

FACTORS ASSOCIATED WITH LOW APGAR SCORE IN NEWBORN BABIES AT A
HOSPITAL IN NAMIBIA

A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF NURSING SCIENCE

OF

THE UNIVERSITY OF NAMIBIA

BY

JUSTINA LUNGAMENI

200821636

SEPTEMBER 2022

MAIN SUPERVISOR: DR EMMA. M. NGHITANWAN (University of Namibia)

CO-SUPERVISOR(S): MRS LAURA UUSIKU (University of Namibia)

ABSTRACT

All newly born infants have to go under examination after birth and again for five minutes to check how well they are tolerating the birth process and the environment outside the uterus. The study aimed to identify factors associated with low Apgar scores among newborn babies in Onandjokwe Intermediate Hospital. The quantitative, 1:1 ratio case-control matching, retrospective, a descriptive research design was used. The target population was cases of 376 maternal records with low Apgar scores. Simple random sampling methods were used to select the sample size for maternal records of low Apgar score babies which was 194 and for babies with normal Apgar scores 194 will give a total of 388 maternal records. Data were collected from June to August 2020 in Onandjokwe Intermediate Hospital using a document review checklist as the data collection tool. A pilot study was done on 10% of maternal records. Data were entered and analyzed using SPSS version 26. Dependent variables were analyzed using Binary Logistic Regression to measure changes in the Independent Variables and results were presented in tables and graphs in the form of frequencies and percentages. In this study, the level of significance was determined by factors with a p-value less than 0.05. The results show that 161 (82.9%) of newborn babies had a low Apgar score at immediate Apgar score and of these 30 (18.6%) had severe low Apgar score while 131 (81%) had moderate low Apgar score. The demographic and maternal factors were significantly associated with immediate low Apgar scores were gravidity ($p < 0.021$), parity ($p < 0.029$), Haemoglobin during the first Ante-natal care (ANC) visit ($p < 0.011$), Antepartum haemorrhage (APH) ($p < 0.004$), membrane status ($p < 0.000$), duration of labour ($p < 0.000$), and neonatal factors include; gestational age ($p < 0.000$) as well as birth weight ($p < 0.000$). The results of Apgar scores after five minutes showed that 33 (8.5%) of newborn babies had low Apgar scores and those with normal Apgar scores were 355 (91.5%). Factors associated with low Apgar scores at five minutes after birth are maternal age ($p < 0.015$), urinary tract infection (UTI) ($p < 0.000$), other pregnancy complications ($p < 0.000$), and gestational age ($p < 0.000$) and birth weight ($p < 0.000$).

Binary Logistic regression model results show factors that were found to be strong predictors on immediate Apgar score are: total duration of labour (OR 4.263; 95% CI:2592-7.010; p-value=0.000), foetal presentation (OR 2.988; 95% CI: 1.182-7.554; p-value=0.021) and cord around the neck (OR 18.473, 95% CI;1.936-176.262; p-value=0.021). While after five minutes Apgar score, proper monitoring of partograph (OR 2.228; 95% CI:1.656-2.997, p-value=0.000) and gestational age (OR 1.475; 95% CI: 1.259-1.728; p-value=0.000) were the factors that increase chances of neonates persisting with a low Apgar score.

Maternal and neonatal factors associated more with low Apgar scores are identified, the study concluded that in-service training for midwives on effective monitoring of pregnant women during antenatal care and labor is needed. In addition, health education about the importance of antenatal care would contribute more to the early detection of complications for prompt action.

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LIST OF ACRONYMS

ANC	Antenatal Care
APH	Antepartum haemorrhage
BMI	Body Mass Index
BP	Blood Pressure
CI	Coefficient
CPD	Cephalopelvic Disproportion
CS	Caesarean Section
CTG	Cardiotocography
DDS	Dietary Diversity Score
ELCIN	Evangelical Lutheran Church of Namibia
GA	Gestational Age
HB	Haemoglobin
HIV	Human Immune deficiency Virus
IUGR	Intra -Uterine Growth Retardation
LBW	Low Birth Weight
MoHSS	Ministry of Health and Social Services
MF	Maternal factors
NICU	Neonatal Intensive Care Unit
NF	Neonatal Factors

OR	Odds Ration
UTI	Urinary Tract Infection
UNAM	University of Namibia
PIH	Pregnancy Induced Hypertension
SFH	Symphysial Fundal Height
SDF	Socio-Demographic Factors
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organisation

ACKNOWLEDGEMENTS

Firstly, I would like to thank the Almighty God for giving me the strength, wisdom, and opportunity to continue with this study until its completion. TO HIM BE THE GLORY.

Secondly, I also wish to express my sincere gratitude to the following individuals and establishments who made it possible for me to carry out this study:

Dr. Emma. M. Nghitanwa, my main Supervisor, and Mrs. Laura Uusiku, my co-supervisor for their patience, availability, great advice, and valuable input during my entire study. It was an absolute privilege to work with you. To Mr. Abel Karera, for his patient guidance and tireless efforts through the data analysis part of this work. Thank you so much. May God bless you to continue with this selfless personality.

To my family for their good support and for always being there for me during my studies. To my cousin, Victorneko Kashululu the question you have been asked me always, ‘When are you coming home?’ has been answered. This work is the reason why you didn’t see me often at home.

To all my friends (Ms. Emilia Ndume, Mr. Endru Nghikambe, Mr. Andrew Thomas, Ms. Delila Ndafenongo, Dr. Marten Shigwedha, Ms. Naemi Likius, and Mrs. Teopolina Haihambo) thank you for your encouragement and prayers especially when I was about to give up during this study.

Mr. Enos Kalua thank you for your assistance during my research proposal. Dr. L. T. Ileka thank you for your computer classes and Dr. Archford Musodza thank you for editing my thesis.

Last but not least, I would like to thank the Ministry of Health and Social Services for permitting me to conduct research in its health facilities.

Thank you all so much.

DEDICATION

I dedicate this study to my two late grandmothers who passed on during this study, *Kuku* Gwamuputu Martha Shekupe Phillips, and *Kuku* Mkwangombe Justina Ndiepelapeni Ashipala.

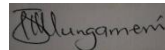
DECLARATIONS

I **Justina Lungameni**, hereby declare that this study is my work and is a timely reflection of my research and that this work or any part thereof has not been submitted for a degree at any other institution.

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CHAPTER ONE

1. INTRODUCTION

This chapter introduces the study on Factors associated with low Apgar Score in newborn babies at a hospital in Namibia. The chapter describes the background information concerning the Apgar score. The chapter also outlines the problem statement, study purpose, objectives of the study, significance of the study, limitations, and delimitations of the study as well as the definition of operational terms.

1.1 Background of the study

All babies born must pass a most important test in their life after one minute of delivery and again at five minutes and that examination is called the Apgar score. This test was originally developed by Virginia Apgar anesthesiologist in America in 1953 (Carlos & Degrandi, 2020). Apgar score is defined as a test given to a baby immediately after birth checking how well the baby is tolerating the birth process, and at five minutes demonstrating how well the baby is tolerating the environment outside the uterus (Khalid, Ghani, Khalid, Malik, & Waqas, 2018). Moreover, the assessment is done by checking five criteria namely heart rate, respiration efforts/breathing, muscle tone, stimulation response, and skin color. Each of the criteria is scored out of two points to give an overall score out of ten (Lewis, 2015).

In addition, the Apgar scoring system assesses clinical indicators on points out of ten. One of the indicators is heart rate, whereby if the newborn baby's heartbeat is more than 100 beats per minute, that baby will be awarded 2 points, beats less than 100 per minute, will get 1 point and those with no heartbeat will get 0 points. The other indicator is respiration effort or breathing; once the baby cries immediately after birth, he/she will be awarded 2 points, slow irregular

breathing, 1 point and with no respiratory effort, 0 points. The third indicator is muscle tone, whereby when the newborn shows active movement, he/she is awarded 2 points, slightly flexion limbs, 1 point and no response, 0 points, with stimulation response, if the newborn coughs and sneezes, 2 points, facial movements, 1 point and no response, 0 points. The last indicator is skin colour, whereby when a newborn with entirely pink colour, he gets 2 points, body pink with cyanotic extremities, 1 point, and pale/cyanotic, 0 points (Lewis, 2015).

Rudiger and Rozycki (2020) indicated that a good Apgar score of 7, 8, 9, and 10 assigned at one minute and five minutes of life indicates that the baby is healthy, while any score below 7 at one minute and five minutes of life and then at five-minute intervals until twenty minutes of life, is considered as low Apgar score. They further described the scores below 7 as follows: (a) a score of 4 – 6 is moderately abnormal, whereby newborn needs help to breathe spontaneously by suctioning, massaging, or offering oxygen. (b) a score of 0 – 3 is very low and severely abnormal, whereby a newborn needs immediate life-saving such as resuscitation and intensive care. According to (Weiss, 2017) a low Apgar score at five minutes projects a high risk of a baby developing conditions such as neonatal sepsis and cerebral palsy that may cause multiple alterations in the newborn functions. Weiss added that these functions can lead the newborn developing disabilities and neurodevelopmental disorders, as well as major social, emotional and economic losses. Newborn health is one of the important components of the sustainable Development goal with countries expecting to achieve the target of reducing neonatal mortality to at least as low as 12 deaths per 1000 live births by 2030 (World Health Organization, 2017). Identifying the factors associated with a low Apgar score will help to bridge the information gap and supplement the information that is necessary for planning aims needed to reduce neonatal mortality and morbidity.

Furthermore, Tharpe, Farley and Jordan (2017) also explain that newborns must make the transition from the intra-uterine environment, where nutritional and respiratory needs are met through the umbilical cord to the outside environment, where the infant must initiate breathing and suckling to survive. Most newborn babies delivered by a midwife begin to breathe spontaneously, while some need assistance to successfully make the transition to life outside the womb. Thus, to assist these newly born infants, the Apgar score may be used as a guide for the method and vigour of resuscitation that the baby may require (Rudiger & Rozycki, 2020). Perinatal asphyxia is a global serious clinical problem and 5-10% of all newborns need resuscitation at birth. It is estimated that the incidence of perinatal asphyxia varies from country to country developed countries are about 1/1000 live birth and in developing is much more common, with an incidence of 5-10/1000 live birth (Mannan, Dey, Karim, Iqbal, Yasmin & Ferdous, 2019). Globally, 2.6 million children died in the first month of life approximately 7000 newborn deaths every year. The majority (75%) occur during the first week of life and about 1 million newborns die within the first 24 hours and intrapartum related events 24% was one of the main causes Mannan (et al, 2019)

Furthermore, this indicates that these newborn babies lack oxygen which then leads to a newborn falling under a very low Apgar score. A low Apgar score can be reduced if risk factors of newborn babies are identified and managed early. Globally, 2.6 million neonates died in 2016 as a result of asphyxia and the majority of these neonatal deaths were concentrated in the first day and week of the child's birth, with about 1 million having died on the first day and close to one million dying within the next six days (Mannan et al, 2019).

Therefore, it is important to assess the health status of the neonate during the birth process using validated methods such as the Apgar scoring system which is done in the first and every fifth minute respectively after birth. The tests are done to establish what a newborn child's

health status is, to provide a necessary management to the newborn child based on the child's particular Apgar score. Studies conducted in America indicated that a low Apgar score is associated with premature neonates from gestation weeks of 24–28 (Mannan, et al., 2019; Svenvik, Brudin & Blomberg, 2015; Yossef, Shepherd, Lynch, Reber & Nelin, 2018). While, in Sweden mothers with babies with low Apgar scores were identified to have low Dietary Diversity Score (DDS) during pregnancy (Quansah, Boateng, Kwantwi, Owusu-Sekyere & Amegah, 2019).

In Africa, some countries have also experienced babies born with low Apgar scores. About 8% to 38% of babies delivered in West Africa may have low Apgar scores and over two-thirds of babies with low Apgar scores may result in perinatal mortality (Jeganathan, Karalasingam, Hussein, Allotey & Reidpath, 2017). Additionally, in Ethiopia, a study done by Getachew, Etefa, Asefa, Terefe and Dereje (2020) pointed out that the proportion of low Apgar scores at five minutes was 11.5% and the significant factors associated with this low Apgar score was foetal distress resulted from prolonged labour. Furthermore, emergency caesarean section due to cord prolapse, Antepartum Haemorrhage (APH) and general anaesthesia were regarded as some of the factors leading to low Apgar score (Sidano, Shitemaw, Yesuf, & Girma, 2019). Further, Nigeria recorded 29.5% of newborn babies with an Apgar score of 0-3, while 59.6% had an Apgar score of 4-5, in 2015 (Bilkius, Muhammad, Abdullahi, Muyideen, Akeem & Taofik, 2015). In addition, a study done in Kenya by Amdany (2021) found that misinterpretation of cardiotocography to rule out foetal distress can lead to a newborn being delivered with low Apgar score.

Namibia has recorded various neonatal birth asphyxia from different researchers that investigated the causes of neonatal death. A total of 11.7% of birth asphyxia was recorded in Namibia (Hatupopi, 2016). Birth asphyxia occurs when the baby is born with the severe Apgar

score. However, there was no study found by the researcher on factors associated with low Apgar scores in Namibia. Onandjokwe Hospital is one of the intermediate hospitals in Namibia with a catchment population of 147 179 with an annual growth rate of 2.2%. It serves people from the northern regions such as Oshikoto, Oshana and Ohangwena. Due to its geographical location, many women prefer to deliver in this hospital as it is also a referral hospital for some districts such as Eenhana, Okongo, Omuthiya hospital, health centers, and clinics in Oshikoto, Ohangwena, and Oshana regions respectively. However, the researcher had not come across any findings on factors associated with a low Apgar score in Namibia and Onandjokwe hospital specifically. It was for this reason that this study identifies and analyses factors associated with a low Apgar score in newborn babies at Onandjokwe Intermediate Hospital.

1.2 Statement of the problem

A study conducted in Namibia in 2018, shows that 24% of the newborn babies had an Apgar score of between 0-2 at one minute and 7% of newborn babies had an Apgar score between 0-2 Apgar score at five minutes, 29% and 17% of newborn babies had an Apgar score between 3 - 4 at one minute and five minutes respectively, while 47% and 76% of the newborn had an Apgar score between 5 - 7 respectively (Hanyanya, 2018). Despite those figures, the factors that lead to a low Apgar score remain unknown. According to the neonatal death review report, (Ministry of Health and Social Services, 2016) premature birth and meconium aspiration syndrome was mentioned as some of the factors that lead to less than seven low Apgar score in five minutes. However, more information is needed to determine other factors that contribute to a low Apgar score.

According to the annual statistics reports of 2018 and 2019 for the maternity ward in Onandjokwe Intermediate Hospital, a total of 39 neonatal deaths were recorded. It has been

noted that 11% of these neonatal deaths occurred as a result of birth asphyxia and these newborn babies were recorded with a low Apgar score at birth. Apgar score of less than seven is associated with a high risk of neonatal mortality and morbidity (Razaz, Cnattingius & Josef, 2019). It is of utmost importance that the midwives assess the Apgar score for each newborn baby at one minute and five minutes respectively. In addition, midwives should acquaint themselves with the history of the pregnant women to determine the risk factors and manage the women and the newborn baby properly and on time. Equally, Almeida (2016) identifies factors that affect the low Apgar score such as prematurity, fetal distress, cord prolapse, medical condition, and educational level.

Moreover, during the whole of 2018, about 6955 deliveries were conducted at Onandjokwe Hospital of which 5.2% (366) newborn babies had a low Apgar score (Onandjokwe delivery register, 2018). Whereas, in 2019, from January to December, statistics showed that deliveries conducted in Onandjokwe Hospital were 6954 of which 5.4% (376) newborn babies were rated with low Apgar scores (Onandjokwe delivery register, 2019). In addition, statistics of neonatal deaths reported in Onandjokwe Hospital due to low Apgar in 2018 from 41% to 58.9% in 2019. It is thus, in the light of the above, that this study intended to identify factors associated with low Apgar scores among newborn babies at Onandjokwe Intermediate Hospital since no study related to low Apgar had been carried out before.

1.3 Purpose of the study

The purpose of the study was to determine factors associated with low Apgar scores among newborn babies at Onandjokwe Intermediate Hospital over a certain period from 01 January to 31 Dember 2019.

1.4 Objectives of the study

The aim of the study was realized by achieving the following objectives:

- Identify and describe factors associated with low Apgar scores among newborn babies at Onandjokwe Intermediate Hospital.
- Analyse the relationship of the identified factors associated with a low Apgar score in newborn babies at Onandjokwe Intermediate Hospital.
- To establish possible recommendations for the study based on the study findings

1.5 Significance of the study

The findings of this study will contribute to the body of knowledge of the nursing and midwifery profession by identifying, describing and understanding factors associated with the low Apgar scores. The study might also equip health care workers at maternity units of the intermediate and all referral hospital departments with new knowledge and skill on identifying those factors and managing them early as well as the effectiveness of the monitoring of pregnant women. In addition, all health care providers in Onandjokwe hospital dealing with pregnant mothers will be made accessible to the findings of this study to initiate in-service training programmes aimed at providing awareness of those factors to curb or reduce the low Apgar score among newborns babies. Furthermore, the findings of this study may provide baseline data for further research in Onandjokwe hospital-specific for the obstetric department. Lastly, the findings of this study could also assist policymakers to develop strategies that help to improve quality service care monitoring of pregnant mothers during antenatal care and delivery.

1.6 Limitation of the study

The study was carried out in Onandjokwe Intermediate Hospital; hence other hospitals in the country were not included. Therefore, the findings of this study cannot be generalized to other health facilities.

1.7 Delimitation of the study

The study was carried out at Onandjokwe Intermediate Hospital in the Oshikoto region and not in other hospitals in the country. The study site was chosen due to its high birth rate in the region and also since it is a referral hospital for some of the district hospitals from the three regions, namely Oshikoto, Oshana, and Ohangwena.

1.8 Definitions and operationalisation of concepts

Factors: One of the elements contributing to a particular result or situation (www.dictionay.com/browse/factors). In this study, factors are referred to as maternal, neonatal and socio-demographic elements associated with low Apgar scores in newborn babies.

Association: This is when a relationship exists between two variables such that if one changes, the other changes in a predictable way (Madlela, 2018). In this study the association was determined using odds ratios (OR) of 95%, Confidence Intervals and Chi-square (p) values <0.05.

Apgar score: This is a simple method of quickly assessing the health and vital signs of a newborn baby based on Appearance, Pulse, Grimace, Activity, and Respiration (Lewis, 2015). In this study, Apgar score refers to an assessment performed on newborn babies delivered in Onandjokwe Hospital at one and five minutes after birth.

Low Apgar Score: Refers to any score lower than 7 out of 10 in one minute or after five minutes the score remains below 7 out of 10 (Tharpe et al., 2017). In this study low Apgar score refers to the assessment of newborn babies if after they are assessed in one minute and five minutes, they still present a score less than 7 out of 10.

Newborn baby: Refers to an infant in the first 28 days after birth (Lomax, 2015). Newborn babies in this study refer to all viable babies born at the Onandjokwe Maternity ward.

Normal Apgar Score: Refers to any score from 7 out of 10 in one minute after delivery and after five minutes the score remains above 7 out of 10. (Tharpe et al., 2017).

1.9 Summary

This chapter outlined the background information concerning the low Apgar score. It highlighted the rationale for conducting the study, statement of the problem, study objectives and defined concepts. Chapter two will review related literature on low Apgar scores among different studies.

1.10 Organisation of chapters

Chapter 1 is the introduction to the concept. It introduces the study and provides a clear statement of the problem, overall objectives of the study, significance of the study, limitations of the study, and the structure of the study as well as the organisation of the study.

Chapter 2 deals with a literature review of related sources. Firstly, the chapter refers to chapter 1 and introduces the chapter. Secondly, it deals with the theoretical literature review and then the empirical literature review, before concluding.

Chapter 3 discusses the methodology used in the research. This is done firstly, by referring to the previous chapter. It further outlines the research methods, data sources, model specification and definitions of variables and ends with a concluding remark.

Chapter 4 exclusively presents the findings of this study.

Chapter 5 is devoted to a discussion of the results.

Finally, **Chapter 6** outlines the conclusion, limitations and recommendations drawn from the research.

CHAPTER TWO

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

The previous chapter introduced the concept and the purpose of the study specifically what triggered this research. This chapter, therefore, reviews previous studies on the subject matter and it has two elements namely the theoretical framework as well as the review of relevant literature.

2.2 Theoretical Framework

The theoretical framework is the structure that can hold or support a theory of a research study. Several scholars have preferred numerous theories in a bid to explain the factors associated with a low Apgar score in newborn babies. In this regard, we discuss the Shonkoff bio developmental theoretical Framework.

2.2.1 Shonkoff biodevelopmental theoretical framework

The grand theory which guided this study was the bio-developmental theory framework that guides the future of early childhood development (Shonkoff, 2017). This framework is informed by a growing body of evidence that the foundations of healthy development and the origins of many impairments can be found among biological memories that are created through general environmental interactions in the early years of life in some cases beginning as early as the prenatal periods (Shonkoff, 2017). The areas that are targeted in this framework and where this study was based are:

a) The environment or relationship in which a young child develops; This refers to family and non-family members as being an important source of stable and growth promotion

relationships and critical protector against threats (Kaewluang, 2015). This area is linked to this study in the way that the family member of the fetus is the mother, her partner and people who are in the mother's environment. Thus, if these people are supporting the mother to go for Ante-Natal Care (ANC) and this care is available to all pregnant women regardless of their ethnicity and geographical areas, proper counselling to all underage pregnant women, then this environment is supportive and growth promotion is enhanced during fibro development until the third trimester that may lead to high Apgar score.

b) Physical, chemical and built environment; This means that the foetus and mother should have safeguards against injury and availability of associated social capital that supports the mother and foetus (Kaewluang, 2015). This links to this study in a way that mothers with medical conditions such as diabetes mellitus, eclampsia or anaemia should be treated, proper counselling of mothers who have social problems should be given, and inadequate sources that will be used in monitoring foetus in the womb should be taken care of, early referrals of mothers to referral hospitals for further management should also be done. Proper examination of pregnant mothers should be carried out to rule out Cephalo Pelvic Disproportion (CPD), and proper decisions should be taken on the mode of delivery. If the mother does not get adequate proper protection from physical and psychological stressors during pregnancy, the neonatal outcome may be a low Apgar score.

c) Nutrition; This one focuses on the availability and affordability of nutrients as well as the mother's knowledge of appropriate and adequate intake of both macronutrients (Kaewluang, 2015). This area is linked to this study in a way that a pregnant mother has to take adequate nutrients in the first trimester. This is important for the development of the placenta and to protect the embryo from nutritional deficiency, to avoid complications such as spina bifida (iron deficiency), Intra-uterine Growth Retardation (IUGR), low birth weight (for

micronutrients) mostly associated with underweight mothers and high Body Mass Index (BMI) for macrosomic babies all this is ranked as risk factors for the low Apgar score.

d) Educational and economic productivity; This refers to the pregnant mother who is encouraged to have a basic educational background that allows her to work and support herself. This area is linked to this study in a way that her socio-demographic condition such as knowledge regarding her health and understanding of the importance of the ante-natal care follow-ups (to rule out pregnancy complications and manage them as possible) and family planning (importance of birth intervals,). Furthermore, pregnant mothers have to be financially secure to be able to support themselves by buying food, and clothes as well as transport money for antenatal care follow-ups. On the other hand, pregnant mothers have to work light jobs during the second and third trimesters to prevent preterm labour which results in the newborn baby having a low Apgar score.

2.3 Literature Review

A literature review is a critical evaluation of the existing published works in a selected research area. It also explores what has already been written about the topic under investigation to highlight a gap. The review of relevant literature is focused on relevant existing secondary sources that are carried out by using databases, direct science, and internet search engines such as Google scholar, eResources Articles, and Journals. The following concepts were used for the literature search: Factors, associations, Apgar score and asphyxia on low Apgar score, and factors (such as socio-demographic, Maternal and Neonatal) that are generally associated with it.

2.3.1 Definition of low Apgar

As stated above, the Apgar score was originally developed by Virginia Apgar in 1953. It is defined as a test given to a baby immediately after birth checking how well the baby is tolerating the birth process and five minutes demonstrating how well the baby is tolerating the environment outside the uterus (Khalid, Ghani, Khalid, Malik & Waqas, 2018).

Gudayu (2017) defines it as a practical method of systematically assessing newborns immediately after birth to identify babies that need resuscitation. Apgar score is also used to determine the level of birth asphyxia. Similarly, Gebreheat, Tesfay, Dessalegn, Hinet, Natnael, Guesh and Desta (2018) suggest that the perinatal asphyxia which is harmful to newborn babies is caused by oxygen deprivation to the newborn that occurs around the time of birth that results in the newborn having a low Apgar score. World Health Organisation (WHO) defines birth asphyxia as a persistent Apgar score of 0 to 3 for more than five minutes (Wosenu et al., 2018). Apgar score system assesses clinical indicators such as; heart rate, respiration, muscle tone, and stimulation.

Each of these components is assessed and assigned a value of 0, 1, or 2 and the sum of these components is the final score. A score is high if it ranges from 7 to 10 and it indicates that the baby is healthy and fit, while any score below seven is considered a low Apgar score. (Lewis, 2015; Congmei, Xia, Shuiling & Fangjie, 2019). A low Apgar score is divided into the following categories: (a) a score ranging from 4 – 6 is moderately abnormal and (b) a score of 0 – 3 is severely abnormal (Rudiger & Rosycki, 2020).

2.4. Low Apgar score on global perspectives

Worldwide, about 45% of deaths of under - five children occur during the neonatal stage as a result of perinatal asphyxia and 23% of neonatal deaths in low to middle-income countries are caused by perinatal asphyxia (Gebreheat et al., 2018 & Asfere and Yesuf, 2018). Several scholars worldwide, including Sub-Sahara African countries, studied the Apgar score with the purpose of understanding factors such as socio-demographic, maternal, and neonatal factors that are associated with the transition from intrauterine to extrauterine life for neonates within one- and five-minutes Apgar score to improve care.

2.4.1 Socio-demographic factors

Socio-demographic factors influence the Apgar score. A study done in Australia by Fuka, Osuagwu and Agho (2020) found that the two main ethnicity groups in Fijian, Itaukafji and Fids had a majority of mothers who delivered their newborn babies with low Apgar scores measured at 49% and 38% respectively. In terms of the influence of religion, a study done in Ethiopia showed that most of the mothers who delivered low Apgar score newborn babies were from Orthodox and Muslim religions (Wosenu, Worku, Teshome & Gelagay, 2018 Yimer, Tenaw, Solomon & Mulatu, 2019). But, in both studies, ethnicity, and religion were not significantly associated with the low Apgar score. Geographical areas were one of the socio-demographic factors pointed out by Jeganathan et al. (2017) in Malaysia. This study revealed that mothers from villages that were far from health facilities may contribute to fewer ante-natal care (ANC) visits. Hence, this, would reduce the opportunity to provide ongoing obstetric care and risk assessment during their pregnancy.

Further, a study done in India indicated that the prevalence of low birth weight (LBW) babies less than 2.500kg that was at risk of the low Apgar score is high among the mothers that used solid or unhygienic fuel and those with no separated kitchen in the household (Patel &

Chauhan, 2020). In addition, unemployment or lowest means of monthly income or not being affiliated with the social security service can endanger the development of pregnancy as mothers will not be able to buy nutritious food that is needed for foetal development (Li, Wu, Lei, Zhang, Mao & Zhang, 2017). While manual occupations were added by Omokhodion, Roberts, Onadeko, Beach, Cherry & Burstyn (2018), having a low salary and poor body resting causes mothers to have preterm labour which is categorised as a risk factor for a low Apgar score.

Furthermore, in a study done in Brazil, it was established that educational level may contribute to low Apgar score in a way that mothers with education may not understand the importance of ante-natal care (Almeida, 2016). While, in Nigeria, Cantarutti, Franchi and Monzio Compagnoni (2017) and Melese, Badi and Aynalem (2018) pointed out that mothers with higher levels of education were at a lower risk of severe neonatal adverse outcomes such as low Apgar scores as they were likely to improve their healthcare-seeking behaviours by having adequate knowledge on the importance of ante-natal care follow-ups. Cantarutti et al. (2017) also identified the migrant status that foreign mothers have as posing a high risk of a low Apgar score because of differences in access to health services and integration policies of the hosting countries. Alcohol and smoking were not found to be associated with low Apgar scores (Mohammed, Getahun, Misrak, Robera & Meron, 2020), But a study done in Poland by Hamulka, Zielinska & Chadzynska. (2018) found that 22% of his study participants smoked and 7% consumed alcohol. These mothers were at risk of preterm babies that are associated more with a low Apgar score.

In Ethiopia, a study done by Woday & Muluneh (2019) found that marital status was statistically significant and associated with a low Apgar score, in a way that mothers living with their partners whether legally married or not would better meet all their needs during

pregnancy by providing social and financial support that promote regular Ante-Natal Care (ANC) consultation compared to single mothers.

2.4.2 Maternal Factors

In this part of the study, the researcher reviewed maternal factors associated with a low Apgar score such as; obstetric and biological factors.

2.4.2.1 Obstetric Factors

Obstetric factors include attendance to antenatal care during the present pregnancy and identifying factors that can put the pregnancy at risks such as Antepartum hemorrhage, contractions, and total duration of labour. In a study done in Brazil on prenatal care, quality indicators showed that 42.3% of mothers had attended ante-natal care more than seven times, and only 26.3% started prenatal care early (Hussen, Melese & Dembelu, 2016). On the contrary but still, in Brazil, another study was done by Santos, Vogt, Duarte, Pimenta, Madeira and Abreu (2019) which concluded that one-third of the mothers did not attend adequate prenatal consultations and that was due to ignorance that can put the new-born baby at risk of a low Apgar score. In Australia, a study done by Jeganathan et al. (2017) showed that mothers who booked late at a gestational age of fewer than 28 weeks were found to be significantly associated with an Apgar score of less than seven at five minutes. Studies in Africa on prenatal care by Ebonwu, Mumbavera, Uys, Wainberg & Medina-Marino (2018) in South Africa indicated that 72% of women presented for their first antenatal care (ANC) visit with 40% presenting late at more than 20 weeks while 32% started in their third trimester. WHO recommends ANC be started at a gestational age of 12 weeks. Pregnant mothers need to attend ANC to monitor the prognosis of pregnancy and be able to attend to early complication risk factors leading to low Apgar score (Corrao, Cantarutti, Porcu, Carbone, Zanini, Lacatelli,

Merlino & Carle, 2020). Improper spacing of pregnancies also leads to exhaustion of the body stores of maternal micronutrients (Hidru, Meresa, Yared & Welay, 2020).

Equally important is a study was done in China, where it was discovered that neonates of anaemic mothers had an increased risk of having a low Apgar score. Pregnant women who had iron deficiency anaemia during the second trimester would cause low nutrients and decreased oxygen-carrying capacities in their newborn babies (Tasleem, Bushra & Muhammad, 2018). This can cause placenta oxygen and nutrients not to meet the needs of the foetal growth and development which would lead to foetal growth restriction. This may induce maternal and foetal stress in the newborn baby that may cause adverse outcomes such as a low Apgar score. Other studies in Nigeria and Tanzania, also found that Mothers who neglected healthy dietary habits and did not receive Iron supplements are associated with a low Apgar score of less than 7 immediately (Ahmad, 2015; Yossef et al., 2018). In addition, mothers with haemoglobin (HB) less than 11d/gl as a result of antepartum haemorrhage, chronic diseases (sickle cell) and infections (malaria parasitaemia) are risk factors for low Apgar score (Adebami, 2015). Nayak & Gupta (2020) in Nepal added that mothers with HB level of less than 7 who presented at the hospital in the third trimester without prior ANC tend to have newborn babies with a low Apgar score of less than 7 in five minutes.

In addition, the mode of delivery such as breech deliveries in their infants tends to cause them to have a low Apgar score at five minutes due to delivery mode (Ahlberg, Norman, Hjelmstedtad & Ekeus, 2016; Omkhodion, Roberts, Onadeko, Beach, Cherry & Burstyn, 2018). On the other hand, assisted deliveries to those babies born via caesarean section after failed vacuum extraction and forceps deliveries tend to have a slightly lower Apgar score at one-minute Wosenu, (Worku, Teshome & Gelagay, 2018). This was confirmed by a study in Australia by Jeganathan et al. (2017) which found that mothers who booked late at a gestational

age of more than 28 weeks were found to be significantly associated with an Apgar score less than seven at five minutes. Still in Australia, in a study by Thavarajah, Harshithaa, Flatley and Kumar (2017) supported by Alexandra, Christopher and Sailesh (2019) it was established that emergency caesarean section and instrumental conveyed a high risk of low Apgar score in a similar study by Dikete, Coppieters, Trigaux, Englert, Simon and Zhang (2019) in a study done in Ethiopia, it was established that infants born via emergency caesarean section had high odds of the low Apgar score and this was due to cord prolapse, non-reassuring foetal state and placenta praevia.

It should be noted that a low Apgar score is not associated with both preterm and term babies where vacuum extraction is successful. (Aberg, 2017). According to Altman, Sandstron and Stephansson (2015) and Zipori, Grunwald, Beloosesky & Weiner (2018) state that low Apgar scores increase with longer duration of the first and second stages of labour and these stages of labour are associated with chorioamnionitis and foetal size. The second stage of labour that lasts more than one hour as a result of a longer duration of maternal pushing may increase the risk of umbilical artery acidosis and Cephalopelvic Disproportion (CPD) secondary to a prolonged second stage of labour of more than three hours due to improper vaginal examination (Sandstron, Altman, Criathngious Johansson, Ahberg & Stephansson, 2017; Tewesa, Chirwa, Majamanda, Maluwa & Chimwaza, 2017).

Furthermore, in Colombia, Torres-Munoz, Rojas, Mendoza-Cuero, Marin-Cuero, Orobio and Echandia (2017) found that the omission of a partograph during labour was associated with the presence of Apgar score. While in India a study shows that 6% of partograph were not monitored and no association was found between asphyxia (Subrata, Kripalini & Sighamitra, 2019). A study done in Malaysia by Tewesa et al. (2017) stressed that primigravida recorded 56% of mothers delivered newborn babies with a low Apgar score because they tend to be

uncooperative during their first and second stages of labour. In Nigeria, in a study by Bilkius et al. (2015) no association between low Apgar score and primigravida was found. Ibrahim, Muhye and Abdulie (2017) say mothers who spent more than 18 hours in labour 98% were likely to have their newborn babies develop a low Apgar score of less than 7. He further found that longer contractions of more than 2-3 minutes occurring repeatedly increases foetal cerebral oxygen saturation. This was supported by Hidalgo-Lopezosa, Hildalog-Maestre and Rodriques-Borrego (2016) found that excessive uterine activity compromised the foetus and increases the risk of an adverse foetal outcome as this decreases umbilical artery blood flow and foetal oxygen saturation. In a study done in the United State of America (USA) by Burgess, Katz, Moretti and Lakhi (2017) it was pointed out that maternal intrapartum fever of more than 38-degree Celcius occurs as a result of maternal infection from prolonged rupture of membranes that may cause Chorioamnionitis which is significantly associated with a low Apgar to score less than 7 at one and five minutes.

The effect of general anaesthesia on low Apgar score has been considered by Muloshi (2016) who says that for a baby to have a low Apgar score it depends on the types of anaesthesia agent used, for example, sodium thiopentone and thiopurine reach the foetus in a second and begins to approach equilibrium between maternal circulation, umbilical vein and artery within 23 minutes. Pain relief like Pethidine and Entoxon affect the low Apgar scores as they cross the placenta and cause a depression that leads to low Apgar scores (Gudayu, 2017). According to a study done by Mohammed et al. (2020) in Ethiopia, the high rate of a newborn delivered with a low Apgar score was due to pre-anaesthetic conditions as 95% of the cases were emergency C/S and foetal distress being the leading indications. Furthermore, more neonates delivered via general anaesthesia appear more depressed soon after birth that required free flow of oxygen, bag and mask ventilation, as this is due to a result of laryngeal spasm induced by aspiration of liquor or blood during intrauterine (Mohammed et al., 2020). Another factor is augmentation

medications such as oxytocin can cause contractions of the uterus to occur more often thus interfering with the uterine blood flow that causes the foetal to be depressed (Adebami, 2015). High doses of oxytocin administered and not controlled well or when the foetal well-being is not reassuring before labour augmentation may do more harm than good (Ashraf & Boulvain, 2020).

2.4.2.2 Biological factors

Biological factors refer to the physical, genetic, or neurological conditions associated with psychological disturbances of pregnant mothers that may cause bad outcomes for newborns such as maternal age (Indongo, 2014). Maternal illness during pregnancy such as diabetic Mellitus is one of the factors leading to a low Apgar score (Yeagle, Michael, William, Curtin & Ural, 2018). In a retrospective case-control study, a gestational diabetic Mellitus mother has a risk factor of intra-uterine fetal death which is due to micro-thrombosis of placental bed vessels and placental infarctions that affect the fetomaternal circulation system leading to low placental perfusion, fetal distress and low Apgar score (Kebapcila, Baldane, Ipekci & Sozen, 2016). In addition, hypertensive disorder during pregnancy may associate with a low Apgar score if there is no proper maternal management. This means that for mothers that had Pregnancy Induced Hypertension (PIH) with Proteinuria and Hemolysis Elevated Liver enzymes, and Low Platelet (HELLP) is not ruled out and treated the neonatal outcome may lead to a low Apgar score (Seyom, Abera & Tesfaye, 2015).

In a study done in Nigeria, on maternal illness in mothers who developed pre-eclampsia at gestational weeks of 20-29, their definitive treatment was a termination of pregnancy which was done despite the prematurity of the baby (Adebami, 2015). This caused the mother to have preterm delivery of birth weight of less than 2.00kg which is a risk of a low Apgar score. In addition, Ethiopia recorded low Apgar score babies of 13.4% born by mothers with severe pre-

eclamptic cases. Eclampsia during pregnancy or labour was found to contribute to placenta dysfunction of not transferred nutrients to the foetus predispose to IUGR which is mostly associated with low Apgar score (Mckenzie & Trotman 2019).

A study was done in Japan it showed that mothers with Systemic Lupus Erythematosus (SLE) in the 3rd trimester were associated with pre-term which was at risk of a low Apgar score. Moreover, the Titter of anti-DNA (Deoxyribonucleic Acid) antibodies at concentration are correlated with the low Apgar score at one and five minutes (Shimanda, Wakiya, Mansour, Nakashima, Kalo, Miyagi, Kada & Dobashi, 2019). The rates of a low Apgar score at five minutes increased among infants of women with obesity class III (BMI more than 40 kg (Omokhodion et al, 2018). Therefore, lack of exercise and poor diet will lead a pregnant mother to some complications during the delivery of macrosomia. In addition, the maternal short status of less than 158 cm and BM of more than 30Kg/m were found to be independent risk factors for Apgar score of less than 7 five minutes. While, a woman with underweight (BMI 8.5-24.9 kg) due to poor dietary intake could result in deficiencies of some essential nutrients that are needed during pregnancy for the growth and development of the foetus as this could have an impact on foetal outcomes (Quansah, Boateng, Kwantwi, Owusu-Sekyere & Amegah, 2019).

Maternal age had significant influences on Apgar scores, in older women (above 35years) who had higher odds of 1.3 (95% CI 1.10-1.58) low Apgar scores compared to women aged 20-35 years, this is due to inadequate pelvic (Getaneh et al., (2021), Abdo, Hali & Kebede, 2019). On the other hand, a study done in Iran by Belechew & Joseph (2018) showed that mothers who were in the appropriate age categories of 20-35 years were 80%, while 10% were those over 35 years and 10% were younger than 20 years. They did not find any significant association in either maternal age of fewer than 20 years or of more than 35 years. Furthermore, maternal age with a neonatal outcome such as morbidity was due to poor placenta function in light of

vascular changes occur with increased age (Correa-de-Araujo & Youn, 2021). The linkages were further emphasized by Klandwaka, Baker, Shaw, Stevenson, Lu and Elsenberg (2018) who stated that advanced maternal age of more than 55 years was associated mostly with the birth outcome of 10% of infants who were at a high risk of assisted ventilation and this happens due to epigenetic changes that occur within spermatocytes. In Malawi, young mothers under 19 years of age were associated with difficult labour due to uncooperative behaviours during the first and second stages of labour (Tewesa et al., 2017). This is almost close to the findings of a study done in Ethiopia by Yimer et al. (2019) who found that maternal age between 21-25 (37%) was strongly associated with a low Apgar score.

2.4.3 Neonatal factors

Neonatal factors such as the sex of the newborn babies, birth weight, gestational age, and congenital abnormalities were reviewed to rule out a low Apgar score. A study done by Jeganathan et al. (2017) in Malaysia showed that approximately 0.59% of neonates 'at birth had one minute Apgar score of less than four. However, in Australia in another study by Thavarajah et al. (2017), it was revealed that the prevalence of Apgar scores of 0 to 3 was 0.3%, 1.1% at 4-6 Apgar scores and 98% had normal Apgar scores. Fetal distress was rated as a highly neonatal factor associated with a low Apgar score in China (Li, Wu, Lei, Zhang, Mao & Zhang, 2017).

In addition, fetal bradycardia was recorded as a factor that was associated with a low Apgar score in Brazil, as stated by (Sori, Belete & Wolde, 2016) that abnormal heart rate is detected by Electronic Fetal Monitoring that showed repeated late deceleration was developed as a presence of meconium-stained amniotic fluid grade three in labour. Fernandez, Carlos, Marin-Ortiz and Naveira (2018) in a study done in Spain, found that 74.8% of the cases of liquor were either grade II or grade III meconium -.stained and if this liquor gets to be aspirated by the fetus

can cause fetal asphyxia. Preterm birth in less than 36 weeks of gestation is an independent risk factor for an Apgar score of less than 7 which is mostly associated with multiple pregnancies (Svenrik, Brudin & Blomberg, 2015). This was in line with a study done by Santos et al. (2019) which indicated that mothers with gestational age below 37 weeks had six-fold higher chances of having a baby with an altered Apgar score.

Neonatal factors such as an extremely premature fetus with a birth weight of less than 1kg can have a low Apgar score because they develop difficulty in breathing that might cause difficulty in cardiopulmonary transition (Gudayu, 2017). This was also supported by Mohammed et al. (2020) who also found that low birth weight was mostly associated with a low Apgar score at one and five minutes due to the immaturity of organ and nervous systems that makes infants unable to adapt to the new environment. In addition, neonates that weigh less than 2.5kg are more prone to developing low Apgar scores (Gebreheat et al., 2018). In contrast, a study done in Ethiopia and Nigeria found that macrosomia, a large size baby at birth weighing more than 4kg is likely associated with CPD which results in prolonged labour that causes birth asphyxia (Gebreheat et al., 2018; Bilkius et al., 2015). Patil, Pawar and Pawa (2020) agree that a macrocosmic baby if delivered via vaginal delivery may cause complications of shoulder dystocia that cause injury to the plexus brachialis due to mother and fetus.

A retrospective study done in Ghana by Abukari, Awuni, Yakuhu, Mohammed, Yakubu & Yakuhu (2021) discovered that babies born via caesarean section developed low Apgar score at five minutes as a physiological phenomenon of the rib cage of the baby squeezed as it passes through the birth canal to enhance clearance of the airway does not take place during caesarean section. However, in a study done in Nigeria by Omokhodion et al. (2018), it was found that male babies were associated with a low Apgar score at five minutes.

2.5. Prevalence of low Apgar score in Africa and Namibia

Like other continents, Africa has also experienced high rates of babies born with a low Apgar score. Ethiopia recorded 30% of neonates with a low Apgar score of less than six immediately after delivery (Asfere & Yesuf, 2018). Similarly, Tigray hospital in Ethiopia recorded 22.1% cases of perinatal asphyxia (Gebreheat et al., 2018). Whereas Nigeria had recorded a 20% Apgar score of less than seven at one minute and 4% at five minutes (Omokhodion, Roberts, Onadeko, Beach, Cherry & Burstyn, 2018). The prevalence of low Apgar scores in South Africa was 71.6%. In addition, Tanzania recorded a prevalence of low Apgar scores were 19.9% (Masanja, Kibusi & Mkhoi, 2020) while, Ghana had less percentage (9.3%) compared to other countries (Abdulai & Zakari, 2019). In Namibia, a study done in one of the local hospitals in Namibia by Hatupopi (2016) indicated that 12.1% of neonates were having neonatal asphyxia.

2.6. Gap in the literature

The study was an effort to fill the gap in knowledge regarding what is known about factors associated with the low Apgar score at Onandjokwe Intermediate Hospital. Numerous studies addressed socio-demographic, maternal, and neonatal factors both globally and in Africa. Researchers have not come across any study done in Namibia yet regarding the low Apgar score. Therefore, further studies are required especially in African countries including Namibia on the prevalence of low Apgar scores.

2.7 Summary

This chapter reviewed the literature on factors associated with the low Apgar score. Chapter 3 will focus on the methodology adopted in this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Chapter 2 reviewed related literature on this study, with a basic emphasis on the theoretical part of literature and empirical literature. This chapter is divided into the following sections; research design, study population, sampling procedure and sample size as well as research instruments and measures used in data collection. It further, provides the model specifications and definitions of variables, measures to ensure validity and reliability, data collection procedures, data analysis and lastly aspects of research ethics.

3.2 Research Design

According to Creswell & Creswell (2017) research design is defined as the ‘blueprint’ of the study and determines the methodology used by the researcher to obtain sources of information such as; subjects, elements and units of analysis, to collect and interpret the results. This study used a Case-control, quantitative, retrospective descriptive, analytical research design to gather, quantify and analyse the data. Quantitative research design ‘is most often about quantifying relationships between or among variables - the independent or predictor variable (s) and the dependent or outcome variable(s) (Valmi, Driessnack, Amelia & Mendes, 2017). This study gives explanatory relationships existing between association factors in newborn babies with low Apgar scores and those with normal Apgar scores. The descriptive approach was used to summarize the numerical data of a sample of a population and is broken into measures of frequencies, central tendency and variability. This study is descriptive as it describes the factors associated with a low Apgar score.

3.3 Data and Source

Retrospective studies investigate a situation or a problem that has happened in the past (Dane, 2017). The data were collected from the maternal record files of delivered newborn babies with low Apgar scores and maternal record files of mothers who delivered newborn babies with normal Apgar scores at Onandjokwe Maternity ward for the period of 01 January 2019 to 31 December 2019.

3.4 Population

Creswell and Creswell (2017) define a population as an individual or elements, who are the focus of research. The study population for this study were all maternal records of deliveries conducted at Onandjokwe Intermediate Hospital from 01 January 2019 to 31 December 2019. These records were selected because 2019 have recorded a high rate (5.4%) of newborn babies born with low Apgar scores compared to the previous year (2018) where only 5.2% of the low Apgar score were recorded. The total population includes all 6954 maternity records of mothers delivered in Onandjokwe Intermediate Hospital during 2019 of babies delivered with low Apgar scores and babies with normal Apgar scores. The target population was cases of 376 maternal records with low Apgar scores. According to Asimah et al. (2017), a target population refers to a group of individuals having one or more characteristics of interest.

3.5 Description and measurement of variables

The variables of interest in this study were low Apgar (LAPGAR) as the dependent variable, and independent variables were Socio-Demographic Factors (SDF), maternal factors (MF) and Neonatal Factors (NF). Brief descriptions and measurements of these variables are presented in the next sections.

3.6 Model specification

To analyse empirically the relationship amongst the variables in this study, the researcher adopted the model used by Chen, Li, Tsangaratos, Shahabi, Iliia, Xue and Bian (2020). This model uses a Binary logistic regression model. The estimated equation to analyse the associations between low Apgar and Socio-Demographic Factors (SDF), maternal factors (MF) and Neonatal Factors (NF) can be specified as follow:

Socio-demographic Factors: This combines information on education, income, age, sex, ethnicity, religious affiliation, marital status, employment, social status and marital status.

Maternal factors: This is information that influences foetal outcomes such as maternal illness, types of delivery, contractions, anaesthesia medications, pregnancy and delivery complications and vital signs.

Neonatal factors: This includes factors such as sex of newborn, birthweight, foetal presentation, use of cardiotocography, incidents of cord prolapse, cord around the neck and congenital abnormality.

Low Apgar = Socio-Demographic Factors (SDF) + Maternal Factors (MF) + Neonatal Factors (NF)

Model specification:

$$LAPGAR = \beta_0 + \beta_1 SDF + \beta_2 MF + \beta_3 NF$$

Whereby LAPGAR represents the low Apgar, SDF represents Socio-Demographic Factors, Maternal factors are represented by MF and Neonatal Factors are represented by (NF) in the model. In addition, β_0 represents the co-efficient of the constant whereas β_1 , β_2 , and β_3 represent the co-efficient of all the explanatory variables.

3.7 Sampling and Sample size

Sample refers to a process used in statistical analysis in which a predetermined number of observations are taken from a larger population (Taherdoost, 2016). This study employed the Simple random sampling method to select participants for the study. The sampling of low Apgar scores and sampling of normal Apgar scores will be explained as follows:

Low Apgar score: In this study, a low Apgar score is defined as maternal record files of mothers who delivered newborn babies with low Apgar scores.

Normal Apgar score: In this study normal Apgar score is defined as maternal record files of mothers who delivered newborn babies with normal Apgar scores in the same hospital which is Onandjokwe Intermediate Hospital.

Simple random sampling refers to a variety of selection techniques in which sample members are selected by chance, but with an equal probability of selection (Datta, 2018). The researcher Choose the simple random sampling method from a table of random maternal record files up to the desired sample size of (194) of each group to the ratio of 1:1, case-control matching namely low Apgar score maternal records and maternal records for normal Apgar score to ensure that all maternal record files for the year 2019 had a chance of being selected for the study.

3.7.1 Sample Size

Sample size refers to a group of subjects that are selected from the general population and is considered a representative of the real population for that specific study (Datta, 2018).

The sample size in this study was determined by using Yamane's Formula ($n = \frac{N}{1 + N(e)^2}$)

$1+N(a)^2$). This helped the researcher to estimate the sampling size. In this formula, ‘n’ represents the sample size, ‘N’ represents the population size under the study and ‘a’ represents the margin of error. The researcher used a 95% confidence level and 5% or 0.05 as the margin of error. The target population was 376 of all the files of mothers who delivered babies with a low Apgar score between 01 January 2019 and 31 December 2019. Below is the calculation that shows how the sample was determined;

$$n = \frac{N}{1+N(a)^2}$$

$$= \frac{376}{1+376(0.05)^2}$$

$$= \frac{376}{1+ 0.94}$$

$$= 194 \text{ sample size}$$

The researcher used a sample size of 194 per group for the study.

3.7.2 Inclusion criteria

Some characteristics must be present for the elements to be included in the sample (Creswell & Creswell, 2017). In this study, the researcher considered all the maternity records of mothers who gave birth to all viable babies and delivered via normal vaginal delivery, caesarean section or assisted deliveries at Onandjokwe Intermediate Hospital during the period from 01 January 2019 to 31 December 2019.

3.7.3 Exclusion criteria.

There are exceptions to the inclusion criteria, and this includes all patients' files with home deliveries and those that were referred to Onandjokwe Intermediate Hospital after delivering at other health facilities.

3.8 Research Instrument

This study used a document review checklist as the data collection tool written in the English language. The data collection tool was compiled by the researcher using the reviewed literature and maternal records of the Ministry of Health and Social Service, Republic of Namibia to come up with factors such as socio-demographic factors, maternal factors, and neonatal factors. It consisted of three sections namely; Section A: which consisted of Socio-Demographic Factors, Section B; which is about Maternal factors and Section C; which is on Neonatal Factors. The tool provided checkboxes to indicate whether the attribute being measured was present or not.

3.8.1 Validity and Reliability of the data collection tool.

To obtain the quality of the instrument and data collection tool was evaluated in terms of validity and reliability. Validity refers to the degree to which an instrument measures what it is supposed to measure (Brian, 2013). In addition, he defined content validity as referring to the extent to which a measure represents all facets of a given construct. To ensure this, the tool was given to an obstetric doctor who was an expert in the field for more than five years to assess the clarity, relevance, and simplicity of the content of the instrument. Furthermore, Construct validity was ensured in this study that indicators and measurements were carefully developed based on the existing knowledge. Lastly, Face validity is an estimate of whether a test appears to measure the right elements that need to be measured (Haradhan, 2017). In this

study, the instrument was given to an expert in the maternity ward such as Gynaecologist, and supervisors of Onandjokwe Intermediate Hospital and rated the validity of a test as it appeared.

Reliability, as defined by Creswell & Creswell (2017), refers to the degree to which the instrument can be reliable because if it is used repeatedly overtime on the same person it will give consistent results. In this study, reliability was ensured by testing data tool on 10% of maternal records as a pilot study before the actual study to ensure that all important variables of concern were covered. The pilot study was conducted in the Onandjokwe Intermediate Hospital maternity ward. The files used in the pilot study were excluded from the main study.

3.9 Data collection procedure

The data collection took place in the maternity ward at Onandjokwe Intermediate Hospital to determine factors contributing to low Apgar scores among the newborn babies after the approval was granted from the University of Namibia (UNAM), Ministry of Health and Social Service (MoHSS), Oshikoto Regional Health Director and Hospital management to access the maternal records of all mothers who delivered from 01 January 2019 – 31 December 2019. The data were corrected in Onandjokwe Intermediate Hospital because there was a high rate of newborn babies delivered with low Apgar scores and neonatal death due to neonatal asphyxia was recorded as increasing. Selected maternal records were taken from the storeroom to the closed safe room in the maternity ward. These maternity files were reviewed using a data collection tool (document review checklist) to indicate whether the attribute being measured was present or not. Data were collected over three months namely, June, July, and August 2020.

3.10 Data Analysis

Data analysis is a method of organizing the raw data and displaying it in a fashion that provides answers to the research question (Tharpe, Farley and Jordan, 2017). Data collected were verified to ensure completeness, coded, cleaned and edited for any inconsistencies before it was entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were calculated in frequency and percentages to summarise and describe the data collected. Furthermore, the Chi-square test was used to measure the association between a dependent variable (low Apgar score) and independent variables (factors). In addition, odds (95% CI) were calculated as a measure of association and the Dependent variables were analysed using Binary Logistic regression to measure changes in the independent variables that were associated with changes in the probability. The level of significance was determined by factors with a p-value less than 0.05 at a 95% confidence interval.

3.11 Research ethics

According to Iphofen (2020), ethics is “an important consideration in research.” To ensure that the study has been conducted under the guidance of ethical principles all clearances were obtained before the study began. The study was approved by the University of Namibia, School of Nursing, Research and Ethical committee. An approval letter was also obtained from the Ministry of Health and Social Service research Ethics Committee and the Oshikoto Regional Health Director. These clearance letters were presented to the medical superintendent of Onandjokwe Intermediate Hospital and the maternity ward supervisor to be granted permission to access the maternal records. The researcher used maternity records that do not require face-to-face interviews of mothers whose files were selected. Therefore, informed consent was not applicable in this study.

During the data collection process, anonymity was applied as the registration number of selected files was replaced with a study code. No name of patients either those of the health personnel in the maternity records was revealed or transferred to data collection tools. Confidentiality was applied since all data collected was only known by the researcher and was kept in the safe room, to which only the researcher had access to it. Principle of Justice was ensured that the researcher sample maternal records based on the research problem, by sampling maternal records with the low Apgar score and those with normal Apgar scores, while non – maleficence was ensured in this study since the study did not include patients physically, it only reviewed maternal records, the name of the patients and health personnel written in the maternal records were not revealed. Therefore, there was no harm layed to participants.

3.12 Summary

This chapter outlined the research methods adopted in this study as well as the description of the variables used. It also laid a foundation for what chapter 4 entails. The next chapter discusses the results of the study.

CHAPTER FOUR

RESULTS OF THE STUDY

4.1 INTRODUCTION

This chapter provides the results of the data collected from 388 maternal record files of which 194 maternal record files were of mothers who delivered newborn babies with low Apgar scores and 194 were of maternal record files of mothers who delivered newborn babies with normal Apgar scores. Data were analyzed to determine the factors associated with a low Apgar score in newborn babies at Onandjokwe Intermediate Hospital from 01 January 2019 to 31 December 2019. A checklist which consisted of three sections namely Section A; demographic characteristics, Section B; Maternal factors, and Section C; Neonatal factors was designed by the researcher and used to collect data from the maternal records.

Both immediately and after five minutes maternal data were analyzed following the format on the checklist. Data is presented in charts and tables as frequencies and row percentages of each variable. A *Chi-square* test was used to determine the association between the independent variables and low Apgar scores at an alpha level of the p-value of 0.05. Stepwise Binary Logistic regression was used to determine the factors contributing to low Apgar scores through the generation of Odds ratios and confidence intervals.

4.2 FACTORS ASSOCIATED WITH IMMEDIATE APGAR SCORE

This section of the study presents the demographic, maternal and neonatal factors associated with immediate low Apgar scores. The results show that 161 (82.9%) of newborn babies had a low Apgar score at immediate measurement and of these 30 (18.6%) had severe low Apgar scores while 131 (81%) had moderate low Apgar score.

4.2.1 Demographic characteristics and their association with the immediate Apgar score.

The demographic characteristics are features of the sample that the respondents and researcher cannot control (Shimada et al., 2019). The demographic characteristics of mothers included; age, religion, ethnicity, nationality, employment status, place of residence, maternal education as well as marital status.

4.2.1.1 Age group of mothers

The mothers' ages were grouped from less than 20 years to above 35 years for the whole sample as indicated in figure 4.1. The results show a great number of 227(59%) of the participants to be between 21 to 34 years and fewer participants constituting 77(20%) recorded were less than 20 years old.

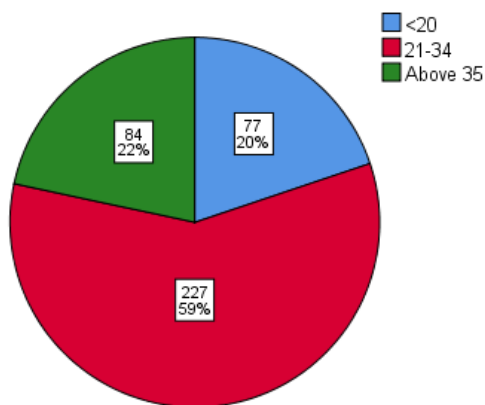


Figure 1. Age distribution of participants(n=388)

The age group of mothers and its association with low Apgar score are shown in Table 4.1 below

Table 4.1 Association between age of mothers and immediate Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Age group (years)				0.897
< 20	38 (49%)	39 (51%)	100	
21-34	106 (47%)	121 (53%)	100	
Above 35	41 (49%)	43 (51%)	100	

Table 4.1 shows that the majority of low Apgar score patients, 106 (47%) belonged to mothers aged 21 -34 years, while the least number of low Apgar score patients, 38 (49%) belonged to mothers below 20 years. The same pattern was observed within the normal group whereas 121(53%) belong to mothers 21-34 years old and 39 (51%) were from mothers below 20 years of age. The mean age for the whole sample was 29 years, with a minimum of 14 years and a maximum of 36 years. There was no statistically significant association between the mothers' age and immediate low Apgar score ($p>0.897$).

4.2.1.2 Gravidity and parity of the mothers

The gravidity and parity of the mothers were extracted and analyzed in total. The majority of the participants were Multigravida 191 (49%) followed by grand multigravida 73(19%) as shown in Finger 2.

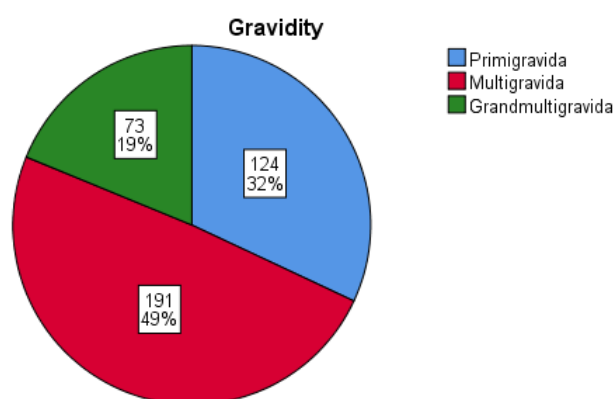


Figure 2. Gravidity distribution (n=388)

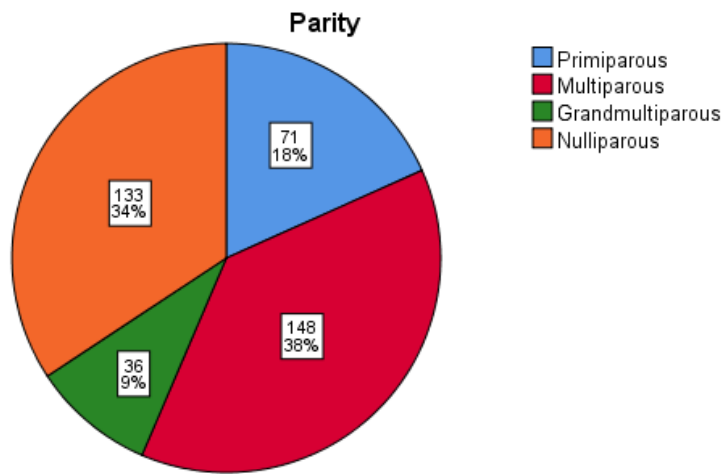


Figure 3. Parity distribution (n=388)

Figure 3 shows that majority of participants were from Multiparous 148(38%) followed by grandmultiparous that has less 36(9%).

Table 4.2 below shows their association between, low Apgar and normal Apgar score newborn babies and gravidity and parity.

Table 4.2 Association between gravidity and parity and Immediate Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Gravidity				0.021
Primigravida	70 (58%)	50 (42%)	100	
Multigravida	81 (43%)	109 (57%)	100	
Grand multigravida	32 (44%)	40 (56%)	100	
Parity				0.029
Nulliparous	75 (56%)	57 (43%)	100	
Primiparous	26 (37%)	45 (63%)	100	
Multiparous	68 (48%)	75 (52%)	100	
Grand multiparous	14 (39%)	22 (61%)	100	

The study shows that the highest number of mothers were multigravida for both low Apgar scores, 81 (43%) and normal Apgar scores, 109 (57%). Mothers with grand multigravida were below 50 in both low Apgar scores, 32 (44%), and normal Apgar score groups 40 (56%). For parity most mothers were nulliparous, 75 (57%), in the low Apgar score and 57 (43%), in the normal Apgar score group. In the low Apgar score group, only 68 (48%) were recorded as multiparous and this increased to 75 (52%) in the normal Apgar score. The immediate low Apgar score showed a statistically significant association with gravidity ($p < 0.021$) and parity (0.029).

4.2.1.3 Religion of the mothers

The mothers' religion was analyzed in total and shows that a high proportion of the study population of 290 (75%) was from the Evangelical Lutheran Church in Namibia (ELCIN) and fewer participants 6 (2%) recorded were from revival Christians as shown in Figure 4 below.

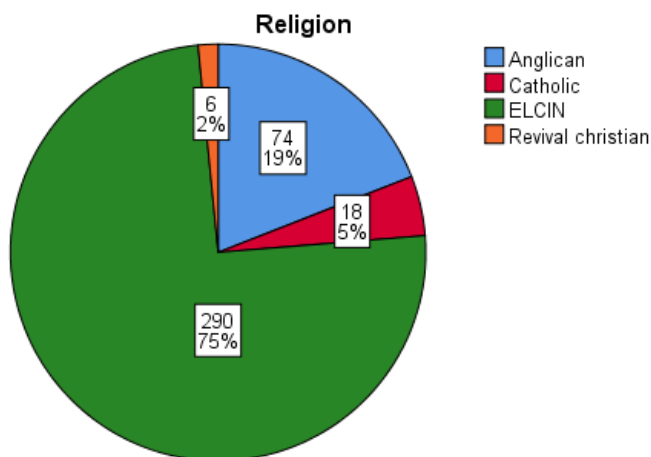


Figure 3. Religion of mothers (n=388)

The association between religion and both low and normal Apgar score is shown below in Table 4.3.

Table 4.3 Association between religion and immediate Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Religion				0.365
Anglican	39 (53.4%)	34 (46.6%)	100	
Catholic	6 (35.3%)	11 (64.7%)	100	
Evangelical Lutheran Church in Namibia (ELCIN)	132 (46.0%)	155 (54.0%)	100	
Revival Christian	4 (66.7%)	2 (33.3%)	100	

The Evangelical Lutheran Church in Namibia (ELCIN) presented a high proportion of the study population both in low Apgar score 132 (46.0%) and normal Apgar score group, 155 (54.0%) while the Anglican and Catholic churches recorded both a total of less than 50. There was no statistically significant association found between the mothers' religion and immediate low Apgar score ($p>0.365$).

4.2.1.4 The ethnicity and nationality of the mothers

The nationality of mothers shows that majority were Namibian 378(97%) and 10(3%) were Angolian. Figure 5 below show the ethnicity of mothers that the majority of the participants more than 384(99%) were Oshiwambo speaking and 1(0%) African.

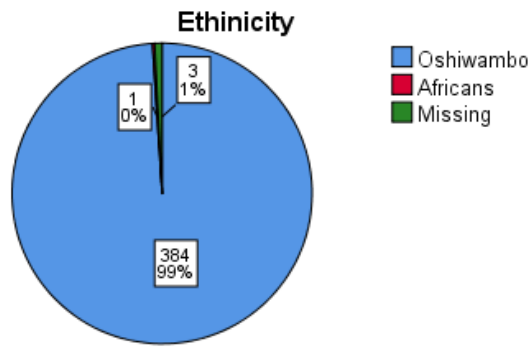


Figure 4. Ethnicity of mothers (n=388)

The association between ethnicity and nationality and immediate Apgar score are shown in Table 4.4 below.

Table 4.4 Association between ethnicity and nationality and immediate Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Ethnicity				0.341
Oshiwambo	183 (47.7%)	201 (52.3%)	100	
Africans	0 (0.0%)	1 (100.0%)	100	
Nationality				0.424
Namibian	178 (47.2%)	199 (52.8%)	100	
Angolan	6 (60%)	4 (40%)	100	

The highest number of mothers were Oshiwambo speaking, 183 (47.7%) in the low Apgar score and 201(52.3%) in the normal Apgar score group. Most of the mothers were also Namibian citizens with 178 (47.2%) in the low Apgar score and 199 (52.8%) in the normal Apgar score group. No statistically significant association was shown between low Apgar score and ethnicity ($p>0.341$) as well as Nationality ($p>0.424$).

4.2.1.5 Employment status of the mothers

The employment status of the mothers was analyzed in total and the majority of the study participants, 331 (85%) were unemployed the results are presented in Figure 6.

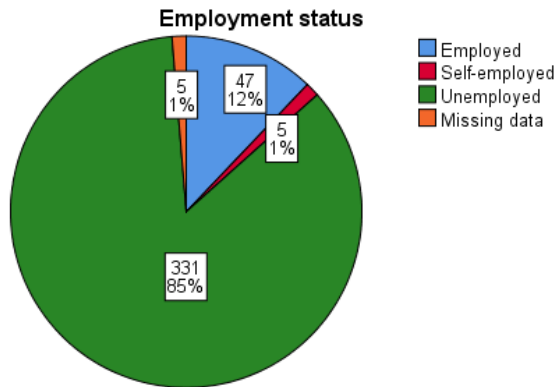


Figure 5. Employment status of the mothers (n=388)

The association of employment status with immediate low and normal Apgar score are shown in Table 4.5

Table 4.5 Association between employment status and immediate low Apgar scores.

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Employment status				0.831
Employed	23 (48.9%)	24 (51.1%)	100	
Self-employed	3 (60%)	2 (40%)	100	
Unemployed	156 (47.1%)	175 (52.9%)	100	

The majority of the study participant was unemployed in both groups 175 (52.9%) in the normal Apgar score group and 156 (47.1%) in the low Apgar score group. Both low Apgar score 23 (48.9%) and normal Apgar score 24 (51.1%) groups had almost an equal number of mothers employed. There was no statistically significant association between the employment status of mothers and the immediate Apgar score ($p>0.831$).

4.2.1.6 The residential place of the mothers

The place of residence of the mothers was extracted from the records and the results show that the majority of the participants are from the rural areas and fewer participant are from semi-urban areas as shown in Figure 7.

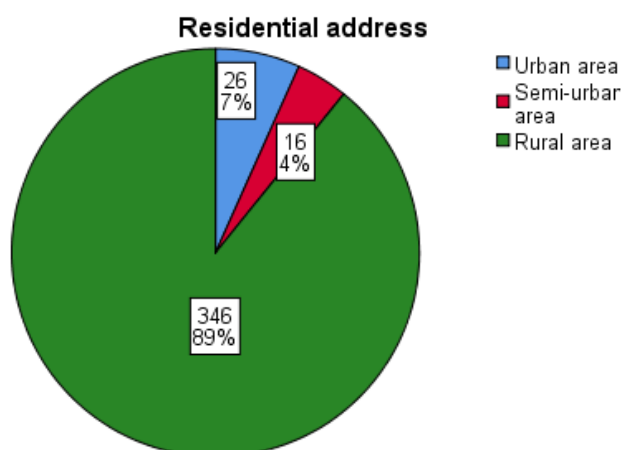


Figure 6. Residential status of the mothers (n=388)

Table 4.6 presents the association of residential address and immediate Apgar score.

Table 4.6 Association between residential address and immediate Apgar scores

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Residential area				0.925
Urban area	13 (50.0%)	13 (50.0%)	100	
Semi-urban area	7 (44%)	9 (56%)	100	
Rural area	165 (47.7%)	181 (52.3%)	100	

An equal number of the participants in this study, 13 (50.0%), in the low and normal Apgar score groups resided in urban areas. The majority of participants were residing in rural areas for both the normal Apgar score 181(52.3%) and low Apgar groups with 165 (47.7%). A few

participants were from the semi-urban areas 16 (4.1%). The immediate low Apgar score showed no statistical significance with the area of residence ($p>0.925$).

4.2.1.7 Education level of the mothers

Results of the maternal educational levels are illustrated in Figure 8 below. Most of the study participants 254 (65%) had secondary education and only a few participants had recorded no formal education 14 (4%).

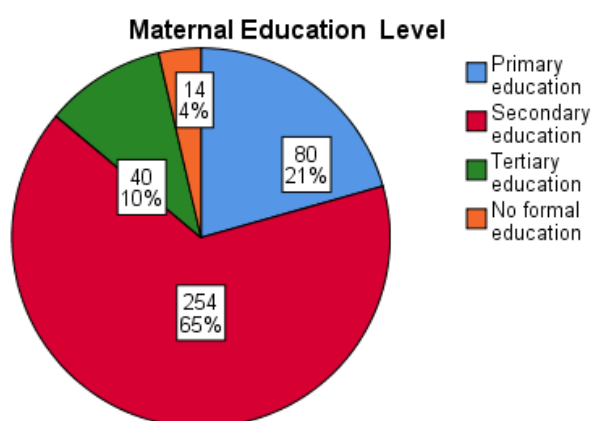


Figure 7. Educational status of mothers (n=388)

The association between educational status and immediate Apgar score are presented below in Table 4.7.

Table 4.7 Association between educational status and immediate Apgar scores

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Maternal education				0.313
Primary education	39 (48.8%)	41 (51.2%)	100	
Secondary education	112 (44.6%)	139 (55.4%)	100	
Tertiary education	22 (57.9%)	16 (42.1%)	100	

No Formal education	8 (61.5%)	5 (38.5%)	100	
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The majority of participant had secondary education of which 139 (55.4%) had normal Apgar scores compared to 112 (44.6%) with a low Apgar score. Of those with primary education 41 (51.2%) had normal Apgar while 39 (48.8) had a low Apgar score. The majority of mothers with tertiary education were in the low Apgar score group, 22 (57.9%), compared to the normal Apgar score group, 16 (42.1%). There was no statistically significant association found between maternal education and the immediate low Apgar score ($P>0.313$).

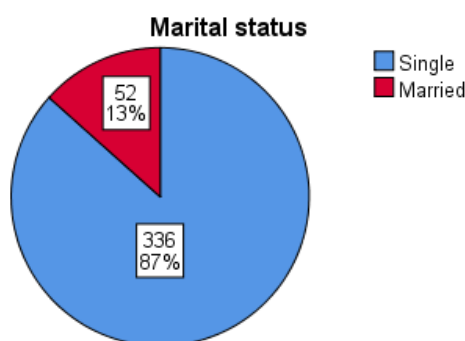


Figure 8. Marital status of mothers (n=388)

4.2.1.8 Marital status of the mothers

Marital status in total shows that the majority of the study participants were single 336 (87%) and married were 52(13%) Figure 9 present the results.

Marital status and its association with immediate Apgar scores are shown in Table 4.8

Table 4.8 Association between marital status and immediate Apgar scores

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
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Marital status				
Single	153 (45.8%)	181 (54.2%)	100	0.110
Married	30 (57.7%)	22 (42.3%)	100	

As shown in table 4.8, 153 (45.8%) and 181 (54.2%) were single in the low Apgar and normal Apgar groups (Table 4.8). Marital status was not significantly associated with the immediate low Apgar score ($p>0.110$).

4.2.9 Social History

The majority of mothers 385 (99.23%) were non-smokers, 3(0.7%) of mothers recorded smoking and 7(2%) of the mothers did not indicate smoking history. Figure 10 depicts the social history a total of 56 (14%) of the mothers who consumed alcohol and Table 4.9 shows the association of the social history of mothers



Figure 9. Alcohol distribution (n=388)

Table 4.9 Association between social history and immediate Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Alcohol				

Yes	28 (50.0%)	28 (50.0%)	100	0.782
No	156 (48.0%)	169 (52.0%)	100	
Smoking				0.073
Yes	3 (100.0%)	0 (0.0%)	100	
No	181 (48.0%)	196 (52.0%)	100	

Table 4.9 indicated an equal number in the low Apgar score, 28 (50.0%), and normal Apgar score group 28 (50.0%). Regarding smoking, a total of 3 (0.8%) mothers were smokers all in the low Apgar score group. There was no statistically significant association recorded between a low Apgar score and alcohol ($p>0.782$) and smoking ($p>0.073$).

4.2.2 Obstetric characteristics and their association with the immediate Apgar score.

The obstetric factors are the factors relating to a mother, especially during pregnancy that affect fetal growth (Shimada et al, 2019). The obstetric factors to be discussed include attendance to antenatal care during the present pregnancy, vital signs during admission for delivery, medical history, augmentation history, types of deliveries and pregnancy complications.

4.2.2.1 Antenatal care status of the mothers

The study looked at the maternal files of the participants to establish if they had attended antenatal care and at which trimester they had commenced with antenatal care during their current pregnancy. The results show that a total of 9 (2.32%) participants, had not booked for the antenatal care while the rest of the mothers 376 (97.68%) had attended antenatal care (ANC). Figure 11 below shows a few participants 51(13%) started antenatal care in their first trimester and a total of 166 (43%) data were not recorded.

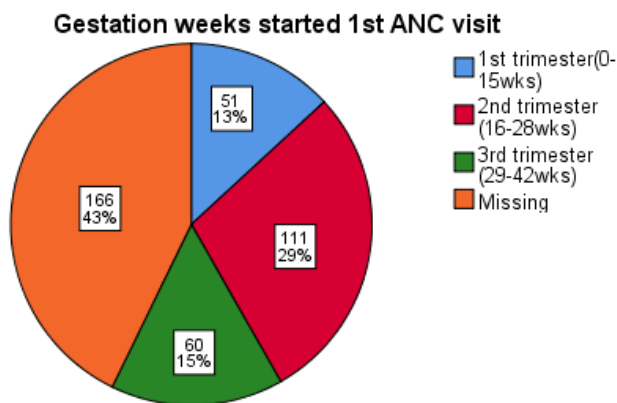


Figure 10. Antenatal care status of mothers (n=388)

Table 4.10 show the results of association between antenatal care status and gestational weeks on ANC initiation and immediate apgar score

Table 4.10 Association between Antenatal care and immediate Apgar scores

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Ante-natal care visit				0.397
Booked	179 (47.6%)	197 (52.4%)	100	
Unbooked	3 (33.3%)	6 (66.7%)	100	
Gestation weeks during 1st ANC visit				0.399
1s trimester (0-15 weeks)	29 (56.9%)	22 (43.1%)	100	
2nd trimester (16-28 weeks)	51 (45.9%)	60 (54.1%)	100	
3rd trimester (29-42 weeks)	31 (52.5%)	28 (47.5%)	100	

A total of unbooked mothers were 3 (33.3%), had babies with low Apgar while 6 (66.7%) had babies with a normal Apgar score group. While those mothers booked ANC 179 (47.6%) had a low Apgar score and the normal Apgar score group had 197 (52.4%). The majority started in second trimester with 51 (45.9%) in the low Apgar score and 60 (54.1%) in the normal Apgar score group. A low percentage of mothers who attended ANC in their 1st trimester with, 29

(56.9%) of these in the low Apgar and 22 (43.1) in the normal Apgar score group. There was no statistically significant association between the immediate Apgar score and antenatal care of mothers ($p>0.397$) and Gestation weeks ($p>0.399$).

4.2.2.2 Medical history of mothers

The medical history of mothers was reviewed from the files and the results are shown in Table 4.11. The results show that the highest number of mothers, 71 (18.3%) were diagnosed with Human Immunodeficiency Viruses (HIV), followed by 17 (4.4%) of mothers diagnosed with Hypertension. However, the majority more than 90 % of mothers were not suffering from medical conditions.

Table 4.11 Medical history of mothers' distribution

Variables	Yes	No	Missing	Total (n)
Hypertension	17 (4.4%)	363 (93.6%)	8 (2%)	388
Diabetic Mellitus	1 (0.3%)	380 (97.9%)	7 (1.8%)	388
Cardiac disease	0 (0.0%)	380 (97.9%)	8 (2.1%)	388
Human Immunodeficiency Viruses (HIV) treatment	71 (18.3%)	310 (79.9%)	7 (1.8%)	388
Urinary Tract Infection (UTI) in pregnancy	2 (0.5%)	379 (97.7%)	7 (1.8%)	388
Other medical histories	6 (1.5%)	369 (95.1%)	13 (3.4%)	388

Table 4.12 presents medical history and their association with low and normal Apgar score.

Table 4.12 Association between medical history and immediate Apgar scores

Variables	Low Apgar score	Normal Normal Apgar	Total %	P-value
Hypertension				0.156
Yes	11 (64.7%)	6 (35.3%)	100	
No	171 (47.1%)	192 (52.9%)	100	
Diabetic Mellitus				0.298
Yes	1 (100.0%)	0 (0.0%)	100	
No	182 (47.9%)	198 (52.1%)	100	
Cardiac disease				0.935
Yes	0 (0.0%)	0 (0.0%)	0.0	
No	183 (48.2%)	197 (51.8%)	100	
Human Immunodeficiency Viruses (HIV) treatment				0.442
Yes	31 (43.7%)	40 (56.3%)	100	
No	151 (48.7%)	159 (51.3%)		
Urinary Tract Infection (UTI) in pregnancy				0.140
Yes	2 (100.0%)	0 (0.0%)	100	
No	181 (47.8%)	198 (52.2%)	100	
Other medical histories				0.942
Yes	3 (50.0%)	3 (50.0%)	100	
No	179 (48.5%)	190 (51.5%)	100	

The highest number of mothers was recorded in mothers with Human Immunodeficiency Viruses (HIV) which 31 (43.7%) having low Apgar and 40 (56.3%) having normal Apgar

scores. Furthermore, the study shows that medical history such as Hypertension, Diabetic Mellitus, Cardiac disease, Urinary tract infection (UTI) as well as other medical histories such as anaemia recorded by less than 20 mothers per each sub-category Apgar scores (Table 4.12). There was no statistically significant association found between all medical history and immediate low Apgar score. Hypertension ($p>0.156$), Diabetic ($p>0.298$), HIV treatment ($p>0.442$), UTI ($p>0.140$) and other medical history ($p>0.942$).

4.2.2.3 Haemoglobin (HB) of the mothers

The results of Haemoglobin during the first ANC visit were extracted from the maternal records and presented. Although the majority of mothers 160(41%) their haemoglobin status recorded not taken on the first ANC visit, more mothers were recorded to have moderate low haemoglobin Apgar score of 152(39%) compared to abnormal low and normal haemoglobin.

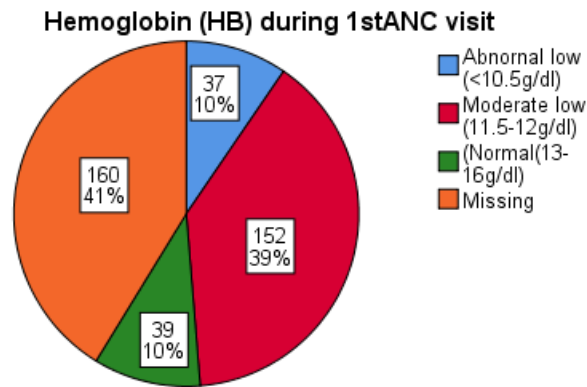


Figure 11. Haemoglobin status of mothers during 1st antenatal care (n=388)

Figure 13 shows majority of mothers not taken haemoglobin on admission for delivery which record 309 (80%) and mothers taken haemoglobin on admission for delivery recorded to have moderate low haemoglobin 39(10%).

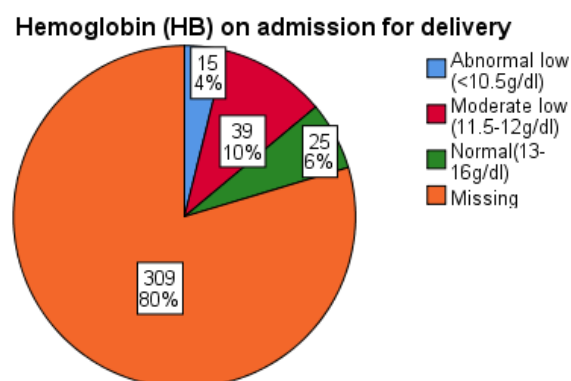


Figure 12. Haemoglobin of mothers on admission for delivery(n=388)

Table 4.13 presents the association between haemoglobin and low and normal Apgar score.

Table 4.13 Association between haemoglobin (HB) and immediate Apgar scores

Variables	Low Apgar score	Normal Apgar score	Total (%)	P-value
Haemoglobin (HB) during the first ANC visit				0.011
Abnormal Low (>10.5g/dl)	10 (27.0%)	27 (73.0%)	100	
Moderate Low (11.5 – 12g/dl)	83 (54.2%)	70 (45.8%)	100	
Normal (13-16g/dl)	18 (46.2%)	21 (53.8%)	100	
Haemoglobin during delivery				0.489
Abnormal low (>10.5g/dl)	13 (76.5%)	4 (23.5%)	100	
Moderate Low (11.5-12g/dl)	30 (76.9%)	9 (23.1%)	100	
Normal(13-16g/dl)	16 (64.0%)	9 (36.0%)	100	

Moderate low haemoglobin group that presented with the majority of mothers during the first ANC visit, 83 (54.2%) were from low Apgar and 70 (45.8%) were from the normal Apgar score group. While, for the group where haemoglobin was taken on admission for delivery, 30 (76.9%) had low Apgar and 9(23%) had normal Apgar scores. There was a statistically significant association between haemoglobin during the 1st ANC and immediate low Apgar score ($p<0.011$), while haemoglobin during admission for delivery was not found statistically significantly associated with immediate low Apgar score ($p>0.489$).

4.2.2.4 Pregnancy complications of the mothers

Table 4.14 shows the pregnancy complications distribution status that was experienced by mothers during their current pregnancy. The results show that more than 90% of participants did not have any Antepartum haemorrhage (APH) 374(96.4%), neither Cephalopelvic disproportion (CPD) 381(98.2%). Less than 5% of mothers were recorded to have pregnancy complications, 11(2.8%) Antepartum haemoglobin and 6(1.5%) cephalo pelvic disproportion. Figure 14 shows that about 80% of participants did not suffer from any pregnancy complications.

Table 4.14 Antepartum haemorrhage and cephalopelvic disproportion distributions

Variables	Yes	No	Missing	Total (n)
Antepartum Haemorrhage	11 (2.8%)	374 (96.4%)	3 (0.8%)	388
Cephalopelvic Disproportion	6 (1.5%)	381 (98.2%)	1 (0.3%)	388

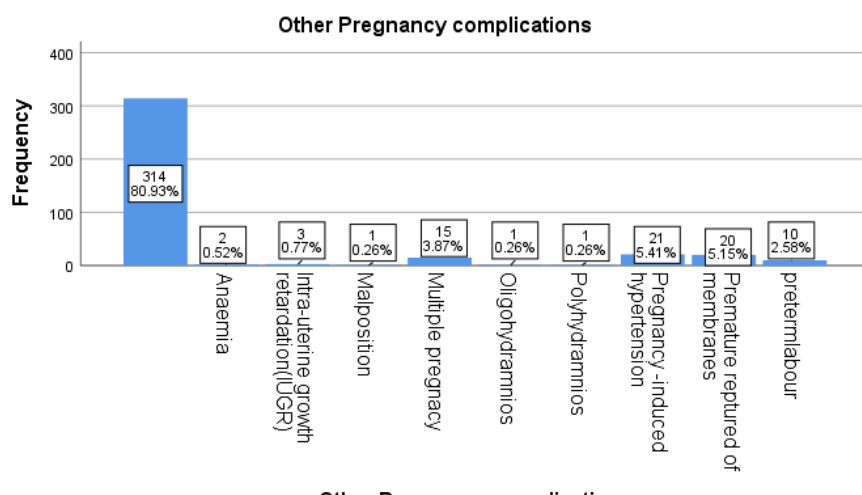


Figure 13. Other pregnancy complications distribution (n=388)

Table 4.15 below show the pregnancy complications and thier association with immediate score.

Table 4.15 Association between pregnancy complications and immediate Apgar score

Variables	Low Apgar Score	Normal Apgar score	Total (%)	P-value
Antepartum Haemorrhage (APH)				0.004
Yes	10 (90.9%)	1 (9.1%)	100	
No	184 (46.5%)	193 (53.5%)	100	
Cephalopelvic Disproportion (CPD)				0.010
Yes	6 (100.0%)	0 (0.0%)	100	
No	188 (47.0%)	194 (53.0%)	100	
Other pregnancy complication				0.027
Anaemia	1 (50.0%)	1 (50.0%)	100	
Intra-uterine growth retardation	2 (66.7%)	1 (33.3%)	100	
Malposition	1 (100.0%)	0 (0.0%)	100	

Multiple pregnancy	11 (73.3%)	4 (26.7%)	100
Oligohydramnios	1 (100.0%)	0 (0.0%)	100
Polyhydramnios	1 (100.0%)	0 (0.0%)	100
Pregnancy Induced Hypertension	15 (71.4%)	6 (28.6%)	100
Premature rupture of membranes	12 (60.0%)	8 (40.0%)	100
Preterm labour	7 (70.0%)	3 (30.0%)	100

Table 4.15 shows that Pregnancy-Induced Hypertension (PIH) had a majority of 15 (71.4%) in low Apgar scores compared to 6 (28.6%) with normal Apgar scores. Premature rupture of membranes was almost equal to PIH as it recorded, 12 (60%) low Apgar and 8 (40.0%) normal Apgar scored. Anemia was recorded equally in both Apgar score group 1 (50%) were from the low Apgar score group while the normal Apgar score group recorded 1 (50%). There was a statistically significant association found between some pregnancy complications and immediate low Apgar score Ante-partum hemorrhage ($p < 0.04$), Cephalopelvic disproportion ($p < 0.010$) as well as other pregnancy complications ($P < 0.027$).

4.2.2.5 Health facility where the mother was referred from.

Figure 15 show some of the health facilities 'referral. Overall, a total of 297 (77%) of the mothers were not referred but, went straight to Onandjokwe Intermediate Hospital maternity seeking care by themselves. And fewer were mothers referred from the clinic 3(1%).

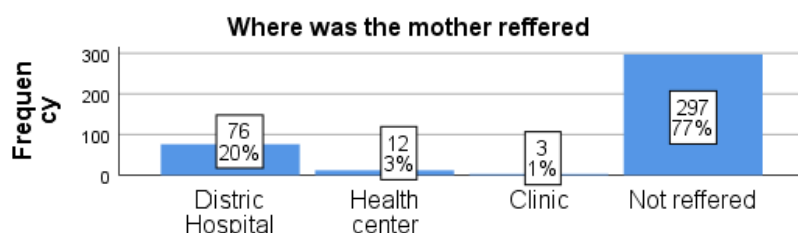


Figure 14. Health facility where mothers referred(n=388)

Table 4.16 shows health facility and their association with low and normal Apgar score

Table 4.16 Associations between health facility referred and immediate Apgar scores

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
From where the mother was referred?				0.000
District hospital	56 (73.7%)	20 (26.3%)	100	
Health centre	9 (75.0%)	3 (25.0%)	100	
Clinic	2 (66.7%)	1 (33.3%)	100	
Not referred	118 (39.7%)	179 (60.3%)	100	

The district hospital referred the majority in both Apgar score groups of which 56 (73.7%) had low Apgar while 20 (26.3%) had normal Apgar scores. A lower number was referred from clinics 2 (66.7%) of which a low Apgar and normal Apgar score had 1 (33.3%). There was a statistically significant association found between mothers' referral to the health facility and immediate low Apgar score. ($p < 0.00$)

4.2.2.6 Observations (vital signs) of the mothers

Figure 16 below presents the total of vital signs of mothers that were taken on admission for delivery. The study shows that the majority of mothers, with a total of 284 (73%) had normal Blood Pressure (BP) and fewer mothers, 12 (3%) had low BP.

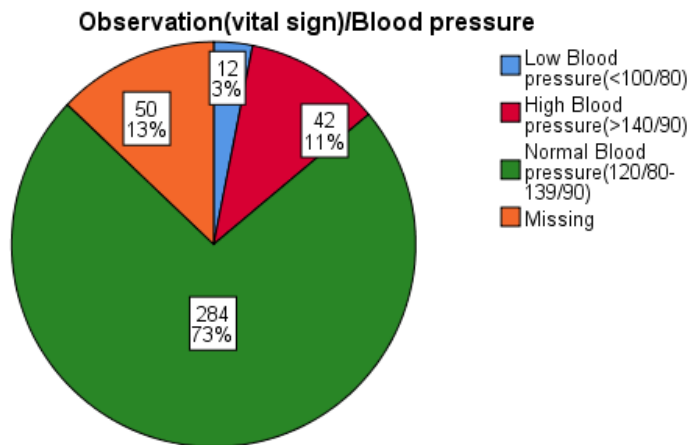


Figure 15. Blood pressure distribution(n=388)

The descriptive statistic of other vital signs recorded that: Pulse was recorded with high a total number of mothers with normal pulse 290 (75%), missing data were 54(14%) and fewer mothers with bradycardia reported 9(2%). The normal temperature was recorded at 223(57%), with fewer mothers recorded with high temperatures 5(1%) and 160(41%) data reported missing. A total of 276 (71%) had normal respiration, 7 (1.8%) of mothers reported with and 105(27%) data were not recorded in maternal files. A similar trend was recorded in Hemo Glucose Test (HGT) having a majority of mothers with normal HGT with a total of 61 (16%), 7 (2%) reported on mothers with abnormal HGT and 320(82%) data were not recorded on maternal files.

Figure 17 below shows the highest number of mothers 162 (42%) was recorded in a group of 36 - 32 cm Symphysial Fundal Height (SFH), and an equal percentage of 57(15%) recorded on >42cm SFH and missing data (57(15%).

Observation (vital sign)/Sympysial fudal height

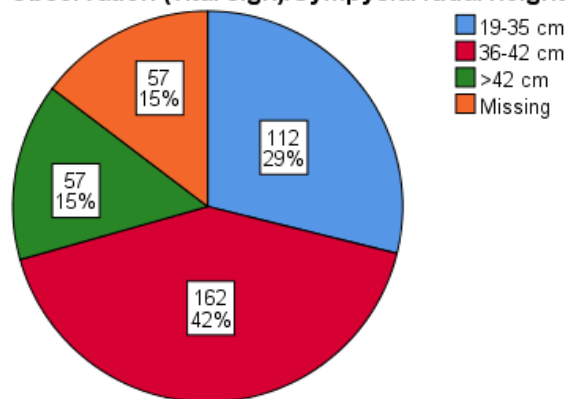


Figure 16. Sympysial fudal height of mothers(n=388)

Below there is Table 4.17 showing vital signs and its association with immediate Apgar score.

Table 4.17 Association between Vital signs of mothers and immediate Apgar score

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Blood Pressure (BP)				
Low BP (<100/80)	7 (58.3%)	5 (41.7%)	100	0.020
High BP (>140/90)	29 (69.0%)	13 (31.0%)	100	
Normal BP (100/80-139/90)	132 (46.5%)	152 (53.5%)	100	
Pulse				
Bradycardia (<70b/min)	6 (66.7%)	3 (33.3%)	100	0.025
Tachycardia (>100b/min)	24 (68.6%)	11 (31.4%)	100	
Normal Pulse (80-90b/min)	134 (46.2%)	156 (53.8%)	100	
Temperature				
Low temperature (<34)	0 (0.0%)	0 (0.0%)	0	0.050
High Temperature (>37.5)	5 (100.0%)	0 (0.0%)	100	
Normal Temperature (35-37.4)	125 (56.1%)	98 (43.9%)	100	
Respiration				0.795

Abnormal respiration (>21b/min)	4 (57.1%)	3 (42.9%)	100	
Normal respiration (15-21b/min)	144 (52.2%)	132 (47.8%)	100	
Hemo Glucose test (HGT)				
Abnormal HGT (>7.8mmg/dl)	5 (83.3%)	1 (16.7%)	100	0.473
Normal HGT (<7.8mmg/dl)	43 (69.4%)	19 (30.6%)	100	
Symphysial Fundal Height (SFH)				
19-35 cm	45 (40.2%)	67 (59.8%)	100	0.040
36-422 cm	85 (52.5%)	77 (47.5%)	100	
42 cm	33 (57.9%)	24 (42.1%)	100	

Normal blood pressure was high both in the low Apgar 132 (46.5%) and normal Apgar score groups 152 (53.5%). Low Blood pressure had 7 (58.3%) in low Apgar and 54 (41.7%) had normal Apgar scores. Furthermore, more mothers who were diagnosed with high BP were in the low Apgar score group 29 (69.0%) compared to 13 (31.0%) in the normal Apgar score group. Mothers with normal pulse recorded 134 (46.2%) in a low Apgar score while those with normal Apgar scores were 156 (53.8%). No low temperature was recorded in both Apgar score groups but the study found that high temperatures were recorded in the low Apgar scores group with a total of 5 (100%).

Abnormal respiration was reported 4 (57.1%) had a low Apgar score and 3 (42.9%) recorded a normal Apgar score group. A similar trend was recorded in Hemo Glucose Test (HGT) having a majority of mothers with normal HGT 43 (69.4%) had low Apgar and 19 (30.6%) had normal Apgar scores. The highest number of mothers was recorded in a group of 36 - 32 cm Symphysial Fundal Height (SFH) which 85 (52.5%) were low Apgar and 77 (47.5%) had normal Apgar scores. A statistically significant association was found between Blood pressure ($p < 0.020$), Pulse ($p < 0.025$), temperature ($p < 0.050$) and Symphysial Fundal Heights ($p < 0.040$)

and immediate low Apgar score. There was no statistically significant association found between immediate low Apgar score and respiration ($p>0.795$) and Hemo Glucose Test HGT ($p>0.473$).

4.2.2.7 Contraction status of the mothers

Contractions were one of the aspects that were analyzed in this study and the description results are shown in Figure 18 The majority of the participants 191(49%) were recorded with moderate contractions and a few participants 48(12%) were recorded not presented with contractions on admission.

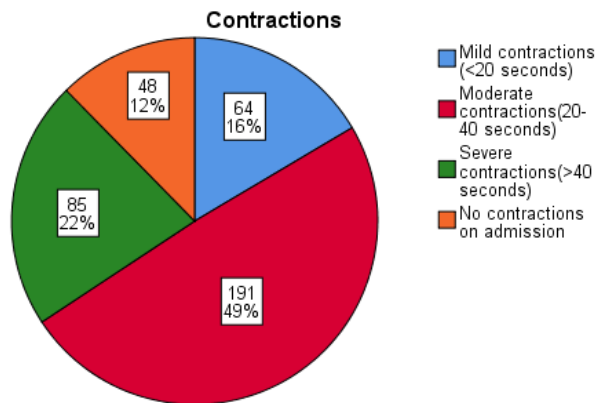


Figure 17. Contractions of mothers (n=388)

The association between contractions and low and immediate Apgar score are shown in Table 4.18 below.

Table 4.18 Association between contractions and immediate Apgar scores

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Contraction status				0.001
Mild contractions (<20 seconds)	35 (54.7%)	29 (45.3%)	100	
Moderate contractions (30-40 seconds)	79 (41.4%)	112 (58.6%)	100	

Strong contractions (>40 seconds)	24 (68.6%)	11 (31.4%)	100	
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The majority of the participants were recorded with moderate contractions, 79 (41.4%) were from the low Apgar and 112 (58.6%) were from the normal Apgar score group. The study found that there was a statistically significant association between contractions and an immediate low Apgar score ($p < 0.001$).

4.2.2.8 Membranes status of the mothers

The history of the rupture of membrane results are presented and shows that half of the participants 222 (57%) had their membranes intact, 131(34%) their membranes had ruptured, and 35(9%) data were missing. Of those mothers who had ruptured membranes, a total of 264 (68%) had clear amniotic fluids, 103(27%) had meconium-stained amniotic fluid, 1(0%) participant had bloody stained amniotic fluid and 19 (5%) data were missing. Figure 19 below presented the meconium grades results. In the majority of mothers whose amniotic fluid had no meconium 265(68%) and 23(6%) data were missing.

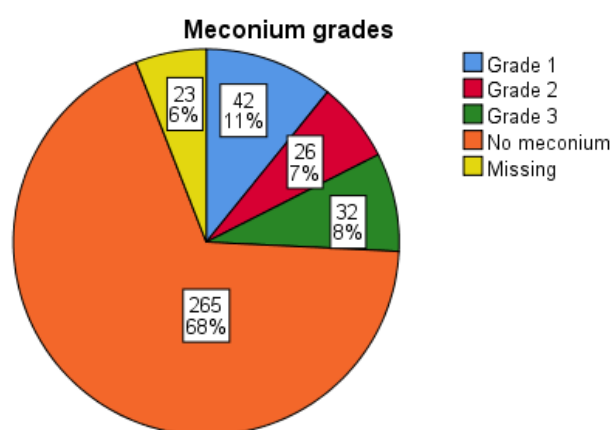


Figure 18. Meconium grades (n=388)

Table 4.19 below shows the association of membranes status, Amniotic fluid colour and meconium grades with low and normal Apgar score.

Table 4.19 Association between membrane status and immediate low Apgar scores

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Membrane's status				0.000
Intact	106 (47.7%)	116 (52.3%)	100	
Ruptured	75 (57.3%)	56 (42.7%)	100	
Amniotic fluid				0.000
Clear	106 (40.2%)	158 (59.8%)	100	
Meconium	69 (67.0%)	34 (33.0%)	100	
Bloody	1 (100.0%)	0 (0.0%)	100	
Meconium grades				0.000
Grade 1	19 (45.2%)	23 (54.8%)	100	
Grade 11	19 (73.1%)	7 (26.9%)	100	
Grade 111	31 (96.9%)	1 (3.1%)	100	
No meconium	106 (40.0%)	159 (60.0%)	100	

Table 4.17 shows that participants that had their membranes intact delivered babies with normal Apgar scores recorded 116 (52.3%) compared to the low Apgar score of 106 (47.7%). In those mothers with clear amniotic fluid, 106 (40.2%) had low Apgar while 158 (59.8%) had normal Apgar scores. The highest number of mothers with meconium grades III was recorded in the low Apgar score group 31 (96.9%) compared to the normal Apgar score group that recorded meconium grade I 23 (54.8%). Overall, membranes status ($p < 0.000$), amniotic fluid ($p < 0.000$), and meconium grades ($p < 0.000$) were both associated with the immediate low Apgar.

4.2.2.9 Duration of labour of mothers

Figure 20 shows the total number of hours that were spent by mothers in labour on admission. A total of 64 (16%) mothers spent more than 10 hours in labour before being admitted for delivery and fewer mothers 7(2%) spent 4 hours in labour before admission for delivery.

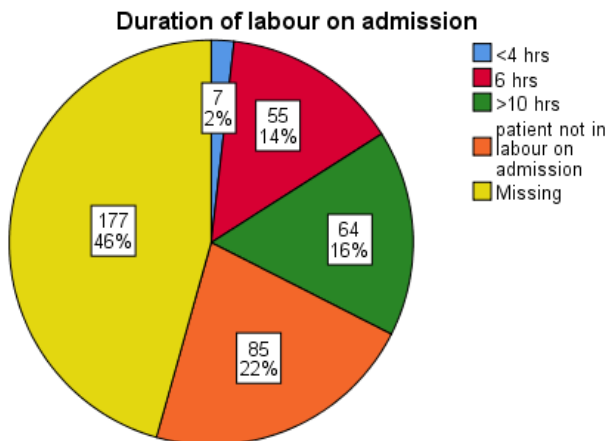


Figure 19. Duration of labour (n=388)

Figure 21 below shows the total hours that mothers were spent in labour. A total of mothers 179(46%) spent 12-19hours in labour and less spent more than 20 hours in labour 36(9%).

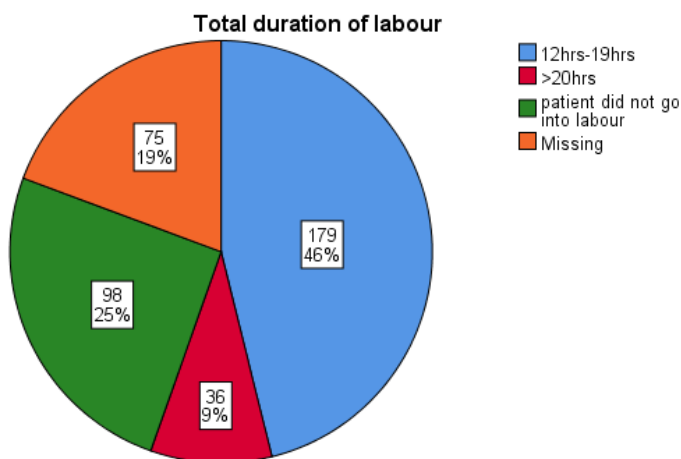


Figure 20. Total duration of labour (n=388)

Table 4.20 show the association between duration of labour and immediate Apgar score analysed.

Table 4.20 Association between duration of labour and immediate Apgar scores

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Duration of labour On admission				0.000
<4hours	5 (71.4%)	2 (28.6%)	100	
6 hours	21 (38.2%)	34 (61.8%)	100	
>10hours	38 (59.4%)	26 (40.6%)	100	
Patients not in labour	63 (74.1%)	22 (25.9%)	100	
Total duration of Labour				0.000
12 hrs-19hrs	52 (29.1%)	127 (70.9%)	100	
>20hrs	29 (80.6%)	7 (19.4%)	100	
Patients not in labour	75 (76.5%)	23 (23.5%)	100	

Mothers who spent more than 10 hours in labour before being admitted for delivery were 38 (59.4%) in the low Apgar score group and 26 (40.6%) had a normal Apgar score. Those mothers who spent < 4hours were few in both Apgar score groups 5(71.4%) had low Apgar and 2 (28.6%) had normal Apgar scores. Mothers admitted after spending 6 hours in labour were 34 (61.8%) in the normal Apgar score group and 21 (38.2%) had a low Apgar score. Mothers who spent 12-19 hours in labour recorded 127(70.9%) in the normal Apgar score group compared to the low Apgar score that had 52 (30%). The majority of mothers that were in labour for more than 20 hours were recorded in the low Apgar score group 29 (80.6%) with a few recorded in the normal Apgar score group 7 (19.4%). There was a statistically significant association found between duration of labour categories and immediate low Apgar score duration of labour on admission ($p<0.000$) and total duration of labour ($p<0.000$).

4.2.2.10 Augmentation of labour

Mothers whose labour was augmented were analysed. In the majority of mothers, 330(85%) of their labour was not augmented, and only 58(15%) of mothers receive augmentation of labour. Figure 22 shows that Oxytocin was one of the medications administered for augmentation of labour with the highest total participants 47 (12%), with prostin gel presented with a low percentage of 1(0%).

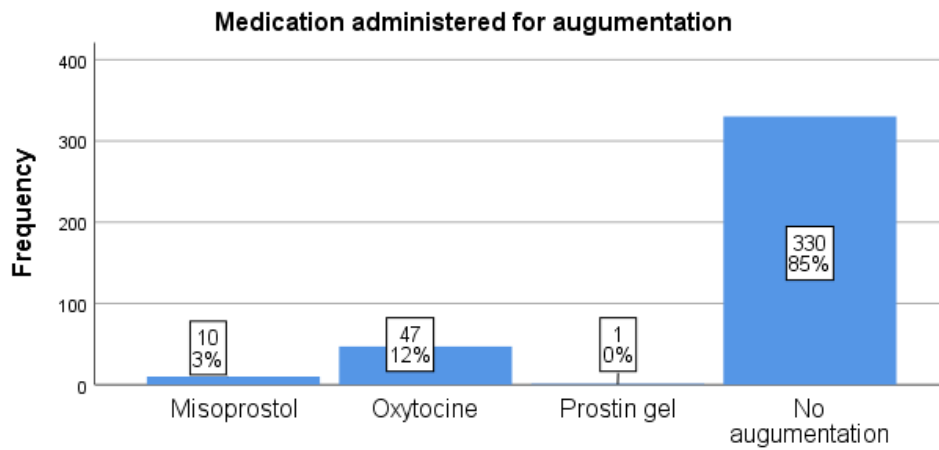


Figure 21. Medication for augmentation (n=388)

Table 4.21 show the augmentation history of labour and their associations low and normal Apgar score.

Table 4.21 Association between augmentation and immediate Apgar scores

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Augmentation of labour				
Yes	37 (64.9%)	20 (35.1%)	100	0.000
No	147 (45.2%)	178 (54.8%)	100	

Medication administered for labour augmentation				
Misoprostol	8 (80.0%)	1 (20.0%)	100	0.019
Oxytocin	29 (61.7%)	18 (38.3%)	100	
Prostin gel	1 (100.0%)	0 (0.0%)	100	
Patient not augmented	146 (44.9%)	179 (55.1%)	100	

In mothers, their labour was not augmented 147 (45.2%) had newborn babies with low Apgar and 178 (54.8%) had normal Apgar scores. Among those mothers who had received Augmentation, the low Apgar score group was recorded with a majority of 37 (64.9%) compared to the normal Apgar scores group of 20 (35.1%). Oxytocin continues to have a majority in both groups low Apgar score of 29 (61.7%) and normal Apgar scores of 18 (38.3%). Prostin gel recorded 1 (0.3%) in the low Apgar score group. There was a statistically significant association found between augmentation of labour ($p < 0.006$) and medications administered for augmentation ($p < 0.019$) and immediate low Apgar score.

4.2.2.11 Types of delivery conducted

Types of delivery conducted by the participants were analysed and illustrated in Figure 23 The majority of mothers 264(68%) had their babies through normal vaginal deliveries. Breech 9(2%) and Vacuum delivery 1(0%) recorded a few cases each.

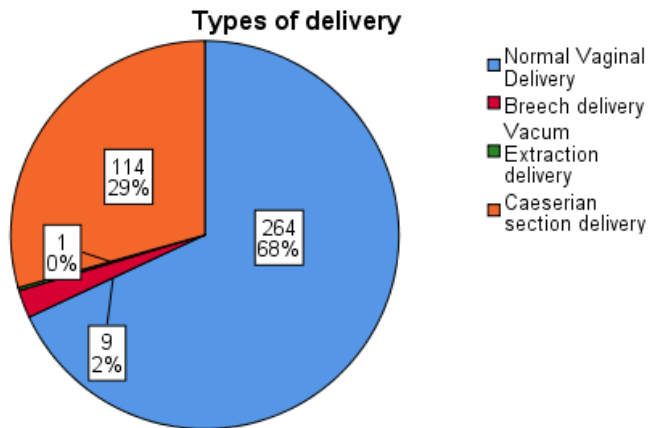


Figure 22. Types of delivery (n=388)

Table 4.22 show the association on types of delivery with low and normal Apgar score.

Table 4.22 Association between types of delivery and immediate Apgar score

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Types of delivery				0.000
Normal Vaginal Delivery	93 (35.2%)	171 (64.8%)	100	
Breech Delivery	8 (88.9%)	1 (11.1%)	100	
Vacuum Extraction delivery	1 (100.0%)	0 (0.0%)	100	
Caesarean section (CS delivery)	83 (72.8%)	31 (27.2%)	100	

Of the mothers that had their normal vaginal deliveries, 93(35.2%) had a low Apgar score and 171(64.8%) had normal Apgar scores. Caesarean section 83 (72.8%) was from the low Apgar score group while normal Apgar score was recorded at 31(27.2%) A statistically significant association was found between types of deliveries conducted and the immediate low Apgar score ($p < 0.000$).

4.2.2.12 Caesarean section delivery operational status of mothers

Types of caesarean section operation results show that most caesarean section (CS) operations were performed on emergency 89 (23%) and elective caesarean section performed was 22(6%) in total. Table 4.23 presents the association between the caesarian section and their indications with low and normal Apgar scores.

Table 4.23 Association between caesarean section and immediate Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Type of caesarean section				0.000
Elective C/S	11 (50.0%)	11 (50.0%)	100	
Emergency C/S	70 (78.7%)	19 (21.3%)	100	
Indications for C/S				0.000
Obstructed labour	1 (100.0%)	0 (0.0%)	100	
Antepartum haemorrhage	4 (100.0%)	0 (0.0%)	100	
Cephalopelvic disproportion	3 (60.0%)	2 (40.0%)	100	
Cord prolapses	7 (100.0%)	0 (0.0%)	100	
Eclampsia	12 (92.3%)	1 (7.7%)	100	
Failed induction	1 (100.0%)	0 (0.0%)	100	
Foetal distress	23 (79.3%)	6 (20.7%)	100	
Macrosomia	2 (66.7%)	1 (33.3%)	100	
Malpresentation	5 (55.6%)	4 (44.4%)	100	
Meconium-stained liquor	6 (100.0%)	0 (0.0%)	100	
Multiple pregnancy	4 (66.7%)	2 (33.3%)	100	
Poor maternal effort	1 (100.0%)	0 (0.0%)	100	
Previous C/S	8 (44.4%)	10 (55.6%)	100	

Prolonged labour	9 (75.0%)	3 (25.0%)	100	
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Most mothers who delivered their babies through emergency Caesarean Section (CS) operations had a low Apgar score of 70 (78.7%) and in normal Apgar score recorded 19 (21.3%). The elective caesarean section operations equal 11 (50.0%) in both Apgar score groups. In addition, foetal distress was the leading indication for the caesarean section had a total of 29 (7.5%) of which, 23 (79.3%) had low Apgar and 6 (20%) from the normal Apgar score group. Followed by previous C/S 18 (4.6%), eclampsia 13(3.4%) which was almost equal to prolonged labour that recorded a total of 12 (3.1%) participants. The rest of the indications recorded 10 participants each a statistically significant association was found between immediate low Apgar score and indications for caesarean section ($p<0.000$) and types of caesarean section($p<0.000$).

4.2.2.13 Anaesthesia used for operation of the mothers

Figure 24 show the types of anaesthesia that were used during the caesarean section. Mothers who were operated on under spinal anaesthesia were 97 (25.0%), while those mothers that were operated under general anaesthesia were 14 (3.6%).

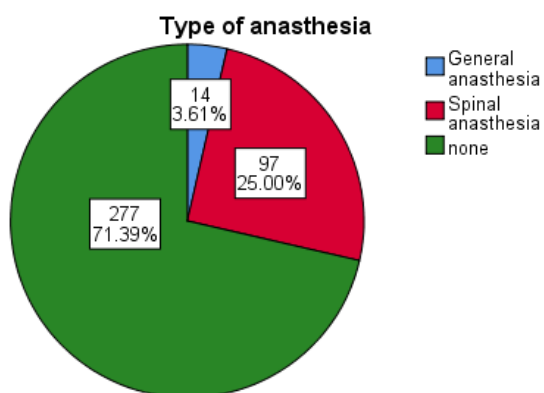


Figure 23. Types of Anaesthesia (n=388)

Table 4.24 presents the association between types of anaesthesia and immediate Apgar score

Table 4.24 Association between types of anaesthesia with immediate Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Types of anaesthesia				0.000
General anaesthesia	14 (100.0%)	0 (0.0%)	100	
Spinal anaesthesia	67 (69.1%)	30 (30.9%)	100	

Table 4.24 shows that in mothers who were operated on under spinal anaesthesia 67 (69.1%) had low Apgar and 30 (30.9%) had normal Apgar score. All the mothers operated under general anaesthesia had low Apgar score babies 14(100.0%. There was a statistically significant association found between immediate low Apgar score and anaesthesia type used ($p < 0.000$).

Moreover, most medications that were used were fentanyl which recorded 94 (24.2%) of which, 70 (74.5%) recorded low Apgar and 24 (25.5%) had normal Apgar score, Bupivacaine had 75 (19.3%) of which, 55 (73.3%) had low Apgar and 20 (26.7%) had normal Apgar score followed by Macain having 16 (4.1%) of which 12 (75.0%) had low Apgar and 4 (25.0%) had normal Apgar score. Ketamine with 13 (3.4%) of which 10 (76.9%) had low and 3 (23.1%) had normal Apgar scores, Suxamethonium had 9 (2.3%), Propolol 6 (1.5%) as well as Thiopental sodium 4 (1.0%). A statistically significant association was found between types of anaesthesia and medication used for anaesthesia ($p < 0.000$) with immediate Apgar scores.

4.2.2.14 Complications of mothers during delivery

The study also extracted information from the maternal file records regarding mother's complications during delivery and is shown in Table 4.25 those uncooperative mothers were more compared 5(1.3%) to those who experienced shoulder dystocia (0.5%) and those with poor maternal effort.

Table 4.25 Delivery complications distribution

Variables	Yes	No	Total (n)
Shoulder Dystocia	2 (0.5%)	386 (99.5%)	388
Poor maternal effort	3 (0.8%)	385 (99.2%)	388
Uncooperative mothers	5 (1.3%)	383 (98.7%)	388

Table 4.26 below show the association of delivery complication with low and normal Apgar score

Table 4.26 Association between delivery complications and immediate Apgar score.

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Shoulder Dystocia				0.137
Yes	2 (100.0%)	0 (0.0%)	100	
No	183 (47.4%)	203 (52.6%)	100	
Poor maternal effort				0.069
Yes	3 (100.0%)	0 (0.0%)	100	
No	182 (47.3%)	203 (52.7%)	100	
Uncooperative mothers				0.579
Yes	3 (60.0%)	2 (40.0%)	100	
No	182 (47.5%)	201 (52.5%)	100	

Table 4.26 shows that fewer mothers experienced complications during deliveries in both low Apgar and normal Apgar score groups compared to those who did not experience any complications with above 99% in each category. There was no statistically significant

association found between immediate low Apgar score and shoulder dystocia ($p>0.137$), poor maternal effort ($p>0.069$) as well as uncooperative mothers ($p>0.579$).

4.2.3 Neonatal characteristics and their association with the immediate low Apgar score.

Neonatal factors are factors relating to or affecting the newborn. The factors to be discussed include; sex of the newborn, birth weight, fetal presentation as well as cardiotocography.

4.2.3.1 Sex of the newborn

The sex of the new-born was analyzed and shown in Figure 25 which shows that a slight majority of newborn babies were females 195 (50.3%) with 193 (49.7%) males.

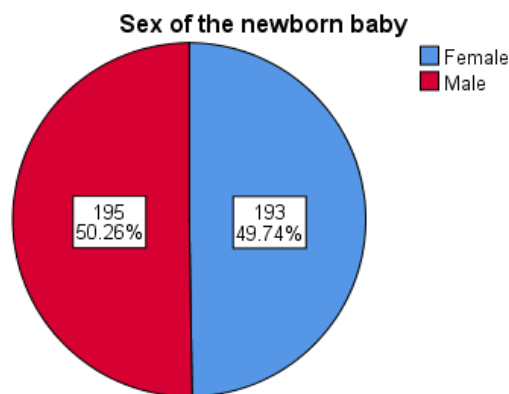


Figure 24. Sex of the new-born (n=388)

The sex of the new-born and their associated with immediate Apgar are presented in Table 4.27.

Table 4.27 Association between sex of the new-born and immediate Apgar score

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Sex of the new-born				0.835
Male	91 (47.2%)	102 (52.8%)	100	
Female	94 (48.2%)	101 (51.8%)	100	

Table 4.27 also shows that there was a small gender difference among the newborn babies delivered with normal and low Apgar scores. Male, low Apgar group had 91 (47.2%) and the normal Apgar score group had 102 (52.8%), while the female low Apgar score group had 94 (48.2%) and the normal Apgar score group had 101 (51.8%). There was no statistically significant association found between the sex of the new-born baby and the immediate low Apgar scores ($p>0.835$).

4.2.3.2 Gestational age of the newborn baby

The gestational age of the newborn baby was analyzed and the results are presented in Figure 26. The majority of newborn babies were delivered at full term (82.5%) and Small for dates 4(1%) and Post-term deliveries 2(1%) had a few participants each.

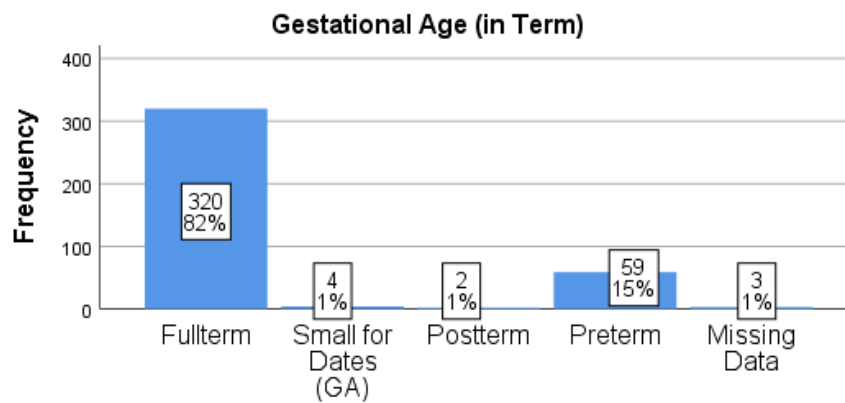


Figure 25. Gestational age (n=388)

The Gestational age and their associations are shown in Table 4.28

Table 4.28 Association between gestational age and immediate low Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total	P-value

Gestational age (GA) in term				
Full-term	136 (42.5%)	184 (57.5%)	100	0.000
Small for dates (GA)	3 (75.0%)	1 (25.0%)	100	
Post-term	2 (100.0%)	0 (0.0%)	100	
Pre-term	41 (69.5%)	18 (30.5%)	100	

Table 4.28 indicates that the majority of newborn babies delivered at full term, 136 (42.5%) had low Apgar and 184 (57.5%) had normal Apgar scores. Pre-term newborn baby's majority of 41 (69.5%) had a low Apgar score compared to 18 (30.5%) that had a normal Apgar score. Small for dates and post-term deliveries had a few participants in both Apgar score groups. There was a statistically significant association found between immediate low Apgar score and Gestational age ($p < 0.000$).

4.2.3.3 Birth weight of the newborns

Birth weight categories of the newborns were analysed and the results are presented in Figure 27. The majority of newborn babies 293 (75%) were delivered with normal birth weight. The rest of the birth weight categories presented a few participants

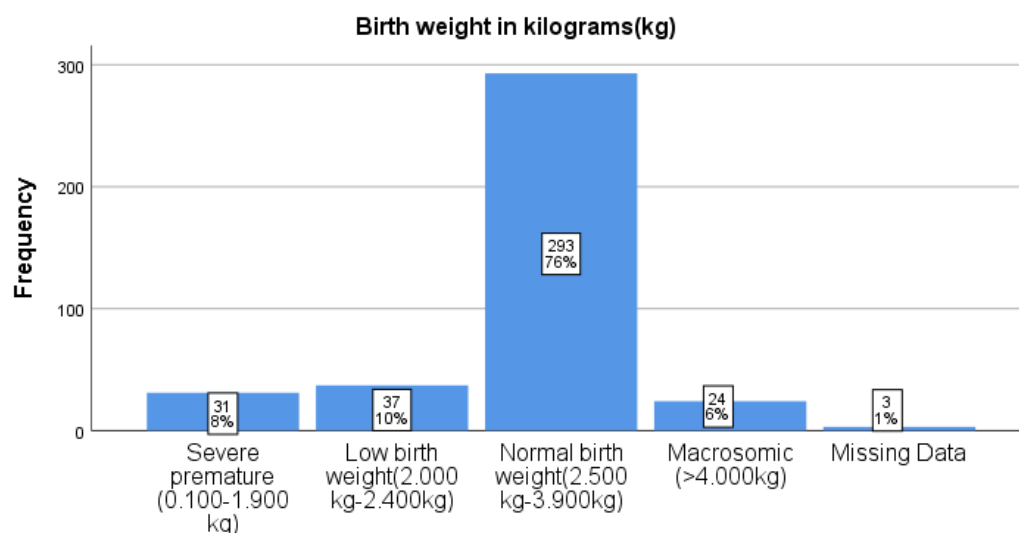


Figure 26. Birth weight distribution (n=388)

Table 4.29 Below show the birth weight associations with low and normal Apgar score.

Table 4.29 Association between birth weight and immediate Apgar score

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Birth weight				0.000
Severe premature (0.100kg1.900kg)	27 (87.1%)	4 (12.9%)	100	
Low birth weight (2.000kg-2.400kg)	22 (59.5%)	15 (40.5%)	100	
Normal birthweight (2.500kg3.900kg)	120 (41.0%)	173 (59.0%)	100	
Macrocosmic (>4.000kg)	13 (54.2%)	11 (45.8%)	100	

The majority of mothers present in both Apgar score groups Low Apgar 120 (41.0%) and normal Apgar score 173 (59.0%). There was a statistically significant association found between immediate low Apgar score and birth weight ($p < 0.000$).

4.2.3.4 Fetal presentation of the newborn babies

Fetal complications such as cord prolapse, congenital abnormalities as well as cord around the neck were extracted from the maternal files and the results are presented in Table 4.30. Furthermore, all newborn babies born with cord prolapse were 9 (2.3%) in total and congenital abnormality 2 (0.5%).

Table 4.30 Fetal complications of the new-born babies

Variables	Yes	No	Total (n)
Cord Prolapse	9 (2.3%)	379 (97.7%)	388
Congenital abnormalities	2 (0.5%)	386 (99.5%)	388
Cord around the neck	10 (2.6%)	378 (97.4%)	388

Figure 28 shows that most of the new-born babies were delivered in vertex presentation (93.28%) and less from compound presentation 6 (1.55%).

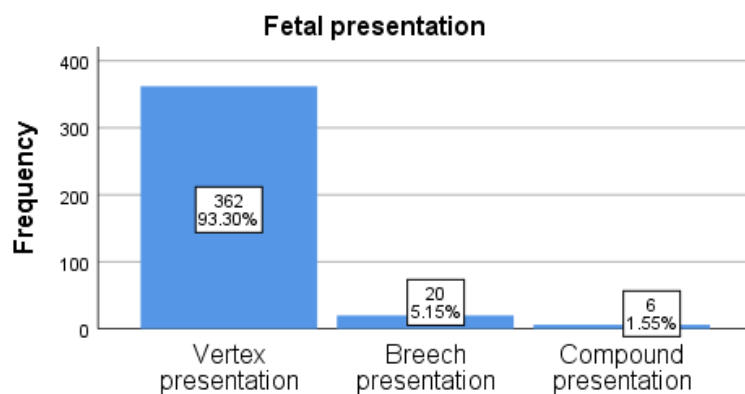


Figure 27. Fetal presentation of the newborn babies(n=388)

Table 4.31 show Fetal presentation and their association with immediate Apgar score

Table 4.31 Association between fetal presentation and immediate Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Foetal presentation				0.008
Vertex presentation	164 (45.4%)	197 (54.6%)	100	
Breech presentation	15 (75.0%)	5 (25.0%)	100	
Compound presentation	5 (83.3%)	1 (16.7%)	100	
Cord Prolapse				0.001
Yes	9 (100.0%)	0 (0.0%)	100	
No	176 (46.4%)	203 (53.6%)	100	
Congenital abnormalities				0.137
Yes	2 (100.0%)	0 (0.0%)	100	
No	183 (47.4%)	203 (52.6%)	100	
Cord around the neck				0.007
Yes	9 (90.0%)	1 (10.0%)	100	
No	176 (46.6%)	202 (53.4%)	100	

Most of the newborn babies were delivered in vertex presentation their normal Apgar score group had more than 197 (54.6%) and the low Apgar score group had 164 (45.4%). The newborn babies delivered with the compound presentation 6 (83.6%) had a low Apgar score. There was a statistically significant association found between foetal presentation and immediate low Apgar score ($p < 0.001$). Furthermore, all newborn babies born with cord prolapse 9 (100.0%) and congenital abnormality 2 (100.0%) had a low Apgar score.

Of the newborn babies delivered with a cord around the neck 9 (90.0%) had a low Apgar score and 1 (10.0%) had a normal Apgar score. There was a significant statistical association found between immediate low Apgar score and foetal presentation ($p < 0.008$), cord prolapse ($p < 0.001$) and cord around the neck ($p < 0.007$), while congenital abnormality was not found statistically associated with the immediate low Apgar score as the ($p > 0.137$).

4.2.3.5 Cardiotocography (CTG) assessment

The graphic recording the foetal heart rate for the assessment of foetal condition was reviewed and the results are presented in Figure 29 319(82%) CTG were not printed.

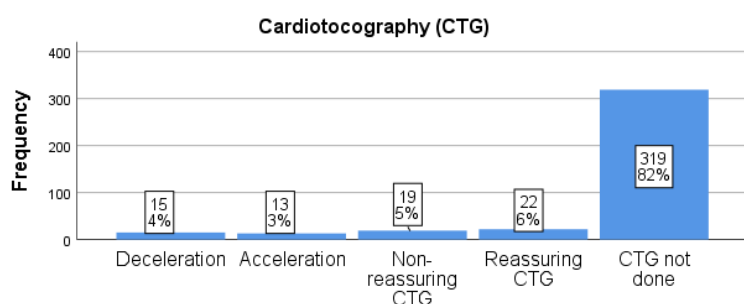


Figure 28. Cardiotocograph (CTG) monitoring (n=388)

Table 4.32 show the cardiotocography association and immediate Apgar score

Table 4.32 Association between Cardiotocography (CTG) and immediate Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P value
Cardiotocography				0.000
Deceleration	14 (93.3%)	1 (6.7%)	100	

Acceleration	9 (69.2%)	4 (30.8%)	100
Non-reassuring	17 (89.5%)	2 (10.5%)	100
Reassuring	17 (77.3%)	5 (22.7%)	100
CTG not printed	128 (40.1%)	191 (59.9%)	100

Table 4.32 shows that most of the newborn babies ‘CTG assessments was not printed and were more constituting the majority in both, low Apgar score 128 (40.1%) and normal Apgar score groups 191 (59.9%). Acceleration reported a few neonates in low Apgar group 9(69.2%) while, in the normal Apgar score group the lowest percentage was reported in deceleration category 1 (6.7%). There was a statistically significant association found between immediate low Apgar score and Cardiotocography ($p < 0.000$).

4.3 FACTORS ASSOCIATED WITH AFTER FIVE MINUTES APGAR SCORE

In this part of the results, the factors that are presented are those factors that possibly affect new-born babies after five minutes Apgar score assessment. Factors were selected from demographic characteristics, obstetric factors and neonatal factors. Furthermore, the statistics show that after five minutes, newborn babies with low Apgar scores were 33 (8.5%) and out of these 5 (1.3%) had severe low Apgar scores and 28 (7.2%) had moderate low Apgar scores. The results are presented considering the association of factors with low and normal Apgar score groups.

4.3.1 Demographic characteristics associated with after five minutes Apgar score.

Factors that were selected in demographic are; age, gravidity and parity as well as social history.

4.3.1.1 Age group of mothers

The age group of mothers was analyzed with Apgar score measurements after five minutes and the results are presented in Table 4.33.

Table 4.33 The age group of mothers and association with five minutes Apgar score (low and normal Apgar score).

Variables	Low Apgar Score	Normal Apgar score	Total (%)	P-value
Age group (in years)				0.025
<20years	11 (14.3%)	66 (85.7%)	100	
21-34 years	20 (8.8%)	207 (91.2%)	100	
Above 35 years	2 (2.4%)	82 (97.6%)	100	

The normal Apgar score group had a majority of the newborn babies after five minutes in each of the age categories. Mothers aged <20 had 66 (85.7%) normal Apgar scores for newborn babies while those aged 21-34 years old recorded 207 (91.2%) and those above 35 years had 82 (97.6%). A few newborn babies remained with a low Apgar score after five minutes, <20 years 11 (14.8%), 21-34 years 20 (8.8%) and above 35 years 2 (2.4%). There was a statistically significant association between the five minutes low Apgar score and maternal age ($p < 0.025$).

4.3.1.2 Gravidity and parity of the mothers

The gravidity and parity of the mothers were analyzed with the five minutes Apgar scores (low and normal Apgar scores) as shown in Table 4.34.

Table 4.34 Gravidity and Parity of mother with after five minutes low and normal Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total (%)	P-value
Gravidity				0.099
Primigravida	14 (11.7%)	106 (88.3%)	100	
Multigravida	16 (8.4%)	174 (91.6%)	100	
Grand multigravida	2 (2.8%)	70 (97.2%)	100	
Parity				0.173
Nulliparous	15 (11.4%)	117 (88.6%)	100	
Primiparous	5 (7.0%)	66 (93.0%)	100	
Multiparous	12 (8.4%)	131 (91.6%)	100	
Grand multiparous	0 (0.0%)	36 (100.0%)	100	

In gravidity, the multigravida category had the majority of mothers 190 (49.0%) whereby the normal Apgar score group had more newborn babies after five minutes compared to the low Apgar score group which had 16 (8.4%). Grand multigravida recorded a few participants 2 (2.8%) in the low Apgar score group. On the other hand, Parity in the Nulliparous category delivered more new-born babies 15 (11.4%) that continued to have a low Apgar score after five minutes, while the normal Apgar score group had the majority of new-born babies after five minutes in Nulliparous 117 (88.6%), Primiparous 66 (93.0%), Multiparous 131 (91.6%) and grand multiparous 36 (100.0%) categories. There was no statistically significant association

found between after five minutes low Apgar scores and gravidity ($p>0.099$) as well as parity ($p>0.173$).

4.3.1.3 Social history

Table 4.35 shows the social history of mothers and their association with five minutes Apgar scores (low and normal Apgar scores).

Table 4.35 Social history of mothers and the association and after five minutes Apgar scores

Variables	Low Apgar Score	Normal Apgar score	Total %	P value
Alcohol				0.662
Yes	4 (7.1%)	52 (92.9%)	100	
No	29 (8.9%)	296 (91.1%)	100	
Smoking				0.592
Yes	0 (0.0%)	3 (100.0%)	100	
No	33 (8.8%)	344 (91.2%)	100	

The study shows that most of the new-born babies from mothers who consumed alcohol tended to have a normal Apgar score, 52 (92.9%) after five minutes, compared to a low Apgar score, 4 (7.1%), while none of the smoking mothers had new-born babies with a low Apgar score after five minutes. There was no statistically significant association found between after five minutes Apgar score and alcohol consumption ($p>0.662$) as well as smoking ($P>0.592$).

4.3.2. Obstetric characteristics associated with after five minutes Apgar scores.

Factors for obstetrics that were selected and that were associated with after five minutes Apgar score are; Antenatal care, medical history, Haemoglobin, pregnancy complications,

membranes status, duration of labour, proper monitoring of partograph as well as caesarean section operational status.

4.3.2.1 Antenatal care visit of mothers

Table 4.36 presents the antenatal care history of mothers ‘antenatal care visits and gestation weeks when the mother started their first ANC visit and their association after five minutes Apgar scores.

Table 4.36 Antenatal care attendance of mothers’ association with five minutes Apgar scores

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Ante-natal care				0.758
Booked	31 (8.2%)	345 (91.8%)	100	
Unbooked	1 (11.1%)	8 (88.9%)	100	
Gestation Weeks During 1st ANC visit				0.212
1 st trimester (0-15 weeks)	1 (2.0%)	50 (98.0%)	100	
2 nd trimester (16-28 weeks)	7 (6.3%)	104 (93.7%)	100	
3 rd trimester (29-42 weeks)	6 (10.2%)	53 (89.8%)	100	

Table 4.34 shows that the majority of the mothers had booked antenatal care visits 376 (96.7%), while those who were not booked were 9 (2.3%). On the other hand, the majority of mothers started their first antenatal care visit in the 2nd trimester 111 (28.6%), followed by those who started in the 3rd trimester 59 (15.2%) and fewer mothers started their first antenatal care in the 1st trimester 51 (13.1%) of which among these mothers 1 (2.0%) had a new-born baby with a

low Apgar score at five minutes. There was no statistically significant association between five minutes Apgar score and antenatal care visit ($p>0.758$) as well as gestation weeks ($p>0.212$).

4.3.3.2 Medical history of mothers

Medical history of mothers such as hypertension, diabetic Mellitus, cardiac disease and history of other medical diseases were analyzed and are shown in Table 4.37

Table 4.37 Medical history of mothers and associations with five minutes Apgar score

Variables	Low Apgar score	Normal Apgar score	Table %	P-value
Hypertension				
Yes	2 (11.8%)	15 (88.2%)	100	0.612
No	30 (8.3%)	333 (91.7%)	100	
Diabetic Mellitus				
Yes	0 (0.0%)	1 (100.0%)	100	0.758
No	33 (8.7%)	347 (91.3%)	100	
Cardiac disease				
Yes	0 (0.0%)	0 (0.0%)	100	
No	33 (8.7%)	347 (91.3%)	100	
Human Immunodeficiency Viruses (HIV) Treatment				
Yes	5 (7.0%)	66 (93.0%)	100	0.591
No	28 (9.0%)	282 (91.0%)	100	
Urinary Tract Infection (UTI) In pregnancy				
Yes	2 (100.0%)	0 (0.0%)	100	0.000

No	31 (8.2%)	348 (91.8%)	100	
Other medical histories				
Yes	1 (16.7%)	5 (83.3%)	100	0.493
No	32 (8.7%)	337 (91.3%)	100	

In this study, no mothers reported having a cardiac disease in both the low and normal Apgar score groups. In all the medical history, mothers who were on HIV treatment were reported of having delivered more newborn babies with a total of 71 (18.3%) of which, the normal Apgar score group had 66 (93.0%) while, the low Apgar score had 5 (7.0%) after five minutes. The statistically significant association was only found between Urinary Tract Infection (UTI) ($p < 0.00$) and after five minutes Apgar scores. Hypertension ($p > 0.612$), Diabetic Mellitus ($p > 0.758$), HIV treatment ($p > 0.591$) and other medical histories ($p > 0.493$) showed no statistically significant association with five minutes Apgar scores.

4.3.2.3 Pregnancy complications of mothers during delivery

Pregnancy complications of mothers during delivery were analysed and are presented in Table 4.38.

Table 4.38 Pregnancy complications of mothers and their association with after five minutes low and normal Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Antepartum Haemorrhage (APH)				
Yes	0 (0.0%)	11 (100.0%)	100	0.303
No	33 (8.8%)	341 (91.2%)	100	
Cephalopelvic Disproportion (CPD)				
Yes	0 (0.0%)	6 (100.0%)	100	0.451
No	33 (8.7%)	348 (91.3%)	100	
Other pregnancy complication				
Anaemia	0 (0.0%)	2 (100.0%)	100	0.000
Intra-uterine growth retardation	2 (66.7%)	1 (33.3%)	100	
Malposition	0 (0.0%)	1 (100.0%)	100	
Multiple pregnancy	2(13.3%)	13(86.7%)	100	
Oligohydramnios	0 (0.0%)	1 (100.0%)	100	
Polyhydramnios	0 (0.0%)	1 (100.0%)	100	
Pregnancy Induced Hypertension	4 (19.0%)	17 (81.0%)	100	
Premature ruptured of membranes	3 (15.0%)	17 (85.0%)	100	
Preterm labour	5 (50.0%)	5 (50.0%)	100	

Table 4.38 shows that mothers that were having complications such as APH, CPD, anemia, oligohydramnios, and polyhydramnios reported no newborn babies with a low Apgar score after 5 minutes. Those mothers with Preterm labour had equal newborn babies of 50 (50%) in both the low Apgar and normal Apgar score groups after five minutes. There was no statistically significant association found between Antepartum ($p>0.303$) and cephalo-pelvic

disproportion ($p>0.451$) and after five minutes Apgar score. Statistically, a significant association was only found between other pregnancy complications ($p<0.000$) and after five minutes Apgar score.

4.3.2.4 Membranes status of the mothers

The condition of the membranes of mothers was also looked at during the analysis of the five minutes Apgar scores and the results are presented in Table 4.39.

Table 4.39 Membrane status of the mothers and their association with after five minutes low and normal Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Amniotic fluid				0.624
Clear	26 (9.8%)	238 (90.2%)	100	
Meconium	7 (6.8%)	96 (93.2%)	100	
Bloody	0 (0.0%)	1 (100.0%)	100	
Meconium grade			100	0.485
Grade I	2 (4.8%)	40 (95.2%)	100	
Grade II	1 (3.8%)	25 (96.2%)	100	
Grade III	4 (12.5%)	28 (87.5%)	100	

Table 4.39 shows that 26 (9.8%) newborn babies had a low Apgar score and 238 (90.2%) had a normal Apgar score. Meconium grades III was the only grade category with more newborn babies in the low Apgar score group 4 (12.5%), compared to grade II, 1 (3.8%) and grade I 2 (4.8%). Both grades recorded more newborn babies with normal Apgar scores after five-minutes grade I had 40 (95.2%), grade II 25 (96.2%) and grade III had 28 (87.5%). There was

no statistically significant association between after five minutes Apgar score and amniotic fluids ($p>0.624$) as well as meconium grades ($p>0.485$).

4.3.2.5 Duration of labour history

The total hours of labour that were spent by mothers before admission for delivery and the total duration of labour were analysed and associated with Apgar scores at five minutes as presented in Table 4.40.

Table 4.40 Duration of labour history and their association with after five minutes low and normal Apgar score.

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Durations of labour on admission				0.552
<4hours	0 (0.0%)	7 (100.0%)	100	
6 hours	5 (9.1%)	50 (90.9%)	100	
>10 hours	6 (9.4%)	58 (90.6%)	100	
Patient not in labour	12 (14.1%)	73 (85.9%)	100	
The total duration of labour				0.124
12 hrs-19 hrs	11 (6.1%)	168 (93.9%)	100	
>20 hrs	4 (11.1%)	32 (88.9%)	100	
Patient not in labour	13 (13.3%)	85 (86.7%)	100	

Mothers who were in labour at home for more than 10 hours had 58 (90.6%) newborn babies with normal Apgar scores and 6 (9.4%) with low Apgar scores after five minutes. While mothers who spent more than 20 hours in labour had 4 (11.1%) of the newborn babies with low Apgar scores and 32 (88.9%) with normal Apgar scores after five minutes. There was no

statistically significant association between five minutes Apgar score and the duration of labour ($p>0.552$) as well as the total duration of labour ($p>0.124$).

4.3.2.6 Proper monitoring of partograph

The use of partographs was analysed to check if labour was monitored correctly during labour and the results are presented in Table 4.41.

Table 4.41 Proper monitoring of partograph and its Association with After five minutes Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Monitoring of partograph				0.009
Yes	6 (10.5%)	51 (89.5%)	100	
No	14 (5.6%)	238 (94.4%)	100	

A total of 252 (64.9%) partographs were not monitored properly of which, a total of 238 (94.4%) newborn babies had normal Apgar scores while 14 (5.6%) had low Apgar scores after five minutes. There was a statistically significant association between after five minutes Apgar scores and partograph ($p<0.009$).

4.3.2.7: Caesarean section operation status of mothers

Table 4.42 shows the indications for caesarean section and their association after five minutes of Apgar scores.

Table 4.42 Caesarean section operational status of mothers and their association with low and normal Apgar score.

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Indications for caesarean section				0.450
Obstructed labour	0 (0.0%)	1 (100.0%)	100	
Antepartum haemorrhage	0 (0.0%)	4 (100.0%)	100	
Cephalopelvic disproportion	0 (0.0%)	5 (100.0%)	100	
Cord prolapses	1 (14.3%)	6 (85.7%)	100	
Eclampsia	4 (30.8%)	9 (69.2%)	100	
Failed induction	0 (0.0%)	1 (100.0%)	100	
Foetal distress	2 (6.9%)	27 (93.1%)	100	
Macrosomia	0 (0.0%)	3 (100.0%)	100	
Malpresentation	1 (11.1%)	8 (88.9%)	100	
Meconium-stained liquor	0 (0.0%)	6 (100.0%)	100	
Multiple pregnancy	0 (0.0%)	6 (100.0%)	100	
Poor maternal effort	0 (0.0%)	1 (100.0%)	100	
Previous C/S	3 (16.7%)	15 (83.3%)	100	
Prolonged labour	0 (0.0%)	12 (100.0%)	100	

Table 4.42 shows that the most common indication of the caesarean section was fetal distress 29 (7.5%) of which the majority of the newborn babies 27 (93.1) had a normal Apgar score. In the low Apgar score group, the indication for eclampsia had more newborn babies 4 (30.8%) compared to other indications that had a few. There was no statistically significant association between indications for caesarean section and Apgar scores after five minutes ($p>0.450$).

4.3.3 Neonatal characteristic associated with after five minutes Apgar scores

Neonatal factors such as the sex of the newborn baby, gestational age and birth weight were presented and analyzed comparing to a low Apgar and normal Apgar score groups.

4.3.3.1 Sex of the newborn babies

Results for the male and female newborn babies are presented in Table 4.43.

Table 4.43 Sex of the new-borns and its association with after five minutes low and normal Apgar score

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Sex of the new-born				
Male	14 (7.2%)	181 (92.8%)	100	0.347
Female	19 (9.8%)	174 (90.2%)	100	

Table 4.43 shows that the normal Apgar score group had a majority in both males 181 (92.8%) and females 174 (90.2%) compared to the low Apgar score group that had fewer participants males 14 (7.2%) and females 19 (9.8%). There was no statistically significant association found between the sex of the newborn and after five minutes Apgar scores ($p>0.347$).

4.3.3.2 Gestational age of the newborn babies

The gestational age of the newborn babies was analysed and Table 4.44 below presents the results in both low and normal Apgar score groups.

Table 4.44 Gestational age of newborn with five minutes low and normal Apgar scores

Variables	Low Apgar score	Normal Apgar score	Total %	P-value
Gestational age (in term)				0.000
Full term	17 (5.3%)	303 (94.7%)	100	
Small for dates (GA)	2 (50.0%)	2 (50.0%)	100	
Post term	1 (50.0%)	1 (50.0%)	100	
Preterm	13 (22.0%)	46 (78.0%)	100	

A total of 320 (82.5%) full-term and preterm 59 (15.2%) were the gestational age group that had the highest number of participants in both Apgar score groups. There is a statistically significant association found between gestation age and after five minutes Apgar score ($p>0.000$).

4.3.3.3 Birth weight of the newborns

Birth weight categories were analyzed and presented in Table 4.45.

Table 4.45. Birth weight of newborns and its association with after five minutes Apgar score (low and normal Apgar score)

Variables	Low Apgar Score	Normal Apgar score	Total %	P-value
Birth weight				0.000
Severe premature(0.100kg-1.900kg)	9 (29.0%)	22 (71.0%)	100	
Low birth weight (2.00kg- 2.400kg)	6 (16.2%)	31 (83.8%)	100	
Normal birth weight (2.50kg-3.900kg)	17 (5.8%)	276 (94.2%)	100	
Macrocosmic (>4.000kg)	1 (4.2%)	23 (95.8%)	100	

Table 4.45 shows that those new-born babies that were delivered with normal birth weight, 293 (75.5%), were more and continued to have the majority in both Apgar score groups, low Apgar 17 (5.8%) and 276 (94.2%) than other birth weight categories after five minutes. Severe premature, low birth weight, and macrocosmic recorded fewer participants in the low Apgar score and more participants in the normal Apgar score group (see Table 4.40). There was a statistically significant association between birth weight and after five minutes Apgar scores ($p < 0.0000$).

4.4 BINARY LOGISTIC REGRESSION

4.4.1 Introduction

The last part of this chapter presents all factors that presented low immediate Apgar score and after five minutes Apgar scores, analysed with Binary logistic regression. Binary logistic regression is a type of prediction model technique that is used to find the relationship between a dependent variable (outcome) and a series of independent variables (predictors) (Almeid, 2016).

In this study, the Binary logistic regression model was used because the dependent variable of this study was dichotomous (whereby the study looked at newborn babies with low Apgar scores and normal Apgar scores). Furthermore, this study had multiple independent variables, hence this model was used to determine the impact of multiple independent variables which were presented simultaneously to predict membership of one or other of the two dependent variable categories.

4.4.2 Immediate low Apgar score Binary logistic regression results

All the variables that were found to be associated with immediate low Apgar scores using the Chi-squared test were added into a logistic regression model. Stepwise logistic regression was used to automatically select and reduce the number of the predictor variables for building the best performance logistic regression model. The effect of the total duration of labour, medication administered for augmentation, from where the mother was referred, indication for caesarean section, cord prolapse and poor maternal effort, foetal presentation, cord around the neck and cardiotocography were added to the model as predictors to ascertain their impact on the immediate low Apgar score. Table 4.46 shows the Binary logistic regression results of the immediate low Apgar score.

Table 4.46. Binary Logistic Regression of the immediate low Apgar score.

Variables	B	P-values	OR	95% CI	
				Lower	Upper
Total duration of labour	1.450	0.000	4.263	2.592	7.010
Medication administered for augmentation	-.707	0.000	0.493	0.345	0.705
From where the mother was referred?	-.396	0.005	0.673	0.512	.885
Indication for caesarean section/ Cord prolapses	-2.400	0.077	0.091	0.006	1.294
Indication for caesarean section/ Poor maternal effort	-2.264	0.095	0.104	0.007	1.479
Foetal presentation	1.095	0.021	2.988	1.182	7.554
Cord around the neck	2.916	0.011	18.473	1.936	176.262
Cardiotocography (CTG)	-.755	0.001	0.470	0.307	0.720

The findings from the binary logistic regression revealed that the obstetric factor that was a strong predictor in this study was total duration of labour (OR 4.263; 95% CI: 2.592 – 7.010; p-value=0.000). The study further showed that medication administered for augmentation (OR 0.493; 95% CI: 0.345- 0.705; p-value=0.000) and where the mother was referred from (OR 0.673; 95% CI: 0.512 – 0.885; p-value=0.005) were poor predictors of the immediate low Apgar score. Indication for a caesarean section such as cord prolapse (OR 0.091; 95% CI: 0.006-1.294; p-value=0.077) and poor maternal effort (OR0.104; 95% CI: 0.007-1.479; p-value=0.095) were possible predictors of immediate low Apgar score but were not statistically significant.

Furthermore, neonatal factors that were found to be strong predictors in this logistic regression model were: foetal presentation (OR 2.988; 95% CI: 1.182- 7.554; p-value=0.021) and cord around the neck (OR 18.473; 95% CI: 1.936- 176.262; p-value=0.011), while Cardiotocography (OR 0.470; 95% CI: 0.307-0.720;) was a poor predictor of immediate low Apgar score although there was a statistically significant association (p<0.001). Cord around the neck had a high Odds ratio of 18.473 compared to other significant predictor variables.

4.4.3 Binary logistic regression for after five minutes Apgar score.

Binary logistic regression was further used to determine the predictors of after five minutes Apgar scores by loading all factors that had a significant association as analyzed by Chi-squared. The results of significant factors are shown in Table 4.47.

Table 4.47. Binary Logistic Regression for after five minutes Apgar score

Variables	B	P-value	OR	95% CI	
				Lower	Upper
Proper monitoring of partograph	0.801	0.000	2.228	1.656	2.997
Gestational Age (in Term)	0.389	0.000	1.475	1.259	1.728

Birth weight (in kilograms)	-.382	0.000	0.683	0.581	0.802
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Table 4.47 shows that the findings for binary logistic regression revealed that proper monitoring of partograph (OR 2.228; 95% CI: 1.656- 2.997; p-value=0.000) and gestational age (OR 1.475; 95% CI: 1.259- 1.728; p-value=0.00) were the only obstetric factors that increased chances of neonates persisting with a low Apgar score after five minutes. These two variables have the odds ratio and confidence intervals which are all greater than 1 and the significant levels are <0.005. In addition, birth weight (in kilogram) (OR 0.683; 95% CI: 0.581- 0.802; p-value=0.000) decreased the chances of neonates persisting with a low Apgar score after five minutes.

4.5 Summary

Data collected for the study were analyzed; results and findings have been presented above. The results were presented by utilizing charts and tables in a form of frequencies and percentages. Three hundred and eighty-eighty (388) patient files were chosen for data extraction. The study obtained a 50% on each group both low and normal Apgar score sample size. Data were analyzed using SPSS version 26. Binary Logistic Regression was used to analyzed dependent variables over independent variables. Levels of significance were determined with a p-value less than 0.05% at a 95% confident interval. The following will consider the study findings, possible explanations and relate them to previous studies undertaken.

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.1 INTRODUCTION

This chapter focuses on discussion and interpretation of the main findings of the study on factors associated with the low Apgar scores. The interpretation of these findings will be discussed in this study and previous studies done and researchers' perspectives are also included.

5.2 DISCUSSION OF THE STUDY FINDINGS

5.2.1 Socio-demographic factors

The study found socio-demographic factors such as gravidity, parity and smoking were statistical significates associated with an immediate low Apgar score. While the age group of mothers were found to associate a five minutes low Apgar score. The findings in this study show that maternal age groups had almost a similar percentage of newborn babies having low Apgar scores immediately, even though it was not observed as an associate factor for immediate low Apgar scores ($p>0.897$). Similarly, in Iran and Malaysia Tewesa et al. (2017) and Belechew & Joseph (2018) observed no association in maternal age groups less than 20 or above 35 years old. However, Ibrahim et al. (2017) from Ethiopia found an association between maternal ages 15-25 years old which is different from the findings of this study. Apart from this, the study observed maternal age as an associate factor of five minutes Apgar score ($p<0.025$). Among the maternal age groups, the majority of mothers were recorded at <20 years and had low Apgar scores for newborn babies. Young mothers tended to have difficult deliveries due to uncooperative behaviours during the first and second stages of their labour that caused distress to the foetus. In contrast to this study findings by Abdo, Halil and Kebede (2019) established that Ethiopian mothers aged >35 years were associated with a low Apgar

score than the young maternal age as they were at the risk of caesarean section and inadequate pelvic. In Brazil, no associations after five minutes of Apgar score were found (Santos et al., 2019).

Gravidity and Parity was an associate factor for an immediate Apgar score in this study ($p < 0.021$ & < 0.029), Although gravidity ($p > 0.099$) and parity ($p > 0.173$) were not found as associate factors of five minutes. Primigravida was highlighted to be a common factor in this study as they indicated a larger percentage of 58.3%. Likewise, in Malaysia and Ethiopia, Tewesa et al. (2017) and Getachew et al. (2020) show that gravidity and primigravida are associated factors with low Apgar scores due to inadequate experience of pain in primigravida they tend to be uncooperative. Furthermore, nulliparous recorded 56.8% delivered low Apgar score in this study. Similarly, Abukari et al. (2021) and Belechew & Joseph (2018) observed that in Iran previous live birth is associated with high Odds of a low Apgar score. While, in Tanzania and Nigeria, Bilkius et al. (2015) and Yimer et al. (2019) found grand multiparous and primiparity at great risk of a low Apgar score.

Even though the majority of the mothers 132 (46%) were Christians, religion was not found to be an associate factor for low Apgar score ($p > 0.365$). Similarly, Wosenu, Worku, Teshome and Gelagay (2018) and Yimer et al. (2019) found similar findings that there was no association between religion and low Apgar scores in Ethiopia. Similarly, ethnicity and nationality were not associate factor for low Apgar scores ($p > 0.341$ and $p > 0.424$). The majority of participants in this study belong to Oshiwambo ethnic group (99.74%) and they were Namibian citizens (97.42%). In Sweden, Abukari et al. (2021) recorded the majority of participants were from the Hadiya ethnic group 80%, and Protestants 74.9% in terms of their religious affiliation. These findings differ from other countries and study setting areas in that most of the participants in this study were Christians, Oshiwambo speaking, and Namibian citizens. This could be because

Onandjokwe hospital is situated in the northern part of Namibia where the majority of Oshiwambo speakers are based. It was reported in the Namibia Intercensal Demographic Survey reported, (2016) that in the four Northern regions of Namibia more than 90% of their population are Oshiwambo speaker and they are the majority ethnic group in Namibia. Evangelical Lutheran Church in Namibia (ELCIN) is a religion in Namibia that constitute the majority of the Namibian population recorded at 44% (Namibia Demographic and Health Survey, 2018).

With regards to the employment status of the mother, this study recorded 86.42% of unemployment, which was quite high compared to the findings were done in the United Kingdom of Omokhodion et al. (2018) which recorded 13.3% of unemployment. The study did not find any association between a low Apgar score and employment status in this study ($p>0.831$). However, In Ethiopia Gudayu et al. (2017) says unemployment had the risk of a low Apgar score. This was because unemployment, lowest monthly income and not being affiliated with the social service can endanger the developmental of pregnancy as the mother will not be able to buy nutritious food that is needed for the fetal growth to avoid Intra Uterine Growth Retardation (IUGR) which is a risk for a low Apgar score in China (Li et al., 2017). On the contrary, Omokhodion et al. (2018) pointed out that in the United Kingdom manual occupation and poor body resting made mothers have preterm labour that which was categorized as a risk factor for a low Apgar score.

In addition, the residential places of the mothers involved in this study were not found to be an associated factor of low Apgar ($p>0.925$). In this study, the majority of mothers (89.18%) were from rural areas. Similarly, in Ethiopia, Getachew et al. (2017) recorded that 52.3% of the participants in their study were from rural areas. In Malawi, Jeganathan et al. (2017) added that mothers from villages that were far from health facilities had reduced Antenatal care (ANC)

visit opportunities to provide ongoing obstetric care which risked assessment during pregnancy that resulted in a low Apgar score.

The study did not find the mother 's education level as an associate factor of the low Apgar score ($p>0.313$). Similarly, some studies in Brazil and Malawi by Santos et al. (2019) and Tewesa et al (2017) did not find an association between mothers' educational level with a low Apgar score. However, Cantrarutti et al. (2017), as well as Almeida (2016) postulate that the risk of five minutes Apgar score decreases as educational level increases. These findings are opposite to the findings of this study. It would appear these results differ according to the population or country characteristic.

Marital status was not an associate factor for low Apgar scores in this study ($p>0.110$), although this study recorded several single mothers (45.8%) with low Apgar scores. Noday et al. (2019) recorded 54.4% of single mothers delivered a low Apgar score babies in Cameroon which was higher than the findings of this study, while Gudayu (2017) in Nigeria recorded 95% of married mothers delivered low Apgar score babies which is high and similar to the findings of this study recorded 57,7% of married mothers. Studies in Colombia, Brazil, and Cameroon by Torres-Munoz et al. (2017), Santos et al. (2019) and Noday et al. (2019), respectively, found that marital status was an associate factor for low Apgar score. This is possible because partners living with expectant mothers would meet all their pregnancy needs. The presence of a partner in the house provides social and financial support that promotes regular ANC consultations that prevent risk factors leading to low Apgar scores (Noday et al., 2019)

Alcohol and smoking were not an associate factors of low Apgar scores in this study ($p>0.782$ and $p>0.073$). The results of the present investigation showed that a higher percentage of pregnant mothers (85.30%) do not consume alcohol and 0.79% of pregnant mothers do smoke. This finding concurs with the results of Mohammed et al. (2020) who found alcohol and

smoking is not to be associated with a low Apgar score. In contrast, Hamulka et al. (2018) found that 22% of their study participants smoked and 7% consumed alcohol. Mothers who consumed alcohol and smoked were at the risk of preterm babies that are associated more with low Apgar scores. These results differ because the fact that the current study conducted retrospective and social history information was not recorded.

5.2.2 Maternal factors

Maternal Factors that were found associated with an immediate Apgar score in this study are Haemoglobin during the first ANC visit, Antepartum haemorrhage, Cephalo pelvic disproportion, referral history, Blood pressure, contractions, membranes status, duration of labour as well as types of delivery. While, at five minutes Apgar score maternal factors found associate areas follow: urinary tract infection, other pregnancy complications and partograph monitoring. There was no association between antenatal care visits and low Apgar scores in this study ($p>0.397$). Mothers that booked for ANC in this study were at 47.6%, which is almost similar to the findings in Brazil by Santos et al. (2019) who recorded 42.3%, while in Ethiopia similar studies recorded that 88% of mothers attended ANC (Gudayu, 2017) which is higher than the findings of this study. Corrao et al. (2020) added that pregnant mothers had attended ANC to monitor the prognosis of pregnancy and be able to attend to early complication risk factors leading to a low Apgar score. Furthermore, in gestational weeks, the timing when mothers started their 1st ANC was not associated with a low Apgar score in this study ($p>0.399$). Mothers who started ANC in the second trimester (16-28 weeks) constituted 28.6% of this study, while a study done in Nigeria by (Ndidi and Oseverem, 2010) reported 73.6% of mothers started ANC in the second trimester. In contrast, Mannan et al. (2019) reported that mothers booked late in the gestation of more than 28 weeks are associated with a low Apgar score of less than 7 at five minutes.

Maternal illness in this study such as hypertension ($p>0.156$), Diabetic Mellitus ($p>0.298$), HIV ($p>0.442$), and UTI ($p>0.140$) was not found to be associated with immediate Apgar score, but UTI was found to be associated to a five-minute Apgar score ($p<0.000$). On the contrary, in a study done in Turkey diabetic Mellitus was found to be associated with a low Apgar score (Kebapcilar et al., 2016). This study recorded that 71.4% of mothers had pregnancy induced hypertension (PIH) as one of the factors associated with a low Apgar score. Similarly, Mothers with Pregnancy-Induced Hypertension that was not diagnosed and treated on time turned into eclampsia that resulting in bad neonate outcome such as IUGR, preterm that are at risk of the low Apgar score (Seyom, Abera & Tesfaye, 2015; Adebami, 2015; Mckenzie & Trotman, 2019).

In the present study a mother's Haemoglobin (HB), that was taken during the first ANC was associated with a low Apgar score ($p<0.011$). While Haemoglobin that was taken on admission for delivery was not associated with a low Apgar score ($p>0.489$). A majority of mothers who had their HB taken either before the beginning of ANC or on admission for delivery were in the low Apgar score group in this study. This was similar to what was reported in Nigeria and Nepal by Adebami (2015) and Nayak and Gupta (2020) who stated that pregnant mothers with HB less than 11g/dl and those with low HB present at the hospital in their 3rd trimester without beginning ANC were at the risk of delivering low Apgar score babies as a result of APH, intrauterine anaemia. On the contrary, other studies from Pakistan and Brazil by Ahmad (2015) as well as Yossef et al, (2018) respectively, suggest that mothers who had iron deficiency anaemia in their 2nd trimester or who neglected healthy dietary habits could cause low nutrients thereby not meeting the nutritional needs of foetal growth and development that leads to the newborn baby having a low Apgar score at five and immediate than those who received the iron.

The results of this study also demonstrate that the following pregnancy complications were found as associate factors for low Apgar scores, such as Antepartum haemorrhage (APH) ($p < 0.004$), Cephalopelvic disproportion (CPD) ($p < 0.010$) and other pregnancy complications such as Pregnancy-induced hypertension (PIH), Preterm & Premature rupture of membranes (PROM) (0.027). Just like the findings of Santos et al. (2019) in Brazil where he established that prolonged second stage of labour as a result of improper vaginal examination may lead to CPD that associated with a low Apgar score. On the contrary, Tewesa et al. (2017) found no association between APH, CPD and low Apgar score. Health facilities from where the mother was referred were regarded as an associate factor of low Apgar score in this study ($p < 0.000$). Since Onandjokwe Intermediate Hospital is a referral hospital in the region, the majority of mothers with complications such as fetal distress, cord prolapse and prolonged labour were referred from district hospitals, health centres and clinics to Onandjokwe hospital. Pregnant women with complications are at risk of a low Apgar score.

Respiration and Hemoglucose test (HGT) were the only vital signs regarded as factors associated with a low Apgar score, while other vital signs such as Blood pressure (BP), Pulse, Temperature and Symphysial Fundal height (SFH) were not associated factors in this study. Different findings in India suggest that mothers with the highest diastolic blood pressure had poorer pregnancy outcomes of lower Apgar score and high temperatures of 38 degrees Celsius as a result of chorioamnionitis (Burgess et al., 2017; Mchkenzie & Trotman, 2019).

Contractions were found to be an associate factor for low Apgar score ($p < 0.001$) in this study. This finding correlates with Hidalgo-Lopezosa, Hidalgo-Maestre & Rodriques-Borrego, (2016) who found similar ($p < 0.001$) contractions that have long intervals may increase foetal cerebral oxygen saturation that results in a low Apgar score. In excessive uterine activity, the compromised foetus increases the risk of an adverse foetal outcome as this decrease's umbilical

artery blood flow and foetal oxygen saturation (Hidalgo-Lopezosa, Hidalgo-Maestre & Rodriques-Borrego, 2016)

The rupturing of membranes before the onset of labour and their amniotic fluid status was an associative factor for a low Apgar score ($p < 0.00$). The study indicated that 67.0% of neonates were delivered through meconium-stained amniotic fluid. This figure is very high compared to other similar studies done in Ethiopia that recorded 18.5% of neonates delivered through the meconium-stained amniotic fluid by Sori, Belete and Wolde (2016) and Fernandez et al (2018) recorded 4.8% of neonates delivered through meconium-stained amniotic liquor. Furthermore, the study established that there was a significant association between the meconium grades and the immediate Apgar score ($p < 0.000$) and that can be explained by a high percentage of newborn babies delivered through meconium-stained amniotic fluid with either meconium grade II (3.1%) or grade III (96.9%). These results were consistent with studies by Sori et al (2019) and Fernandez et al (2018) who recorded that in 74.8% of the cases, liquor was either grade II or grade III meconium stained. Therefore, the thickness of meconium in the amniotic fluid and aspirated by the foetus can be a sign of intrauterine foetal asphyxia that results in a low Apgar score and then thin meconium. But there was no association between the membrane status of mothers and five minutes Apgar score. This was due to the significant amount of meconium in the amniotic fluid.

Total hours spent by mothers in labour before admission including the total duration of labour were strong predictors for a low Apgar score in this study (OR 4263; 95% CI; 2.592-7.010; P-value 0.000). Similar to what was found by Altman et al. (2015) risk of a low Apgar score increased with the duration of the first and second stages of labour. In addition, Zipori et al. (2018) suggest that in the USA longer labour duration increased with chorioamnionitis and foetal size. While in Malawi and Sweden a similar study was done by Tewesa et al. (2017) and

Sandstron et al. (2017) added that due to poor maternity, pushing prolonged leads to the second stage of labour which can lead to a low Apgar score.

Mothers that had their labour augmented and the medication that was used for augmentation were found to associate factors with a low Apgar score in this study ($P < 0.006$ and $P < 0.019$). In a similar study done in Ethiopia, Gudayu (2017) showed similar findings that augmentation of labour was associated with low Apgar score. This similarity can be because of the fact that the medication for augmentation is given in high doses but not monitored and can cause contractions of the uterus to occur more often and this interferes with uterine blood flow to the foetus, which could further affect the Apgar score. In other cases, similar to the findings of this study, when the foetal well-being is not reassuring labour augmented may do more harm than good (Ashraf & Boulvain, 2020).

This study also showed that types of delivery were associated with low Apgar scores ($p < 0.00$). Similar findings to this study by Omkhodion et al, (2018) as well as Wosenu et al, (2018) suggest that breech delivery and caesarean section after failed vacuum extraction had high odds of a low Apgar score. This is because the fact that the second stage of labour can be prolonged and that causes foetal acidosis. In addition, certain types of caesarean section (C/S) and their indications are associated with a low Apgar score ($p < 0.000$). The magnitude of a low Apgar score was associated with emergency C/S due to cord prolapse (Mohammed et al., 2020; Alexandra et al., 2019). Foetal distress and eclampsia were reported both in this study and in China (Li et al., 2017; Mckenzie & Trotman, 2019) as top leading indications for CS associated with the low Apgar score.

Partograph monitoring was an associate factor of five minutes Apgar score ($p < 0.009$). The study showed that only 10.5% of the cases partograph were monitored properly. In a similar study done in India, Subrata, Kripalini and Sighamitra (2019) found 6% and did not find an

association between partograph adherence with birth asphyxia, although health workers know the importance of partograph, if not used it can attribute to a lack of intrapartum monitoring.

The current results indicate a significant relationship between the type of anaesthesia, the medication used for anaesthesia and a low Apgar score ($p < 0.000$). This study found that newborn babies with low Apgar scores were high among mothers who were under General anaesthesia compared to spinal anaesthesia. Similarly, Molushi (2016) found that general anaesthesia had a low Apgar score of less than 7 both immediately and after five minutes. This is because the fact that the presence of anaesthesia medication concentration in maternity can cause cardiovascular depression in the mother and this placental perfusion and fetoplacental exchange and interference may result in a low Apgar score (Bakhsha et al., 2015). In addition, Bupivacaine and Fentanyl were the most medication used by expectant mothers in this study, unlike Sodium Thiophene and Thiobartine (Molushi, 2016). These results differ from the earlier studies elsewhere depending on the countries of anaesthesia protocols. The other point is that the study did not find an associate factor between complications that may occur during delivery such as shoulder dystocia ($p > 0.137$), Poor maternal effort ($p > 0.069$) and uncooperative mothers ($p > 0.579$).

5.2.3 Neonatal factors

The study recorded neonatal factors such as Gestational age, birth weight, foetal presentation cord around the neck and cardiotocography associated with immediate low Apgar score and gestation and birth weight found statistical significant associate at five minutes Apgar score. This study recorded a high prevalence of low Apgar scores as follows; immediate low Apgar scores had a total of 84.8% of newborn babies of these, 83.7% of newborn babies had moderate low Apgar scores, and 16.21% of newborn babies had severe low Apgar score. After five

minutes 33 (8.5%), newborn babies had low Apgar scores, of these, 28 (7.2%) had moderate Apgar scores and 5 (1.3%) had severe low Apgar scores.

The sex of the newborn baby was not an associate factor of low Apgar score in this study. Female and male newborn babies were almost equal in having a low Apgar score. Omokhodion et al. (2018) found that male newborn babies are associated more with low Apgar score than females. This was because they tended to be delivered by instrumental delivery as well as caesarean section for failure to progress in the normal way. Additionally, Gestational age was an associate factor of low Apgar score in this study ($p < 0.000$). The youngest gestational ages have a higher proportion of low Apgar scores. This is because they tend to have preterm labour and are delivered before pregnancy become term.

Birth weight was also found as an associate factor of both immediate and five-minute low Apgar scores ($p < 0.000$) in this study. Severe premature newborn babies' weights of 0.100kg to 1.900kg made up the highest percentage in this study because of the inability to breathe spontaneously after delivery as they have premature lungs. Similarly, in Nigeria Mohammed et al. (2020) found that a low birth weight of less than 2.5kg was associated more with a low Apgar score at one- and five-minute Apgar score due to immaturity of organ and nervous system. On the contrary, in a study by Gebreheat et al. (2018), Bilkisu et al. (2015) and Patil, Pawar and Pawa (2020) in Ethiopia and Nigeria, respectively, found that newborn babies with a birth weight of more than 4kg were associated with Cephalopelvic Disproportion (CPD) resulting in prolonged labour that causes low Apgar score and leads to complications of shoulder dystocia and causes injury plexus brachialis.

In addition, fetal presentation ($p < 0.00$), cord prolapse ($p < 0.000$), cord around the neck ($p < 0.000$) and Cardiotocography assessment ($p < 0.000$) are associated with a low Apgar score in this study. In the findings, CTG with deceleration their newborn babies were delivered with

low Apgar scores compared to newborn babies with normal CTG in this study. This is because factors can affect enough oxygen flow to the fetus. This was supported by Bogdanovic et al. (2016) who maintain that the late deceleration associated with tachycardia and bradycardia can result in newborn delivered with low Apgar scores. The results of this study can be reliably interpreted as the majority of mothers' Cardiotocographs was not printed.

5.3. SUMMARY

This chapter has discussed the findings of the research factors associated with a low Apgar score as presented in the previous chapter. The findings such as socio-demographic, maternal, and neonatal factors were compared with the reports of findings from similar studies in other parts of the world. In the next chapter, we conclude the research report, make recommendations and highlight the limitations of the study.

CHAPTER SIX

CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter presents a summary of the findings of the research based on the research objectives. A conclusion is drawn based on the findings and recommendations are formulated about the context of the findings which will include recommendations for future research. The limitations encountered in this study are also highlighted.

6.2 CONCLUSION

This was a quantitative retrospective study used to analyse factors that might be associated with low Apgar scores both immediate and after five minutes. The cases were maternal records for low Apgar scores and maternal records for normal Apgar scores were used as a control. The main aim of the research was to identify factors associated with low Apgar scores among newborn babies in Onandjokwe Intermediate Hospital. The findings of this study have shown different factors such as socio-demographic, maternal and neonatal during the continuing care of pregnant mothers that results in a low Apgar score. The factors that were identified associated with an immediate low Apgar score in newborns were, gravidity and parity, mothers referred from district hospital, meconium-stained liquor, augmentation of labour, indications for caesarian section, types of anesthesia, and birth weight. While, factors such as maternal age, Urinary Tract Infection, Partograph, Gestation age and birth weight were factors identified as associated with after five minutes Apgar score. There was an association between obstetric factors and neonatal factors both at immediate and after five minutes with a ($p < 0.000$). The total duration of labour and the cord around the neck was a strong predictor of immediate Apgar score and after five minutes strong predictors were partograph monitoring and gestational age. The study concluded that in-service training for midwives on effective monitoring of pregnant women during antenatal care and labour is needed. In addition, health education about the

importance of antenatal care would contribute more to the early detection of complications for prompt action

6.3 LIMITATION

The researcher encountered a challenge with incomplete maternal records which made it impossible for some factors to be studied and analysed. However, data were collected from an adequate sample. The study was only limited to Onandjokwe Hospital, therefore the study findings can not be generalized to other hospitals because there were not involved in this study.

6.4 RECOMMENDATION

Given the results of the study and to prevent factors associated with low Apgar score in newborn babies, the following recommendations are made:

- Pregnant mothers to be given health education on the importance of starting Antenatal care in the first trimester to rule out pregnancy complications.
- Midwives and clinicians in the antenatal care and labour ward should effectively monitor women in labour through the appropriate use of the partograph, prompt decisions and take appropriate and timeous actions.
- In-service training on cardiotocograph use and interpretation should be introduced.
- Health education of pregnant mothers on the need to come to the hospital early once labour pain starts to reduce the high incidence of preventable health conditions.

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8. APPENDICES

Appendix 1: Data collection tool

DATA COLLECTION TOOL (DOCUMENT REVIEW CHECKLIST) ON:

TITLE: FACTORS ASSOCIATED WITH LOW APGAR SCORE IN NEW-BORN BABIES AT ONANDJOKWE INTERMEDIATE HOSPITAL.

STUDY CODE.....

LOW APGAR SCORE

NORMAL APGAR SCORE

SECTION A: DEMOGRAPHIC PROFILE OF A MOTHER

1. Personal factors

1.1	Age group in (years)	
1.2	Gravidity	
1.3	Parity	
1.4	Religion	
1.5	Ethnicity	
1.6	Nationality	

2. Employment status

2.1	Employed	
2.2	Unemployed	
2.3	Self-employed	

3. Residential address

3.1	Urban area	
3.2	Rural area	
3.3	Semi-urban area	

4. Maternal education level

4.1	Primary education	
4.2	Secondary education	
4.3	Tertiary education	
4.4	No formal education	

5. Marital status

5.1	Single	
5.2	Married	

6. Social history

		Yes	No
6.1	Alcohol		
6.2	Smoking		

SECTION B: OBSTETRIC FACTORS OF MOTHERS

1. Ante-natal care visit

1.1	Booked IF , booked state Gestation weeks of 1st ANC visit.....	
1.2	Unbooked	

2. Medical history

		Yes	No
2.1	Hypertension		
2.2	Diabetic mellitus		
2.3	Cardiac Disease		
2.4	HIV (Human Immunodeficiency Viruses) treatment		
2.5	History of UTI (urinary tract infection) during pregnancy		
2.6	Others.....		

3. Haemoglobin (HB)

3.1	During 1 st ANC Visit	
3.2	During on admission Delivery	

4. Pregnancy Complications

		Yes	No
4.1	Antepartum Haemorrhage		
4.2	Cephalopelvic Disproportion		
4.3	Others.....		

5. Parameters during Admission for delivery

5.1. Health facilities where mothers was referred.

5.1.1	Hospital	
5.2.2	Health Centre	
5.3.3	Clinic	

5.2. Observations (Vital signs)

5.2.1	Blood Pressure	
5.2.2	Pulse	
5.2.3	Temperature	
5.2.4	Respiration	
5.2.5	Urine test	
5.2.6	High Glucose Test	
5.2.7	Height of Fundus	

5.3. Contractions

5.3.1	Mild contractions	
5.3.2	Moderate contractions	
5.3.3	Severe contractions	

5.4. Membrane's status

5.4.1	Intact	
5.4.2	Ruptured	

Amniotic fluid	Clear	
	Meconium & state Grades.....	
	Blood	

5.5. Duration of labour on Admission

5.5.1	<1hour	
5.5.2	6 hours	
5.5.3	> 10 hours	

		Yes	No
6.	Augmentation of Labour		

If **YES**, choose medication used 6.1, 6.2& 6.3, If **NO** go to question 8.

6.1	Misoprostol	
6.2	Oxytocin	
6.3	Prostin gel	

	Yes	No
7. Proper monitoring of Partograph until delivery		

8. Types of Delivery

		Yes	No
8.1	Normal Vaginal Delivery		
8.2	Breech Delivery		
8.3	Vacuum Extraction Delivery		
8.4	Forceps Delivery		
8.5	Caesarean Section		

If **caesarean Section**, state the indications.....

.....

9. Type of Caesarean section operation

9.1	Elective caesarean section	
9.2	Emergency caesarean section	

11. Type of Anaesthesia used

11.1	General Anaesthesia	
11.2	Spinal Anaesthesia	

12. Name of Analgesia used

12.1.	Fentanyl	
12.2	Propofol	
12.3	Macain	
12.4	Ketamine	
12.5	Suxamethacium	
12.6	Thiopental Sodium	
12.7	Bupivacaine	

13. Total Duration of labour (hours)

13.1	12-19 hours	
13.2	>20 hours	

14. Complications during delivery

		Yes	No
14.1	Shoulder Dystocia		
14.2	Poor maternal effort		
14.3	Uncooperative mothers		
14.4	Others.....		

SECTION C: NEONATAL FACTORS

1. Sex of the new-born

1.1	Male	
1.2	female	

2. Apgar Score Rate

2.1	Immediate Apgar Score	
2.2	5 Minutes Apgar Score	

3. Gestational weeks

3.1	Full Term	
3.2	Small for Dates	
3.3	Post-term (weeks)	
3.4	Pre-term (weeks)	

4. Birth weight

4.1	Severe premature (0.100- 1.900Kg)	
4.2	Low birth weight(2.000kg-2.400kg)	
4.3	Normal birth weight (2.500kg -3.400kg)	
4.4	Macrocosmic (>3.500kg)	

5. Foetal Presentation

5.1	Vertex Presentation	
5.2	Breech Presentation	
5.3	Compound Presentation	

6. Cardiotocography

6.1	Deceleration	
6.2	Acceleration	
6.3	Non-reassuring CTG	
6.4	Reassuring CTG	

		Yes	No
7.	Any Cord Prolapse History		
8.	Any Congenital Abnormalities		
9.	Any Shoulder Dystocia History		

.....THE END.....

Appendix 2: Ethical clearance certificate from the University of Namibia



ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: SON 2021 Date: 1 December, 2021

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: Factors Associated With Low Apgar Score In Newborn Babies At Onandjokwe Intermediate Hospital; Oshikoto Region, Namibia

Student: JUSTINA LUNGAMENI

Student Number: 200821636

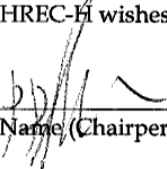
Supervisor(s): *Dr Emma Ngitanwa (Main) Ms Laura Uusiku*

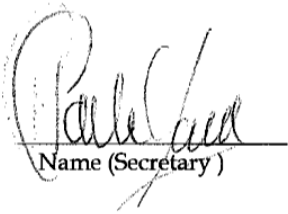
Main Campus

Take note of the following:

1. Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the HREC-H. An application to make amendments may be necessary.
2. Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the HREC-H
3. The Principal Researcher must report issues of ethical compliance to the HREC-H (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by HREC-H
4. The DEC retains the right to:
 1. Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
 2. Request for an ethical compliance report at any point during the course of the research.

HREC-H wishes you the best in your research.


Name (Chairperson)


Name (Secretary)

Appendix 3: Research permission letters

Appendix 3.1: Research permission letter from Ministry of health and Social Services



REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
Windhoek

Tel: 061 - 203 2507
Fax: 061 - 222558
E-mail: itashipu87@gmail.com

OFFICE OF THE EXECUTIVE DIRECTOR

Ref: 17/3/3 JL

Enquiries: Mr. A. Shipanga

Date: 17 July 2020

Ms. Justina Lungameni
PO Box 80078
Ongwediva
Namibia

Dear Ms. Lungameni

Re: factors associated with low apgar score in newborn babies at Onandjokwe Intermediate Hospital

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. Kindly be informed that permission to conduct the study has been granted under the following conditions:
 - 3.1 The data to be collected must only be used for academic purpose;
 - 3.2 No other data should be collected other than the data stated in the proposal;

- 3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;
 - 3.4 A quarterly report to be submitted to the Ministry's Research Unit;
 - 3.5 Preliminary findings to be submitted upon completion of the study;
 - 3.6 Final report to be submitted upon completion of the study;
 - 3.7 Separate permission should be sought from the Ministry for the publication of the findings.
4. All the cost implications that will result from this study will be the responsibility of the applicant and not of the MoHSS.

Yours sincerely,


BEN NANGOMBE
EXECUTIVE DIRECTOR



Appendix 3.2: Research permission letter from Onandjokwe Intermediate Hospital



ONANDJOKWE RESEARCH AND ETHICS COMMITTEE (OREC)

APPROVAL NOTICE

Ethics Reference OREC/0729/20

Name of applicant: JUSTINA LUNGAMENI

Date: 29/07/2020

TITLE: Factors Associated With Low Apgar In Newborn Babies At Onandjokwe Hospital

Dear Ms Justina

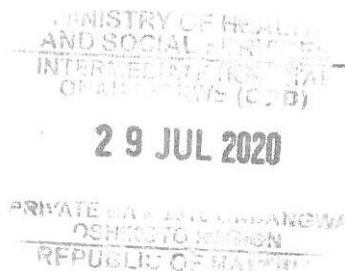
The New Application received on 27 July 2020, was reviewed by some members of Onandjokwe research and Ethics Committee via Expedited review procedures on 28-07-2020 and was approved.

Please note the following information about your approved research protocol:

1. The data to be collected must only be used for operational purposes
2. Preliminary findings to be submitted upon completion of the study
3. Final report to be submitted upon completion of study.
4. Separate permission should be sought from the ministry of Health and social services for the publication of the findings.

DR. A. Munyika
Chairperson OREC

DR.F. STRATO
Secretary OREC





29 July 2021

TO WHOM IT MAY CONCERN

REF: COPYEDITING AND PROOFREADING OF JUSTINA LUNGAMENI'S THESIS FOR THE DEGREE OF MASTER OF NURSING SCIENCE.

This letter serves to confirm that I copyedited and proofread Justina Lungameni's Masters' thesis titled: (FACTORS ASSOCIATED WITH LOW APGAR SCORE IN NEWBORN BABIES AT ONANDJOKWE INTERMEDIATE HOSPITAL).

I declare that I professionally copyedited, proofread this thesis, and removed mistakes and errors in spelling, grammar, and punctuation. In some cases, I improved sentence construction without changing the content provided by the student. I also removed some typographical errors from the thesis. I also declare that I am a professional copyeditor & proof reader and that I have edited numerous Masters and Doctoral theses here in Namibia, Botswana, Zimbabwe, and South Africa.

It was a pleasure proofreading and copyediting your student's thesis.

Please contact me should you need some clarification.

Yours Sincerely,

A handwritten signature in black ink, appearing to read 'Archford Musodza'.

DR ARCHFORD MUSODZA

Academic Consultant, Copy Editor & Proofreader

PhD (UNISA), MPhil Arts (UZ), LLM (FELLOW) (UNISA) LLB (UNISA), BA HONS (UZ), DIP IN RS (UZ), DIP IN PS (BGC), DIP IN CE&PR (BLACKFORD CENTRE, UK)

Unit 2, Promenaden Gardens, Erf 7 Promenaden Street, Eros, Windhoek, Namibia

Email: nacs062019@gmail.com Mobile: +264818704864