). Various studies have shown that pregnant women in endemic areas are highly susceptible to malaria, and both the frequency and severity of the disease is higher in pregnant than non-pregnant women(15). An estimated 64 million persons are at risk for Plasmodium vivax malaria in the eastern Mediterranean region; as many as 25% of these people live in Afghanistan(16), where most (70%–90%) malaria cases are caused by P. vivax and the rest by P. falciparum.

Afghanistan is endemic for malaria, and an annual incidence of 240 episodes per 1000 people in the more endemic rice-growing areas of altitudes below 1500 m is recorded. In 2002, the total malaria burden was estimated by the WHO to be three million cases per year with more than 30% in the eastern region. Laghman, the province located in the East in which the study was conducted is endemic for malaria and around 24 deaths occurred due to the outbreak of falciparum malaria in the province in October 2001.

Transmission is reported to be seasonal from June to November in the province, with negligible transmission occurring between December and March “although many vivax infections relapse during these months”. This seasonality results in the population being effectively non-immune to malaria. Pregnant women are considered as being at particularly high risk, due to overall reduced immunity during pregnancy.

Maternal mortality ratio in the province is estimated at 800 deaths per 100,000 live births. It was estimated that 87% of these death could be prevented through increased access to health care,

including screening for preventable causes of maternal complications, such as malaria, for which the province is highly endemic.

Literature review

Extensive review of many journals, books and magazines for Anemia in pregnancy is an issue of great concern especially for the developing world. Care for the Anemia in pregnancy often receives little attention in maternal health programs. Although various efforts have been made by governments to reduce maternal mortality but it keeps increasing.

Anemia in pregnancy is considered to be one of the commonest problems affecting pregnant women in developing countries and is a major risk factor for a poor outcome of pregnancy and has been associated with low birth weight, preterm birth and perinatal mortality in infants.

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The World Health Organization (WHO) estimates that nearly half of all pregnant women worldwide suffer from anemia(3). In developing countries, anemia prevalence rates in pregnant women are commonly estimated to be in the range of 40-60 %(5). Few studies have been conducted to estimate the prevalence of anemia in Afghanistan.

The physiological backgrounds for the adverse outcomes differ for the mother and the fetus. For the mother, severe anemia leads to high cardiac output that may lead to cardiac failure, or she may have less blood reserves to withstand any hemorrhage during childbirth. For the fetus, maternal anemia may give a sub-optimal nutritional environment, leading to growth retardation, preterm birth and increased risk of mortality.

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Methodology

Study design: The present study was an adopted cross-sectional research. And was conducted during January – June, 2018 in cooperation with the Ministry of Public Health (MoPH) and implementing NGO in Laghman province. .

Study methods: In-depth Interview (IDI) had been use to identify influencing the odds of anemia among the pregnant women with malaria in Laghman provinces, Afghanistan.

Study setting: This study was conducted in Laghman province, which is located in the eastern part of Afghanistan at an altitude below 1500m. The province is composed of five districts, Alingar, Alishang, Dawlatshah, Mehterlam, and Qarghaee having the overall population of 372,600(32). Pashton, Tajik and Pashaee are the major ethnicities. Laghman province will be selected for the study, because of the high malaria endemicity with high proportion of anemic pregnant women.

Study subjects: The key informants were purposefully selected among pregnant women who attend health facilities due to any reason will be interviewed.

The study excluded those pregnant women who did not want to do interview due to serious health problems of his illness, so that they were not able to attend the interview; and those who did not give consent for the interview.

Study teams: Head of reproductive health, female nursing/midwifes and who how have close contact with pregnant women were hired to undertake data collection. The data collectors were fluent in both spoken and written Dari and Pashto. They were responsible for conducting the interviews; and transcribing them.

I was in charge of coordinating the activities, training the data collectors, managing the data and controlling the quality of the whole process.

Data collection: The each data collectors carried out a minimum of 50 IDI with pregnant women in Laghman province health facilities. In total, 850 IDI with pregnant women were conducted in health facilities.

Adhering to the principles of crass-sectional study, the number of interviews was not determined prior to data collection. The data collection and analysis were performed simultaneously and the interviews were continued with the subjects till reached the point of saturation. This was when the data collected from participants were redundant and no new information was given by any new participant.

Study duration: The study is completed in six months period started from January 2018 and ended in June 2018. The study timeline presented below summarize the main study activities and their proposed times.

Activities/Months	M1	M2	M3	M4	M5	M6
Develop and submit draft outline proposal	X					
Revise and submit the final outline proposal	X					
Application for ethical approval	X					
Submission of questionnaire		X				
Ethical approval		X				
Data collection and initial analysis			X	X		
Draft methodology and result chapters					X	
Draft discussion chapter					X	
Final draft						X

Final submission						X

Plan of Analysis

Principle Investigator (PI) carried out the analysis manually taking the following steps:

1. Read through all the data repeatedly until an insight develops about the content of each interview.
2. Information was organized into two section including description of pregnant women on their attendance to the HFs.
3. Themes are identified and labeled.

Ethical Considerations

The study is carried out after seeking ethical approval from Ethics Panel of Maulana Azad University, Department of Public Health/Institutional Review Board (IRB) of the Ministry of Public Health (MoPH), and Afghanistan.

Since the study intended to deal with human data, verbal informed consent was taken from each participant. The consent forms is translated to local language (Dari) and the interviews were conducted in Dari and Pashto languages.

The participants voluntarily taken part in the study and provide them with the option to withdraw from the study at any time they feel uncomfortable. To observe confidentiality, we did not record any names or addresses of the participants. We were used specific codes for HFs; type of study subjects i.e. pregnant women attended selected health facilities, into and each individual participant. All information is kept in a safe place.

The privacy during all interviews by conducting the interviews in a place within the health facilities that was convenient for the study subjects and that no one else was able to hear the dialogue.

Since the study merely involved the in-depth interview with the subjects, no adverse effects were expected to be imposed on the subjects. The investigation team were observed privacy, confidentiality and safety measures to ensure that the study subjects were not be exposed to any risk as a result of information they shared with the study team.

The study provided direct benefits neither to the subjects, nor to the society to which the subjects belong. However, the study identified the factors hindering anemia by pregnant women. This, in turn,

contributes to the formulation of effective policies and strategies to improve practice of emergency center and thus effective population control and improved anemia in pregnant women.

Except taken 5 - 10 minutes of time of each individual study subject during in-depth interview, the study imposed no other monetary and non-monetary costs to the participants. Therefore, no compensation or incentive was provided to the participants.

Data Management and Quality Control

Principle Investigator (PI) oriented the data collectors on data collection methods and interview guides. And organized regular meetings with the study teams on a daily basis before them to start their interviews practically. The teams shared their experience, and the problems they were faced during the interview. Possible solutions or refinements in the process were also discussed.

The teams were responsible for conducting the interviews and transcribing them while Principle Investigator (PI) was in charge of compiling the data collected by the teams and filing them. Interview data were kept in separate files for health facilities. The files were updated on daily basis and kept in as save place.

Nobody except me, and the team members in case of need, were permitted to have access to them and was also reviewed all filled checklist were collected by data collectors during interviews, check all transcriptions and translated them from local language to English.

Results

In this study, a total of 830 pregnant women were enrolled between January and June, 20018. The mean Hb level was 10.6g/dL (SD≈1.0). The range is from 7.0 g/dL to 13.5 g/dL with a median of 10.5 g/dL. The current age distribution of the 830 pregnant women showing digital heaping, but mean and median age was very close (28 years). According to quartile analysis 25% participants were aged 24 years or less and 75% were aged 32 or less. The youngest and oldest participants were respectively 15 and 48 years old. About 6.4% of all pregnancies were among teenagers and about15.3% pregnancies were among women 35 and above. The lowest age at first pregnancy was 12 and highest was 29 with mean marriage age of 18 years. The majority of the participants (49.8%) were in the second trimester of pregnancy, 2.7% in the first trimester and47.6% in the third trimester with mean gestational age was 27.9 weeks (± 7.2).

Approximately forty-two percent of the subjects took iron and Folate supplements. Forty seven (5.7%) women were restricted from some food. The majority (63.7%) reported using bed nets while sleeping. Only 63 (7.6%) participants had formal schooling. And only 44 (5.3%) participants were working to earn money. Among workers 72.7% were farmers and/or keeping livestock and the rests were employees with government or NGO. Most of the participants were married/with spouse 819 (98.7%). More than 68% of the sample was from Pashton ethnic origin, about 25% were Tajik and rests were Pashaee.

The overall prevalence of anemia in this population using a cutoff level of 11 g/dL was 52.9 % with 95% Confidence Interval of [49.5%-56.3%]. All anemic participants were moderately anemic and there were no severe anemic cases in the sample since the lowest hemoglobin level reported was 7 g/dL. In our sample, the larger proportion of anemic cases was in age category 33-48 years (55.1%) and small proportion was in age category 25-28 years (48.7%). A U-shaped association was observed between anemia and pregnancy trimester and inverse J-shaped association was observed between anemia and gravidity (Primigravidae, 2 to 4 gravidae and gravidae 5+).

The prevalence of malaria parasitemia in the sample using the thick and thin films was 7.3% with 95% confidence interval [5.6%-9.1%]. Thick smears were used to identify the parasites and thin smears for identifying the specific species. All the malaria cases in this sample were Plasmodium vivax. In this sample, the larger proportion of malaria cases was in age category 25-28 years (10.2%) and small proportion was in age category 33-48 years (3.9%). And the larger proportion (9.4%) of the malaria cases was observed in women in their second pregnancy trimester and small proportion (4.5%) in women of first pregnancy trimester. Women with 2 to 4 gravidae had the higher percentage of the malaria parasitemia as compared to primigravidae and 5+ gravidae (Table 11).

Prevalence of malaria parasitemia did not vary significantly between urban and rural districts (8.6% urban vs. 5.4% rural, p-value=0.08), while the prevalence of anemia in pregnant women attending the ANC varied significantly between urban and rural districts (47.4% urban vs. 61.1% rural, p-value = 0.0001).

Discussion

To my knowledge, this study is among the leading studies conducted in Laghman province, Afghanistan on pregnancy anemia and malaria. This survey was carried out with the objectives to explore prevalence of anemia and malaria and determine correlates of anemia in pregnant women attending ANC clinics. Our study found that a substantial number of pregnant women attending ANC clinics were anemic and had malaria parasitemia in Laghman province. We estimated a prevalence of 52.89 %, 95% CI = [49.49 to 56.29%] of anemia and 7.57%, 95% CI = [5.57 to 9.13%] of malaria among pregnant women. The high

proportions indicate that anemia and malaria are major problems for pregnant women living in Laghman province. This result is consistent to the results of national Multiple Indicator Cluster Survey, 2000 Afghanistan, reported the estimated prevalence of the anemia in the pregnant women 55-91%.

Prevalence of anemia in pregnant women attending the ANC varied significantly between urban and rural districts (47.4% urban vs. 61.1% rural). But, the prevalence of malaria parasitemia did not vary significantly between urban and rural districts (8.6% urban vs. 5.4% rural, p-value=0.08). In Laghman, the accessibility of both food and health care are higher in the urban districts than in the rural area and may explain much of the lower proportion of anemia in urban districts compared to rural.

We observed the high proportion of anemic pregnant women, which is also observed in studies conducted in other countries with similar socio-economic and cultural characteristics to Afghanistan. A study from Pakistan, conducted at Gynae/Obs OPD of Railway Hospital, Multan, reported 96% anemia during pregnancy from a sample of n=100, and in Hyderabad, Pakistan anemia reported to be 90.5% in a sample of (n=1369) in pregnant women. Results from these studies show much higher prevalence of anemia in pregnant population. Small sample size of the earlier study and enrollment of the participants after 20th week of gestation in the later study could be the possible reasons for high anemia prevalence and variation with our results. On the other hand in a cross-sectional survey, conducted at prenatal clinic of Mirwais national Hospital Kandahar, comparatively lower prevalence of 42.5% was reported and in a study conducted in Nangarhar 43.17% prevalence of anemia was estimated.

The Indian national anemia survey reported 47.5% anemia prevalence in pregnant women and in Bangladesh, a prevalence of 49% was reported among pregnant women.

Our study found that pregnancy-trimester, living in a particular type of district, and working to earn money were significantly associated with anemic status of the pregnant women and no significant association was observed between malaria, education status, food restriction, gravidity and anemia.

Studies conducted on the topic around the world shows the association between anemia and malaria; a study, conducted at Entebbe Hospital, Uganda, on women at their first antenatal visit shows that malaria parasitemia were strongly associated with anemia (OR= 3.22), 95% CI=[2.43-4.26]. Another study on Kenyan pregnant women, attending their first antenatal clinic, also reported the association between anemia and malaria parasitemia (OR=1.34), 95% CI=[1.24-1.45](43). In Ugandan study all malarial cases and in Kenyan study 97.5% cases were P. falciparum infections but in our study all cases were P. vivax. Without taking in consideration the recent contrasting and yet controversial evidence demonstrating that P. vivax malaria may be associated with higher frequency and more severe degrees of anemia, traditionally, P. falciparum infection has been considered to produce anemia more frequently and with more severe degrees than infections caused by P. vivax, . This could be a possible reason that we could not find a significant association between anemia and malaria in our study.

In our study, pregnancy-trimester was found to be significantly associated with anemia. And a U-shaped association was observed between anemia and pregnancy trimesters. About 59.1% participants were

anemic within first trimester, 45.8% within second trimester and 60% within third trimester of pregnancy (Table 7). The odds of being anemic among the pregnant women of first trimester was 1.64 times as compare to those in their second trimester while adjusting for other variables in the model. And the odds of being anemic among the pregnant women of third trimester was 1.91 times as compare to those in their second trimester while adjusting for other variables in the model. These ratios were statistically significant in multivariable analysis. Studies from Mali and Malaysia have also reported that anemia is more common in third trimester. This may well be explained by the physiological expansion of maternal plasma volume by 25-40% causing a drop in the hemoglobin levels.

Findings from studies worldwide showing that the iron stores of most women are exhausted during pregnancy unless supplemented. Iron supplementation in pregnancy has been shown to have a beneficial effect on anemia. Which justifies antenatal routine iron supplementation in areas with high prevalence of iron deficiency. A study conducted in rural Vietnam reported significant positive correlation between anemia and taking iron tablets. In our study taking ferrous sulphate /folic acid tablets was not significantly associated with anemia status. The possible reason, supported by our data (Table 12), could be not taking sufficient doses of the supplements recommended by health professionals (none compliance).

Studies on pregnancy anemia shows some association between gravidity and anemia e.g. a study by Lawrence Muhangi et al, (2007) revealed that primigravidae are more likely to be anemic than multigravidae(50). Another study from Nigeria also reported that anemia is more prevalent in primigravidae than the multigravidae. But, we could not find a significant association between gravidity and anemia in our study.

Association of educational level with anemia has been reported in studies carried out in Vietnam and African countries like Burkina Faso. In our study, we could not find any association between anemia and educational level. This could be because of small proportion of people with education (7.6%) in our study population.

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Annexure:

List of Tables

Table 1. Socio-demographic characteristics of women attending ANC clinics in Laghman province, Afghanistan

Variable	N (%)
Age of the women (in years)	
15-19	53 (6.4)
20-24	166(20.0)
25-29	265 (31.9)
30-34	219 (26.4)
35+	127(15.3)
Education status	
No schooling	767 (92.4)
Schooling	63 (7.6)
Marital status	
Married/with spouse	819 (98.7)
Divorced/separate	11 (1.3)
Working for last one year or more	
Yes	44 (5.3)
No	786 (94.7)
Trimester of pregnancy	
First	22 (2.7)
Second	413 (49.8)
Third	395 (47.6)
Bed net use during pregnancy	
Yes	529 (63.7)

No	301 (36.3)
Taking Ferrous sulphate+ Folate	
Yes	346 (41.7)
No	484 (58.3)
Ethnicity	
Pashton	568 (68.4)
Tajik	206 (24.8)
Pashaee	56 (6.7)

Table 2. Prevalence of Anaemia, and Malaria among women attending ANC clinics in Laghman province, Afghanistan.

	Prevalence	95%CI
Anemia	52.9	[49.5 - 56.3]
Malaria parasitemia	7.3	[5.6 - 9.1]

Table 3. Anaemia by age category

Age category	Anemic status of the women	
	not anemic	anemic
15-24	45.7%	54.3%
25-28	51.3%	48.7%
29-32	45.7%	54.3%
33-48	44.9%	55.1%

Table 4. Anaemia by pregnancy trimester

Trimester	Anemic status of the women	
	not anemic	anemic
First trimester	40.9%	59.1%

Second trimester	54.2%	45.8%
Third trimester	40.0%	60.0%

Table 5. Anaemia by gravidity

Gravidity	Anemic status of the women	
	not anemic	anemic
Primigravidae	44.4%	55.6%
Gravidae 2-4	49.6%	50.4%
Gravidae 5+	46.2%	53.8%

Table 6. Malaria by age category

Age category	malaria status of the women	
	malaria negative	malaria positive
15-24	93.2%	6.8%
25-28	89.8%	10.2%
29-32	92.4%	7.6%
33-48	96.1%	3.9%

Table 7. Malaria by pregnancy-trimester

Trimester	malaria status of the women	
	malaria negative	malaria positive
First trimester	95.5%	4.5%

Second trimester	90.6%	9.4%
Third trimester	94.7%	5.3%

Table 8. Malaria by gravidity

Gravidity	malaria status of the women	
	malaria negative	malaria positive
Primigravidae	95.4%	4.6%
Gravidae 2-4	90.5%	9.5%
Gravidae 5+	93.3%	6.7%

Table 9. Compliance to ferrous sulphate/folic acid tablets (F/F)

# of F/F tablets taken/24 h	N (%)
1	197 (57.0)
2	105 (30.3)
3	44 (12.7)

Each tablet contains 60 mg ferrous sulphate and 0.4mg folate

Table 10.: Univariate analysis - Correlates of anemia among women attending ANC clinics in Laghman province, Afghanistan (Logistic regression)

	Crude OR	95% CI for OR	P-Value
Malaria parasitemia			
Yes	1.30	0.77-2.22	0.32

No	1.0		
Trimester of pregnancy			**<0.001**
First trimester	1.71	(0.71 – 4.09)	0.22
Third trimester	1.77	(1.34- 2.35)	<0.001
Second trimester	1.0		
Working for last one year or more			
Yes	2.80	(1.39 – 5.63)	0.004
No	1.0		
Bed net use during pregnancy			
Yes	1.0		
No	1.25	(0.94 – 1.66)	0.11
District			
Rural	1.74	(1.31 – 2.31)	<0.001
Urban	1.0		
Formal schooling			
Yes	1.0		
No	1.66	(0.98-2.79)	0.057

	Crude OR	**95% CI for OR**	**P-Value**
Can read book			
Yes	1.0		
No	1.64	(0.95-2.83)	0.071
Food restriction			
Yes	1.61	(0.87 – 2.97)	0.12
No	1.0		

P-value(**bold**) is from the likelihood ratio test
P-values(not bold) are from the Wald Chi square tests

Table 11.: Change in (-2 Ln likelihood) by adding one more variable in the next step in the model

	Change in -2 Ln likelihood	df	P-value
Malaria	0.998	1	0.3178
Pregnancy trimester	17.4290	2	0.0001
District	15.6368	1	<.0001
Working to earn money	12.6690	1	0.0004
Schooling	2.2539	1	0.1333
Read book	2.5443	1	0.1107
Food restriction	3.0748	1	0.0795

Table 12.: All possible interactions

Interactions	Change in -2 Ln likelihood	df	P-value
Malaria*trimester	0.33	2	0.84
Malaria*district	0.12	1	0.72
Malaria*working	0.02	1	0.86
Trimester*district	0.86	2	0.64
Trimester*working			
District*working	0.04	1	0.83

Table 13.: Multivariable analysis- Correlates of anemia among women attending ANC clinics in Laghman province, Afghanistan (Logistic regression)

	AOR*	95% CI for AOR**	P-Value***
Malaria parasitemia			
Positive	1.51	(0.87– 2.61)	0.13
Negative	1.0		
Trimester of pregnancy			**<.0001**
First trimester	1.64	(0.67-4.00)	0.26
Third trimester	1.91	(1.43-2.54)	<.0001
Second trimester	1.0		

District			
Rural	1.90	1.42-2.54	<.0001
Urban	1.0		
Working for last one year or more			
Yes	3.66	(1.80- 7.4)	0.0004
No	1.0		

*AOR = Adjusted odds ratio
**95% CI for AOR = 95% confidence intervals for adjusted odds ratio
***P-values are from the Wald Chi square tests

Table 14.: Univariate analysis - Correlates of hemoglobin level of women attending ANC clinics in Laghman province, Afghanistan (Linear regression)

Variable	Unstandardized coefficients		t -statistic	P-value for t-test
	β	Std.Error		
Malaria parasitemia	-0.02	0.13	-0.17	0.86
District	-0.38	0.06	-5.62	<0.001
Working for last one year or more	-0.31	0.15	-2.05	0.04
Food restriction	-0.24	0.14	-1.63	0.10
Formal schooling	-0.24	0.13	-1.85	0.06
Can read book	-0.28	0.13	-2.12	0.03

Table 2: Multivariable analysis- Correlates of hemoglobin level of women attending ANC clinics in Laghman province, Afghanistan (Linear regression)

Variable	Unstandardized coefficients		t -statistic	P-value for t-test
	β	Std.Error		
Malaria parasitemia	-0.06	0.13	-0.46	0.64
District	-0.42	0.07	-6.05	<0.001
Working for last one year or more	-0.37	0.15	-2.48	0.01
Food restriction	-0.28	0.14	-1.96	0.05

Annex 2. List of Figures

Figure 1: Distribution of haemoglobin levels in the blood

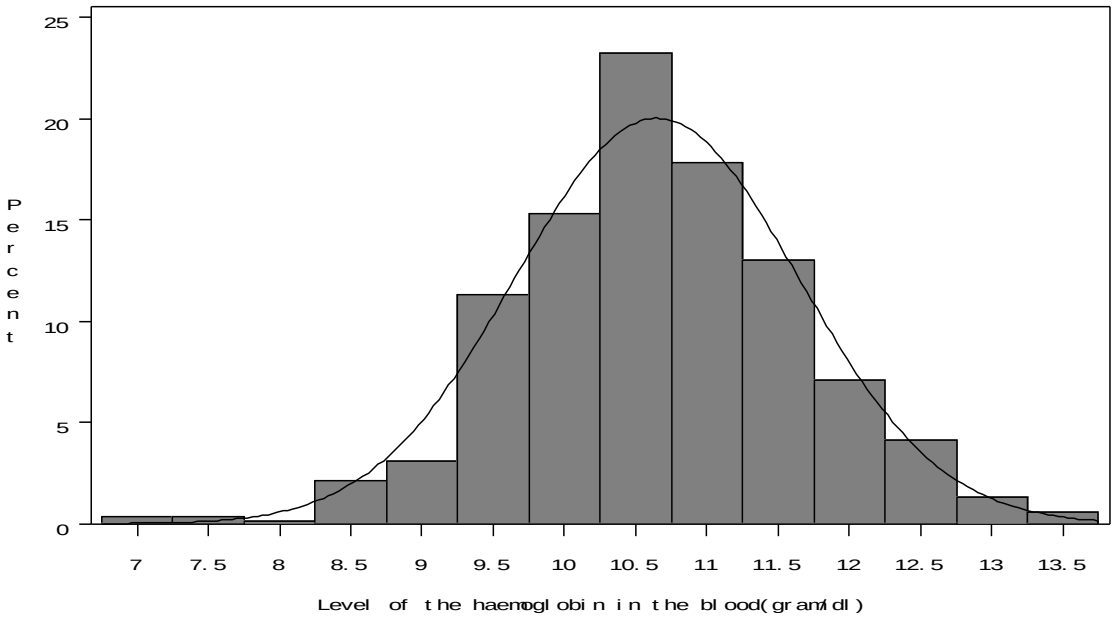
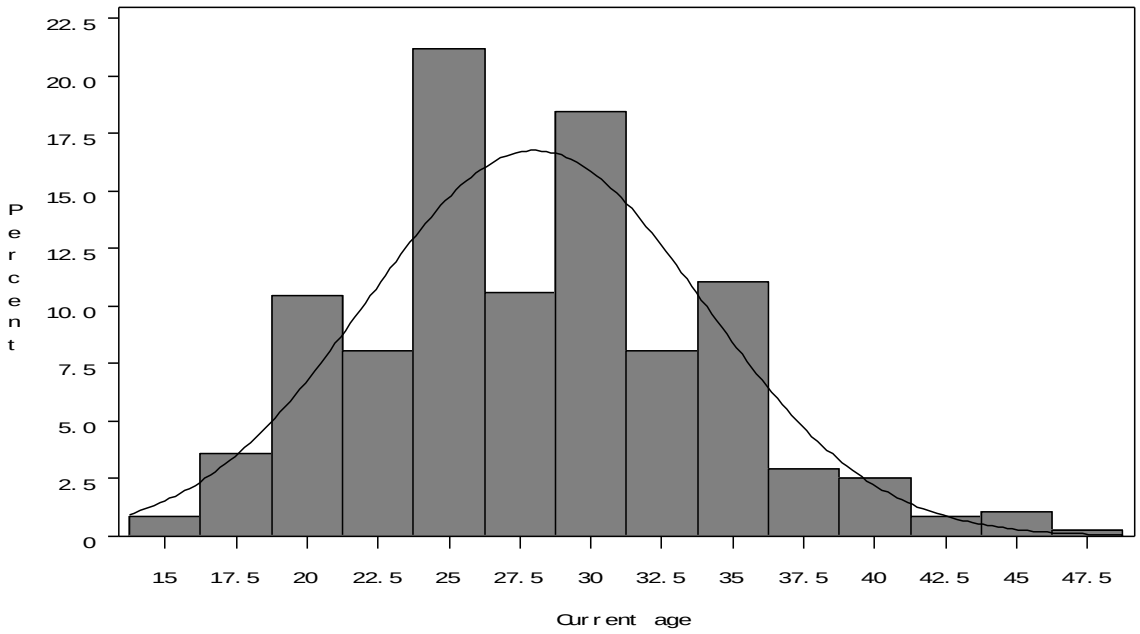


Figure 2: Distribution of the current age



Annex 3: Consent form for interviews with pregnant women attending selected health facilities

Introduction

I am Dr. Wahdat Alkozai, student of Master of Public Health at University of Maulana Azad. I am the Principal Investigator of current research on "Study, Knowledge, Attitude and practices of children caretaker regarding routine immunization in Afghanistan". You need to understand the following information to make an informed choice about participating in this research.

Background information

Anemia in pregnancy is one of the commonest problems affecting pregnant women in developing countries and puts the mother and fetus at risk for death. In developing countries, anemia prevalence in pregnant women is reported to be between 40-60 %. Afghanistan Multiple Indicator Cluster Survey, 2000 shows that anemia (Hb<11g/dl) is widespread in all Afghanistan. Several factors contribute to anemia during pregnancy and due to complex etiology of pregnancy anemia the relative role of risk factors is difficult to estimate. In addition to nutritional deficiencies malaria, which is prevalent in Afghanistan, regarded as a major risk factor for anemia during pregnancy.

Purpose of this research study

The objective of the study was to estimate the prevalence of anemia and malaria in pregnant women, and to examine any relationship between anemia and malaria during pregnancy.

Procedures

Survey of attending pregnant women to all (n=5) Comprehensive Health Centers was conducted during January – June, 2018 in Laghman province. A sample of 830 pregnant women attending the CHCs between the ages 15 to 49 years was interviewed and tested for malaria and anemia. Clients attending for their first antenatal visits were included in the study regardless of the trimester of the pregnancy.

Possible risks or benefits

Except granting your time, there is neither risk nor direct benefit to you in this study. However, the results of the study may help us to develop more effective policies and strategies.

Sharing the Results

If you agree we will take your contact address to send you summary of the findings before it is made available to the public.

Right of refusal to participate and withdrawal

You are free to choose or to refuse to participate in the study without any loss of benefit which you are otherwise entitled to. You may also withdraw any time from the study or refuse to answer questions if you don't feel comfortable.

Confidentiality

Nobody except Principal Investigator will have an access to information provided by you. Your name and identity will also not be disclosed at any time.

Available Sources of Information

If you have any questions you may contact the Principal Investigator Dr. Wahdat Alkozai at University of Maulana Azad by using following options:

Cell #: +93(0) 700 670 780

Email: wahdat_alkozai@yahoo.com

Authorization

I have understood this consent form. I volunteer to participate in this research. I understand that my consent does not take away any legal rights in the case of negligence or other legal fault of anyone who is involved in this study. I further understand that nothing in this consent form is intended to replace any applicable national or local laws.

Annex 4: Consent Form and Research Subject Information sheet 1:

Department of Public Health, Maulana Azad University, Jodhpur

Thesis Form (MPH 2016-18)

Thesis in MPH course comprise of research done on a particular subject of public health importance. Through thesis, students get opportunity to apply public health concepts and enhance research knowledge and skills.
Semester III and Semester IV are dedicated for thesis work in MPH course. To complete the thesis, the student must submit thesis proposal at the end of semester III and final thesis at the end of semester IV

Name:	Dr. Wahdat Alkozai
Address:	House# 3966, Arzan Qeemat, 12th districts, Kabul, Afghanistan
Emergency contact number:	+93(0) 700670780
Email id:	wahdat_alkozai@yahoo.com
Topic of Thesis:	The prevalence of Anemia and Malaria, and their association, among pregnant women attending antenatal clinics in Laghman province, Afghanistan
Name and Place of Study Site (Please provide full address):	This study will be conducted in Laghman province, which is located in the eastern part of Afghanistan at an altitude below 1500m. The province is composed of five districts, Alingar, Alishang, Dawlatshah, Mehterlam, and Qarghaee having the overall population of 372,600(32). Pashton, Tajik and Pashaee are the major ethnicities. Laghman province will be selected for the study, because of the high malaria endemicity with high proportion of anemic pregnant women.
Name of thesis site supervisor:	Dr. Najibullah Safi
Designation and qualification of site supervisor	MPH, MD, Position, World Health Organization (WHO), Kabul, Afghanistan
Contact Phone No. and Email ID of site supervisor	+ 93 (0) 777890855 najibullah.safi@gmail.com

Student's Signature
Date:

Sign of thesis site supervisor

Sign of Head, Department of Public Health
Date: **Place:**

Consent Form and Research Subject Information Sheet 2:

Consent Letter from Site Supervisor (MPH 2016-18)

Date: November, 2017

To,
The Head
Department of Public Health
Maulana Azad University
Jodhpur, Rajasthan

Sub: Consent Letter to be a site supervisor for project/ thesis of Dr. Wahdat Alkozai

Dear Madam,

This is in reference to the above mentioned subject. In this regard I wish to inform you that I am willing to accept Dr. Wahdat Alkozai as my student for guiding his project/thesis work leading to the MPH degree from Maulana Azad University, Jodhpur. I will guide him for the entire duration of his project/thesis work and will supervise him throughout the process.

Thanking you

Yours faithfully

Signature

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