A Descriptive Study of Low Risk Women Presenting in Suspected Preterm Labour at Tygerberg Hospital

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DECLARATION

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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Date: December 2018

ABSTRACT

Introduction

Preterm birth refers to delivery before 37 completed weeks' gestation and is often, but not always, preceded by spontaneous preterm labour. Prematurity due to preterm birth is the leading cause of direct neonatal mortality worldwide, as well as a cause for significant neonatal morbidity and long-term sequelae. The estimated preterm birth rate varies worldwide and represents 5-18% of all live births with approximately 15 million babies born preterm annually worldwide.

Early identification and adequate management of preterm labour and subsequent preterm birth is paramount. However, the signs and symptoms of preterm labour are non-specific, and can lead to over diagnosis and over treatment with unnecessary interventions and medications, which could be harmful to both the mother and the foetus. Thus, there remains a great challenge in clinical practice to be able to differentiate true preterm labour from false labour and to be able to risk stratify high risk women with features necessitating admission and intervention, and low risk women with features that make conservative, non-interventional management safe.

Aims and Methods

The study was a retrospective descriptive audit of all women presenting to TBH with suspected preterm labour between 24 and 34 weeks gestation in a predetermined 6-month period from 01/01/2015 to 30/06/2015. The primary aim was to determine the incidence of preterm birth in women who present in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital. Secondary aims were to identify the demographic and obstetric characteristics, evaluate the management performed, assess the obstetric and neonatal outcomes, and to determine risk factors for preterm delivery in women presenting in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital.

Results

Of the 5103 women triaged in Tygerberg Hospital during the 6-month study time-period, a total of 102 low risk women (42 women included in the study, 60 women in active labour at presentation) presented with suspected preterm labour had

subsequently delivered at a preterm gestation less than or equal to 34 weeks. The total number of babies delivered in this time period was 3940. Thus, the incidence of preterm birth from suspected preterm labour for the study period was 2.59%.

One hundred (100) low risk women were included in the study and 48% of the women were in their first or second pregnancies. This precluded them from routine screening for risk of preterm labour as they were not identified as high-risk patients with 2 or more previous trimester two losses or preterm births.

The correct use of clinical obstetric criteria that fulfil the diagnosis of preterm labour is essential in correctly diagnosing true preterm labour and differentiating it from false preterm labour. Less than a third (32%) of the women included in the study presented with both pain and a show. Only 19% of patients had a cervical dilatation greater than 2cm and in addition to this, only half (50%) had a cervical length less than 20mm. Sixty eight percent (68%) of women, though, were admitted and interventions such as suppression, antibiotics and steroids were given.

Risk factors identified for preterm birth (with an interval to delivery from presentation of less than one week), include pain and show as presenting symptoms (P<0.001), cervical dilatation >2cm (P0.001), cervical length <20mm (P0.006), clinical presence of a show (P<0.001), and when objective criteria are met for preterm labour according to set protocols (P<0.001).

Conclusion

The incidence in the index study of 2.59% is a population-based reflection of risk of preterm birth in low risk women that present with suspected preterm labour. The risk factors for preterm birth that were identified are thus invaluable in understanding this condition that is still of global concern. Risk factor identification and correct clinical diagnosis of true preterm labour is essential to correctly admit and provide management for only those at high risk of preterm birth. This would prevent increasing the workload of an already overburdened health system. Vigilance with these factors will aid in decreasing the morbidity and mortality related to preterm labour and preterm births.

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LIST OF ABBREVIATIONS

95% CI	95% Confidence Interval
ACOG	American College of Obstetricians and Gynecologists
BMI	Body Mass Index (kg/m2)
CS	Caesarean Section
ECM	Electronic Content Management
g	grams
GA	Gestational age
HIV	Human Immunodeficiency Virus
kg	kilogram
PPROM	Preterm prelabour rupture of membranes
PTB	Preterm birth
PTL	Preterm labour
RCT	Randomised control trial
ROM	Rupture of membranes
RR	Relative risk
SD	Standard deviation
T2	Second Trimester
TBH	Tygerberg Hospital
VS	Versus
W	Weeks
WHO	World Health Organization

1. INTRODUCTION

Preterm birth refers to delivery before 37 completed weeks' gestation. It is often, but not always, preceded by spontaneous preterm labour (1,2). The estimated preterm birth rate varies worldwide and represents 5-18% of all live births (3). Approximately 15 million babies are born preterm annually worldwide (4–7). Sub-Saharan Africa has a preterm birth rate of approximately 13% (8).

Prematurity due to preterm birth is the leading cause of direct neonatal mortality worldwide, as well as causing significant neonatal morbidity and long-term sequelae. In keeping with Millennium Developmental Goal Four, which aimed to reduce childhood mortality by two thirds by 2015, early identification and adequate management of preterm labour and subsequent preterm birth is paramount.

However, the signs and symptoms of preterm labour are non-specific, and can lead to over diagnosis and over treatment with unnecessary interventions and medications, which could be harmful to both the mother and the foetus. This causes a significant burden on health care resources, especially those in developing countries that are already under severe financial strain.

Thus, there remains a great challenge in clinical practice to be able to differentiate true preterm labour from false labour and to be able to risk stratify high risk women with features necessitating admission and intervention, and low risk women with features that make conservative, non-interventional management safe.

2. LITERATURE REVIEW

2.1. Definition

Gestation in a singleton pregnancy lasts on average 40 weeks from the first day of the last menstrual period to the estimated date of delivery. The period from 37 weeks gestation until 42 weeks gestation is considered term. Deliveries prior to this gestation are thus defined as preterm births (1). Preterm labour is defined as the onset of labour after the gestation of 24 completed weeks and before 37 completed weeks. In clinical practice, we further divide preterm labour and preterm birth into those occurring at gestations less than 34 weeks, and those occurring at gestations more than 34 weeks (2). The reason why this distinction is important is that there is an expectation that neonatal outcomes from deliveries above 34 weeks gestation

will be good (1,2). There is a relatively low risk of mortality and morbidity, and it is too low to support the potential risks and costs of interventions aimed such as steroids and tocolysis to be used as routine. However, because of the prematurity risks associated with birth before 34 weeks gestation, neonates at gestations less than 34 weeks will benefit from interventions aimed at improving neonatal outcomes such as steroids, tocolysis, transfer to a higher care facility, and possible magnesium sulphate for neuro-protection.

2.2. Incidence

The estimated burden of disease from preterm births varies worldwide and is approximately 5-18% of all live births (3). Approximately 15 million babies are born preterm annually worldwide (4–7). What is of great significance is that the World Health Organization (WHO) statistics for 2013 show that the second most contributing factor to mortality in children under the age of five is preterm births and prematurity related complications (5). Whereas the rates in developed countries range from 5 to 7 % (3), the estimated numbers in developing countries are substantially higher. Sub Saharan Africa and Asia contribute to the majority of all preterm births, amounting to approximately 60% of all preterm births (6,7), and the trend is increasing over time.

2.3. Consequences of Preterm Births

2.3.1. Neonatal Morbidity

Modern medical advances in recent times have ensured that the survival rates of preterm babies have significantly improved. Slattery and Morrison's review article on preterm delivery shows that almost 100% of babies born over 31 weeks gestation survive (9) . This improved survival trend does unfortunately lead to an increase in the short-term morbidity and long-term physical and mental disability in infant survivors of very preterm birth. Horbar et al. identified that although the mortality trends of even severe preterm babies, defined as those born between 24 weeks gestation and 27 weeks gestation, have improved between 2000 and 2009, major morbidity in survivors ranges from 18.7% to 89.2 % depending on weight at delivery (10).

A Dutch study by de Waal et al. in 2007 on extremely premature infant birth morbidity and mortality showed that up to 43.1% of all surviving infants developed severe neonatal morbidity in the form of retinopathy of prematurity,

bronchopulmonary dysplasia and/or severe brain injury (11). These long-term consequences add to already over-burdened health systems worldwide.

2.3.2. Neonatal Mortality

Globally, 7.6 million children died in 2010 before their fifth birthday (12). The global neonatal mortality rate declined 40 percent from 33 deaths per 1,000 live births in 1990 to 20 in 2013(13). Although the number is ever decreasing, there is still an unacceptably high number of under-five year of age deaths. Of serious concern though is that preterm births and the complications of prematurity have now become the leading cause of death in children under the age of five, contributing to 17 percent of under five deaths) (13). A systematic analysis by Liu et al. shows that of the 7.6 million deaths in children under five, 14.1% were attributable to preterm birth complications (14).

2.3.3. Long Term Sequelae

For those infants that survive the initial short term risks of prematurity, the long term sequelae of neurodevelopmental disabilities and recurrent health problem persist into early childhood (15–17). Difficulties with motor skills, speaking, writing, mathematics, behaviour and physical education are seen in up to a third of 7 year olds born preterm in a study by Huddy et al. in 2001 (18). Cerebral Palsy prevalence is also related to gestational age of birth, with levels of about 3% for infants born preterm after 27 weeks gestation (19). The resultant burden on the health system and community cannot be over emphasised. The resultant loss of educational potential (20) and employment opportunities mean that the burden on the social and disability services are also increased.

2.4. Aetiology of Preterm Labour

The main obstetric precursors leading to preterm birth include iatrogenic delivery for maternal or foetal indication, spontaneous preterm labour with intact membranes, and preterm premature rupture of membranes (21). A precise mechanism for spontaneous preterm labour is not always available or understood because the condition is known to be multifactorial. Romero et al. described the preterm parturition syndrome to identify the processes of term and preterm labour. The authors concluded that preterm labour arises from pathological signalling and activation of one or more components of the common pathway of parturition. The review of the evidence shows that the pathological processes include intrauterine

infection/inflammation, uterine ischaemia, uterine over-distension, abnormal allograft reaction, allergy, cervical insufficiency, and hormonal disorders (22).

2.5. Risk Factors for Spontaneous Preterm Labour

The risk factors for preterm birth include demographic characteristics (race, age, socio-economic status, and pre-pregnancy weight), behavioural factors, and aspects of obstetric history (23,24). Both in the ACOG Bulletin and Goffinet's review of primary predictors of preterm labour, the most significant finding in the prediction of preterm birth was a history of previous preterm birth or second trimester pregnancy loss, increasing the risk by 6 to 8 fold, even after adjustment for the standard confounding factors like demographics and behavioural factors (24). Thus, this aspect of obstetric history is heavily relied upon in risk stratification.

2.6. Diagnosis of Preterm Labour

Preterm labour can be diagnosed as the onset of labour between 24 and 37 weeks with documented regular uterine contractions associated with cervical change or rupture of membranes. Threatened preterm labour, is defined as regular uterine contractions between 24 and 37 weeks, but without cervical changes. In practise, however, this distinction is difficult to make as the natural inclination is often to initiate treatment when preterm labour is suspected, rather than wait for more advanced cervical dilatation. This is especially true in women deemed to be at high risk for preterm delivery, where timeous intervention may lead to improved neonatal outcome.

Besides for clinical examination, two other modalities are well studied and are useful adjuncts in the diagnosis of preterm labour. These are cervical length measurement and foetal fibronectin testing.

Foetal fibronectin is a glycoprotein found in the amniotic fluid, placenta and membranes which is thought to be released through mechanical or inflammatory damage before birth. Detection of foetal fibronectin using immunological assays may be used to predict the likelihood of spontaneous preterm birth. In a systematic review conducted by Honest et al in 2002, cervicovaginal foetal fibronectin was found to be accurate in predicting spontaneous preterm birth within 7 – 10 days of testing among women with symptoms of threatened preterm labour before

advanced cervical dilatation (25). However, foetal fibronectin testing comes at some cost and, at present, is not available in the public sector.

Transvaginal ultrasound can visualise the cervix and internal os and give a measurement of cervical length. This is usually performed in the second trimester to predict later preterm birth but has also been studied as a tool to identify symptomatic women at risk of impending preterm birth before advanced cervical dilation, thus allowing more time for endeavours aimed at improving neonatal outcome. Tsoi et al., in an observational study, found that no women with a cervical length of more than 15 mm delivered within 48 hours of presenting with threatened preterm labour and only 0.7% delivered within 7 days (26).

A later small randomised control trial by Alfirevic et al. was conducted to evaluate the hypothesis that the decision to administer tocolytics and steroids should be based on the sonographic measurement of cervical length. They concluded that women with threatened preterm labour and cervical length of more than 15 mm do not require therapy in the form of tocolysis (27). There is, however, a paucity of studies examining cervical length measurement as a triage tool in symptomatic women. Accordingly, the Cochrane review by Berghella et al. concludes that there is insufficient evidence to recommend routine screening of cervical length in asymptomatic and symptomatic women at risk for preterm birth (28). Accurate measurement of cervical length also requires skill and expertise in sonography, may make this inappropriate for routine practice in overburdened, often understaffed, busy public obstetric centres.

The algorithm for the management of suspected preterm labour proposed by Lockwood (29) includes a combination of clinical examination, cervical length measurement and foetal fibronectin testing. The aim is to distinguish between women where preterm labour is likely, and interventions are therefore necessary, and those women where preterm labour is unlikely, and can be safely discharged home.

The effectiveness of such an approach is not in question, but the high cost and expertise required to implement such a management approach is a limiting factor. Hiersch et al. and Melamed et al. both showed that when only cervical length screening was performed, thereby reducing the laboratory costs of foetal fibronectin testing, prediction of preterm birth was quite poor (30).

It is this diagnostic dilemma that makes the correct assessment and management of women presenting in suspected preterm labour challenging. In a resource poor and overburdened health care system such as South Africa, particularly where patients are often seen by junior and less experienced doctors, this difficulty may equate to some women not receiving the care and interventions they require, while others may be over-treated. Therefore, it is imperative to discern between women at high risk for preterm birth and those at low risk.

2.7. Prevention of Preterm Births and Management of Preterm Labour

Jay et al. highlighted the interventions necessary to reduce the morbidity and mortality of preterm birth in the Series of papers in the Lancet Journal on Preterm Birth. The interventions can be primary (directed to all women), secondary (aimed at eliminating or reducing existing risk), or tertiary (intended to improve outcomes for preterm infants) (31). Most efforts are directed at tertiary interventions such as appropriate referral systems for higher levels of care, treatment with antenatal corticosteroids, tocolysis, and possibly magnesium sulphate for neuro-protection. The above-mentioned interventions have all been proven to significantly reduce neonatal morbidity and mortality related to prematurity.

Therefore, there is a dire need for highlighting of relevant primary and secondary preventable factors in clinical studies. Chao et al. conducted a prospective observational study in Texas, America, of women with symptoms of labour within the preterm gestational period (32). The objective was to evaluate the natural history of pregnancies in women that present with preterm labour, and to assess outcomes of those women sent home with a diagnosis of false preterm labour. Outcomes of women sent home were compared to a general obstetric population that delivered during the same period. Their study evaluated demographic and obstetric characteristics of the women meeting their inclusion criteria for non-interventional management and assessed the interval between presentation and delivery. Of 690 women who were discharged home without intervention after presenting with symptoms of preterm labour, namely uterine contractions, lower abdominal pain, lower back pain, pressure and vaginal discharge but with cervical dilatation less than 2 cm, only 13 (2%) delivered before 34 weeks. The study revealed that women sent home had a similar rate of preterm birth as the general population, and that

there was no difference in neonatal mortality rates, despite not receiving interventions aimed at improving neonatal outcomes.

In resource poor countries, the cost of health care is ever increasing, and unnecessary admissions and management of threatened preterm labour worsens the financial burden. This effect is also felt in resource rich countries. An American study by Lucovnik in 2011 identified that the total cost of unnecessary admissions and treatment for threatened preterm labour in one year was more than a million dollars, with a mean cost of $20 373 for each patient (33). Although there are no current calculations of cost to the state in a South African context available, Metro East's statistics for admissions into Tygerberg Hospital's antenatal wards between the period January 2013 and May 2015 show on average 300 patients a month are admitted to the antenatal ward of Tygerberg Hospital. A significant proportion of these women are admitted for threatened preterm labour. The outcome of these pregnancies has never been followed up to assess need for admission and timing of delivery. The costs from these admissions could be distributed to much more necessary and vital endeavours.

With any hospital admission, the other risks to consider are infections and unnecessary caesarean deliveries from cardiotocograph abnormalities. Thus, the importance of correct identification of risk factors will reduce both unnecessary admissions, but also assist in identification of pregnancies at high risk for preterm labour, and institute the correct management strategies. This would ultimately reduce the strain on an already overburdened health system.

Currently, the protocol at Tygerberg Hospital for the acute management of spontaneous preterm labour highlights the importance of correct diagnosis of preterm labour, and the identification of relevant risk factors in the patient's current pregnancy or those identified on history of the previous pregnancies (34).

Concerns on past obstetric history include previous 2nd trimester pregnancy losses, previous preterm births and previous cervical procedures. Concerns in the current pregnancy include recent history of genito-urinary infection, multiple pregnancy, hypertensive disease or other medical conditions, antepartum haemorrhage, polyhydramnios, domestic violence and previous abdominal surgery.

Management for those without clear cervical changes but regular uterine contractions is divided into two groups: for those identified to have a low background risk for preterm labour and those that have been identified as having high risk for preterm labour. Ones with low risk profile are not admitted, only observed, thereby reducing unnecessary interventions. Those deemed high risk are admitted irrespective of whether there are cervical changes or not. Tertiary management in the form of tocolysis and corticosteroids for lung maturity is only initiated once the diagnosis of preterm labour has been confirmed.

Although determination of cervical length with trans-vaginal ultrasound forms part of the Tygerberg Hospital protocol, this can only be done by accredited medical staff that have been assessed by the ultrasound unit. For this reason, a clinical assessment with digital vaginal examination is usually the norm. Management is thus determined on history and simple clinical examination.

2.8. Conclusion

Thus, although preterm birth and preterm labour are well described, the problems with prediction and prevention mean that it continues to be a burden on the health care system worldwide.

Although the recognised interventions improve outcomes, this is based on correct identification of risk factors and correct diagnosis and treatment of the condition. Although there are recognised criteria to risk stratify women into high and low risk, the necessary interventions are often used ineffectively because of the unavailability of resources and expertise. At present, there are also still no uniform clinical criteria that are internationally accepted to risk stratify these women. The only true marker of preterm labour after all is preterm birth.

The evaluation of the assessment and management of women presenting in threatened preterm labour in our setting will thus reveal aspects of our care that could be improved. Better understanding of the risk factors for preterm birth in our clinical setting, will also assist us in ensuring that interventions are directed towards women who will benefit from them, while reducing unnecessary admissions, ultimately assisting us in providing safe, obstetric care within resource constraints.

3. OUTCOMES OF THIS STUDY

3.1. Primary outcome

3.1.1. To determine the incidence of preterm birth in women who present in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital.

3.2. Secondary outcome

3.2.1. To identify demographic and obstetric characteristics of women presenting in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital.

3.2.2. To describe the management performed for women presenting in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital.

3.2.3. To assess the obstetric outcomes of women presenting in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital.

3.2.4. To assess the neonatal outcomes of the babies delivered by women presenting in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital

3.2.5. To determine risk factors for preterm delivery in women presenting in suspected preterm labour between 24 and 34 weeks at Tygerberg Hospital.

4. METHODOLOGY

4.1. Description of study design

The study was a retrospective descriptive audit of all women who presented to TBH with suspected preterm labour between 24 and 34 weeks gestation in a predetermined 6-month period from 01/01/2015 to 30/06/2015. Review of the follow-up of the women was done for a period three months post inclusion into the study to identify gestational age at delivery.

4.2. Inclusion criteria

- All women who presented to Tygerberg Hospital with a singleton intrauterine pregnancy with intact membranes and symptoms of suspected preterm labour.
    - The Tygerberg protocol definition of preterm labour include the presence of documented regular uterine contractions (at least one every 10 minutes) with documented cervical changes (dilatation of greater than 2cm at internal os and cervical length less than 1cm) or confirmed rupture of membranes.
    - Threatened preterm labour is defined as presumed labour with documented regular uterine contractions in the absence of cervical changes.
- Gestational age between 24 and 34 weeks, if gestation was known, or between 500 and 1850g, where gestational age was uncertain.

4.3. Exclusion criteria

- Women who presented with suspected preterm labour with gestational age less than 24 weeks or estimated foetal weight less than 500grams
- Women who presented with suspected preterm labour with gestational age more than 34 weeks or estimated foetal weight more than 1850grams
- Multiple pregnancies
- Spontaneous rupture of membranes
- Active labour with cervical dilatation greater than 4 cm
- Significant antepartum haemorrhage
- Hypertensive disorders of pregnancy
- Severe maternal medical illness
- Foetal distress
- Foetal demise
- Iatrogenic cause for preterm labour

4.4. Duration of Study

- The study included the 6-month period from 00:00 01/01/2015 to 23:59 30/06/2015. Follow up was done for a period of three months post inclusion into the study to determine gestational age at delivery.

4.5. Study Population

All women that presented to Tygerberg Hospital between 01/01/2015 and 30/06/2015 and fit the inclusion criteria were included.

4.6. Sample size and sampling method

The sample group included all women presenting to Tygerberg Hospital in the specified 6-month period fulfilling the inclusion criteria for the study. Currently, all women presenting to Tygerberg Hospital must be admitted via the triage area in labour ward. The only exceptions are those with severe illness, or where delivery is expected to be imminent. Because these women would not be included into the study, it is expected that all women fulfilling the inclusion criteria would go via this Triage area.

Not all women with preterm labour were included in the study. Women where the diagnosis was certain or where delivery was imminent were excluded. This included women with cervical dilatation of more than 4 cm or where membranes were ruptured. The women with preterm prelabour rupture of membranes were excluded as they have a separate set of protocols for further management and are managed expectantly till 34 weeks gestation and then electively delivered. Any women that presented with symptoms of preterm labour but with any other maternal or foetal complication were also excluded as management would differ and be directed towards the other pregnancy complications. These complications include hypertension, vaginal bleeding, foetal compromise or death or maternal medical illness.

Women were identified by the principal investigator with the aid of the admission register that is in the obstetrics triage area. Details including the demographic information and current gestation at presentation were captured. Patient records at Tygerberg Hospital are stored electronically on the TBH OpenText ECM system. All patient files were accessed electronically via the TBH OpenText ECM system to obtain clinical records.

Records were reviewed, and data were captured in the following categories:

- General findings on history/ demographics: age, parity, antenatal care, HIV status

- Obstetric (previous obstetric history): previous miscarriages, previous preterm births
- Current presentation details: gestational age, symptoms of preterm labour
- Interventions/ management modalities used
- Delivery: gestational age at delivery, mode of delivery, birth weight, APGARS and neonatal outcome where available

All women that were included into the study were then reviewed three months after presentation on the Clinicom system. Files not available were from women not delivering at Tygerberg Hospital and these were excluded from the analysis.

5. BUDGET AND IMPACT ON CURRENT WORK LOAD

The retrospective review of case files by the principal investigator did not impact on any aspect of patient management and did not add any further duress on daily workload. Electronic identification of the patients negated any increase in workload for postnatal staff or clinics within Tygerberg Hospital. Minimal costs were encountered as data was sourced and captured electronically. Financing of minor expenses was done by the principal investigator.

6. TIME PLAN AND LOGISTICS

The identification of women meeting inclusion criteria commenced immediately after ethical approval was obtained. Retrospective review of case files commenced thereafter. Files were reviewed, and data captured within 1 year of commencement of case reviews. Data was then processed within 2 years of ethical approval, and conclusions made with feedback provided to relevant health professionals at this time. The areas identified in the study that could improve patient care will be presented to senior administrators with the aim of initiating interventions where feasible.

7. DATA MANAGEMENT AND STATISTICS

Data were collected and captured electronically by the principal investigator and assessed by the study supervisor. All data were treated with strict confidentiality and all records were kept anonymous by assigning a research code to each individual. As the code was used whilst collecting data, the women themselves were not

identifiable. This ensured a process of de-identification whereby the data could be re-linked in future depending on research needs. All data and codes were kept on the secure, password protected computer of the study supervisor and principle investigator. This data was only accessible to the principal investigator and the study supervisor. The data will be stored on these secure computers for a minimum time period of 15 years.

Data were collected using Microsoft Excel® spreadsheets and statistical evaluation and analysis were done using Stata version 14. Data were represented in different ways in the study. Firstly, data were presented descriptively. Continuous data were presented using means and standard deviations with 95% confidence intervals for the population for normally distributed data. This data was presented graphically using bar and pie charts.

The primary aim of the study was to determine the risk of preterm birth in women presenting in suspected preterm labour at Tygerberg Hospital. This objective is descriptive in nature and was analysed using the aforementioned methodology. The secondary objective was determining the factors associated with suspected preterm labour and this was done using a univariate analysis of the individual factors. A two-sample t-test was performed with equal variance comparing the women that were admitted as preterm labour versus those discharged after initial evaluation. In order to identify statistically significant factors predisposing to preterm birth, cross-tabulation of the outcome variable interval to delivery with categorical factors from antenatal demographic and obstetric characteristics, and obstetric outcome were done, and the chi-square test association was performed to compare the group admitted and evaluated against the group not admitted. The distribution of interval to delivery was therefore reported and compared between each level of the factors.

8. ETHICAL CONSIDERATIONS

Sound ethical principles were incorporated throughout the consideration and design of the study. The aim was to investigate an aspect of patient care that needed clarification and improvement, and that would benefit the clinician in aiding with bettering clinical management. Knowledge obtained from the study was aimed at guiding protocols and assisting with future patient care.

The retrospective nature of the study ensured that no patient was victimised or adversely affected by the study. Confidentiality and anonymity were of utmost priority to the investigators, and patient rights were maintained throughout the study.

The study methodology ensured that there was no inconvenience to any patient, and that there were no cost implications to any of the women. There was no additional time or work constraints on any of the Tygerberg or Metro East health facility staff. The benefits of the research could be far reaching, in both a financial and clinical way, thereby being of particular importance in our resource poor setting. For this, ethical approval was sought and obtained from the Health Research Committee of the University of Stellenbosch (Ref no S16/01/012) .

9. INFORMED CONSENT

The study involved retrospective case reviews with no contact with women directly, and so we found the waiving of informed consent justified. The benefit from the study is to the entire population that is serviced by the hospital, and there will be possible interventions that will reduce morbidity and mortality involved with preterm birth.

10. RESULTS

10.1. Background of Selected Population of Women Included in the Study

A total of five thousand one hundred and three (5103) patient encounters were documented in the Tygerberg Hospital triage register during the study time-period (01 Jan 2015 to 30 June 2015). During this period, there were three thousand nine hundred and forty (3940) babies delivered. All these entries were assessed manually and of these files, three hundred and sixty-two (362) files were audited and identified as having been low risk women presenting with suspected preterm labour at gestations fulfilling the inclusion criteria of the study i.e. twenty-four weeks (24) to thirty-four weeks (34). One hundred (100) of these women were included in the study as they fulfilled all the inclusion criteria (Fig 10.1.1). Approximately two thirds (68%) of these women were diagnosed as true preterm labour and admitted for further evaluation and management. The remaining one third (32%) were diagnosed as false preterm labour and discharged after initial evaluation (Fig 10.1.2). Six (6) women had multiple presentations for threatened or spontaneous preterm labour, of which 2 women had more than 3 encounters. Of all the women included in the study, 42% delivered at a gestation less than or equal to thirty-four (34) weeks.

Of the two hundred and sixty-two (262) women excluded, one hundred and two (102) had preterm prelabour rupture of membranes (PPROM), sixty (60) were in active labour with cervical dilatation greater than 4cm, and one hundred (100) had incomplete records as they did not have any record of having delivered in Tygerberg Hospital. According to referral criteria at Tygerberg, low risk women at gestations greater than thirty-five (35) weeks are down referred to lower levels of care. Of the 3940 deliveries, a total of 102 low risk women (42 women included in the study, 60 women in active labour at presentation) that presented with suspected preterm labour had preterm births with gestational age less than or equal to 34 weeks. Thus, the incidence of preterm birth from suspected preterm labour for the study period was 2.59%. The women with PPROM were excluded as they have a separate set protocols for further management and are managed expectantly till 34 weeks gestation and then electively delivered.

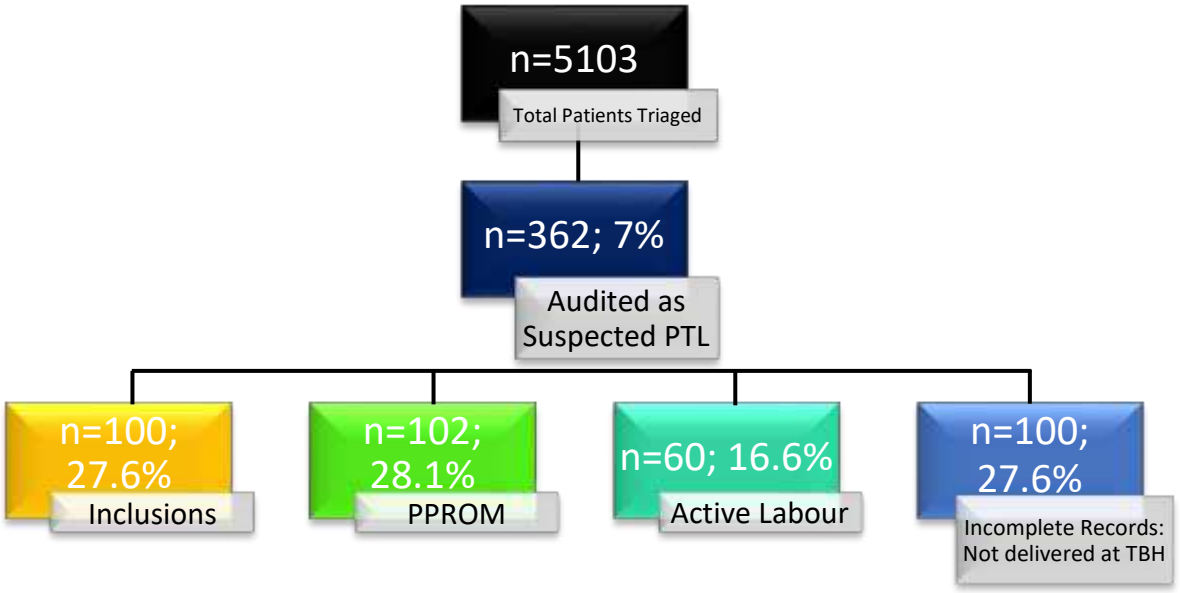

Figure 10.1.1 – Background Profile

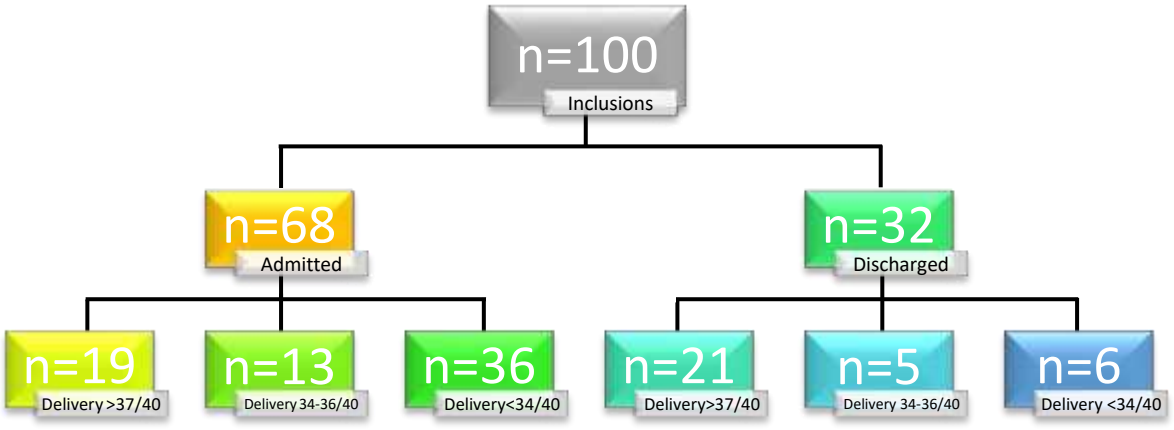

Figure 10.1.2 – Delivery Outcomes Differentiating Admissions versus Discharges

10.2. Demographics Characteristics of Selected Population of Women Included in the Study (n=100)

Age (Years)	
Mean	27 [16-43]
Less than 20 Years Old	13
20 to 29 Years Old	**53**
Greater than 30 Years Old	34
Gravidity	
Gravida 1	28
Gravida 2	20
Gravida >2	**52**
BMI	
Mean	28.2 [17-54]
Previous Preterm Birth/Trimester 2 Miscarriage	
No Losses	**72**
1 Loss	17
≥2 Losses	11
ANC Visits	
<4 Visits	29
≥4 Visits	**71**
Substance Abuse	
Smoking	33
Alcohol	15
Drugs	8
Polysubstance	18

Table 10.2.1 – Demographic Characteristics

The median age of the patient population was 27 years with a range of 16 to 43 years. Ten percent (10%) of women were younger than 18 or older than 40 years of age. Teenagers (13-19) comprised 13 percent of the sample. Those between 20 and 29 years of age comprised 50 percent (Figure 10.2.1).

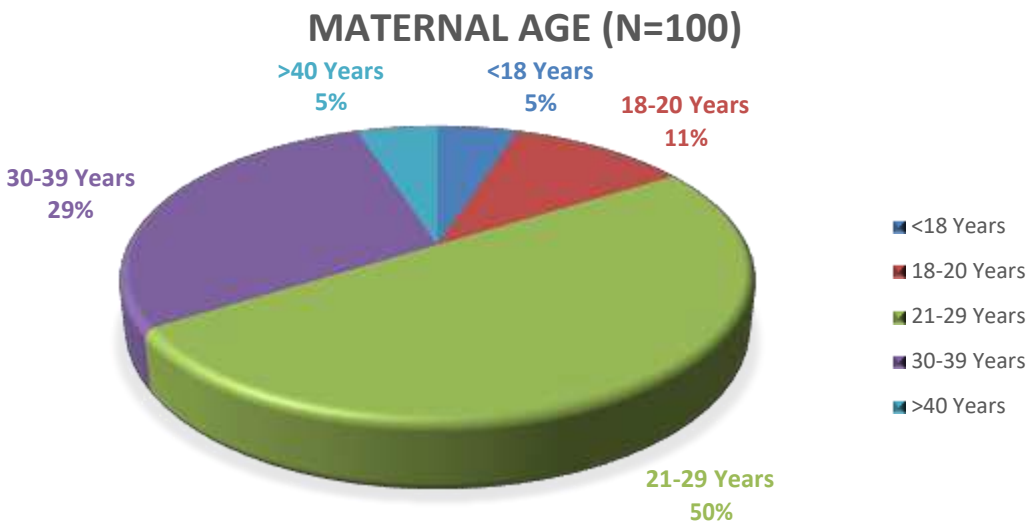

Figure 10.2.1 – Age Distribution of Sample

Twenty eight percent (28%) of women were primiparous. A further 20% of the women were in their second pregnancy.

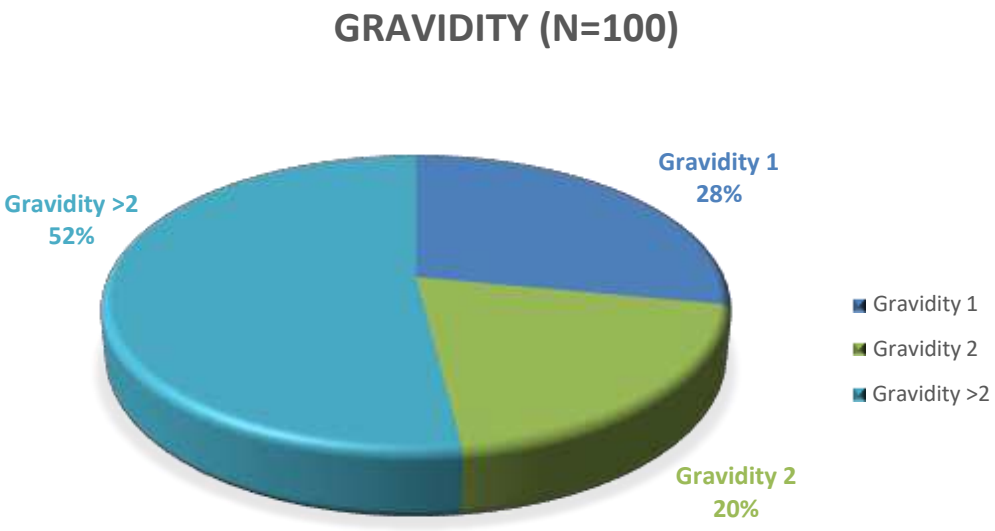

Figure 10.2.2 – Gravidity of Sample

The average BMI was raised at 28.2 with a range of 17 to 54. Approximately one third of women (34%) had a normal BMI between 18.5 and 24.5 kg/m^2.

Seventy two percent (72%) of women had no history of previous second trimester losses or preterm births. Only 11% of women had the prescribed 2 or more losses or preterm births to be deemed high risk for preterm labour.

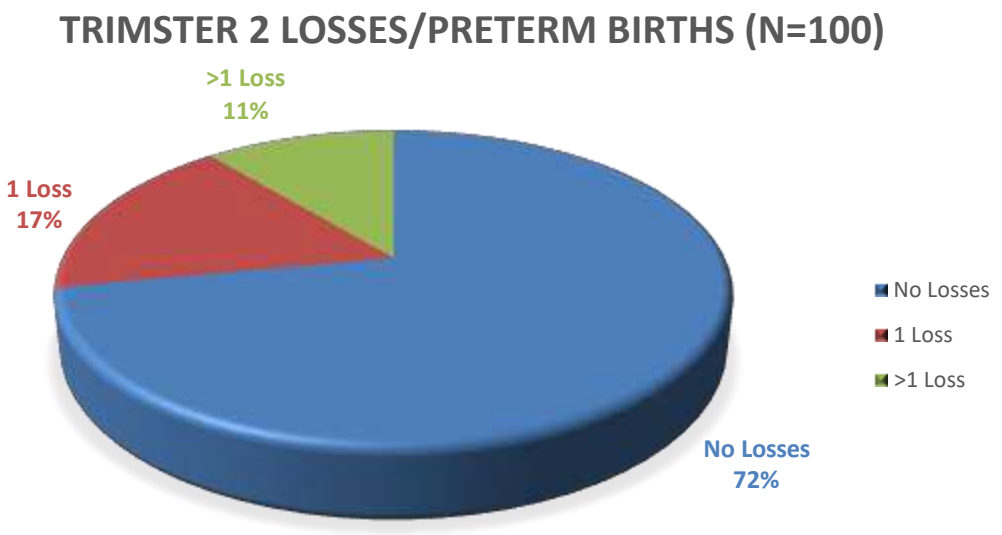

Figure 10.2.3 – Previous Trimester 2 Losses/Preterm Births

Seventy one percent (71%) of women had greater than or equal to 4 ante natal clinic visits prior to presentation with suspected preterm labour.

Polysubstance abuse was present in 18% of women. Sixty five percent (65%) of women noted no substances abuse.

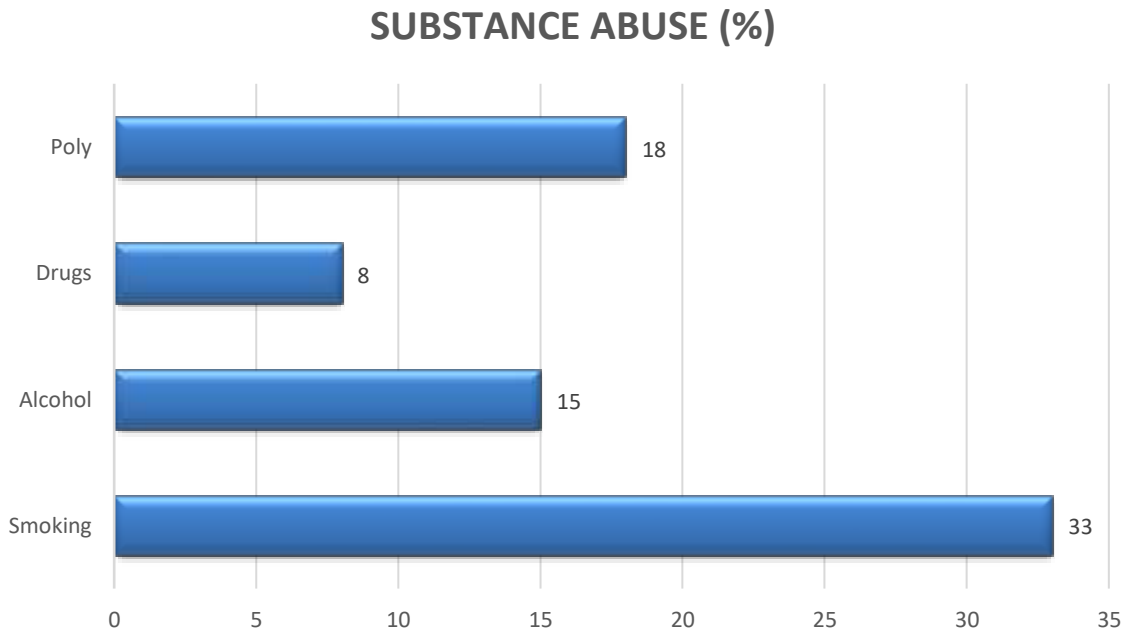

Figure 10.2.4 – Substance Abuse

10.3. Obstetric Characteristics of Selected Population of Women Included in the Study (n=100)

Gestation at Presentation (Weeks)	
Mean	29.7 [SD 2.6]
24 Weeks to 28 Weeks	32
29 Weeks to 34 Weeks	**68**
Symptoms	
None	3
Pain and Show	32
Pain Only	**62**
Show Only	3
Cervical Dilatation (cm)	
Unknown	1
<1cm Dilated	**39**
1-2cm Dilated	**41**
>2cm Dilated	19
Length of Cervix (mm)	
Unknown	7
<10mm Length	**20**
10-20mm Length	**30**
20-30mm Length	17
>30mm Length	26

Table 10.3.1 – Obstetric Characteristics

The mean gestational age of presentation was 29.7 weeks with a standard deviation of 2.6 weeks. Sixteen percent (16%) of women presented at a pre-viable gestation of before 27 weeks according to Tygerberg Hospital viability criteria. Thirty two percent (32%) of women presented from 32 weeks gestation till the exclusion criteria of 34 weeks gestation.

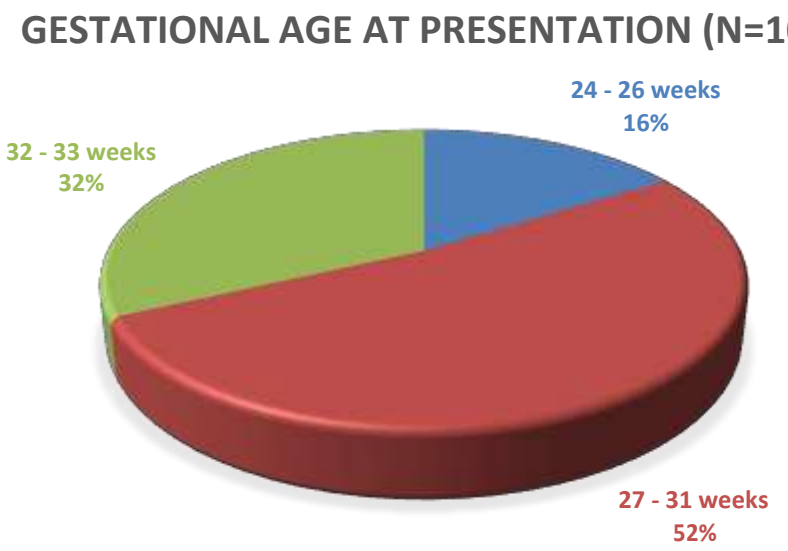

Figure 10.3.1 – Gestation Age at Presentation

Sixty two percent (62%) of women presented with only lower abdominal pain as the chief complaint. Thirty two percent (32%) of women presented with both pain and a show.

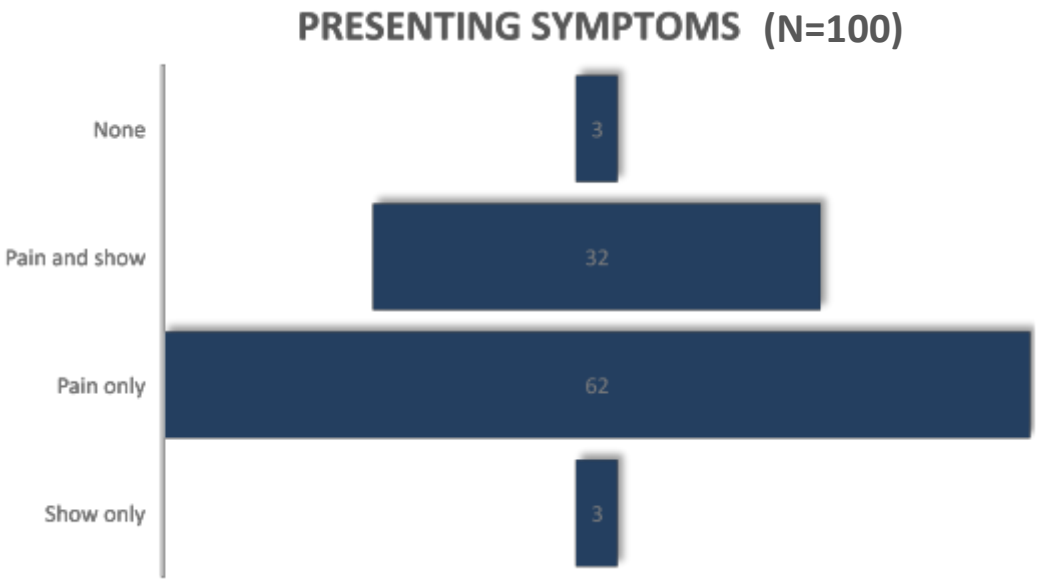

Figure 10.3.2 – Symptoms at Presentation

Only 19% of women had an initial cervical evaluation that showed a dilatation of more than 2 cm. Forty-one percent (41%) of women had a cervical dilatation of between 1 and 2 cm. Thirty nine percent (39%) of women had a cervical dilatation noted to be less than 1cm.

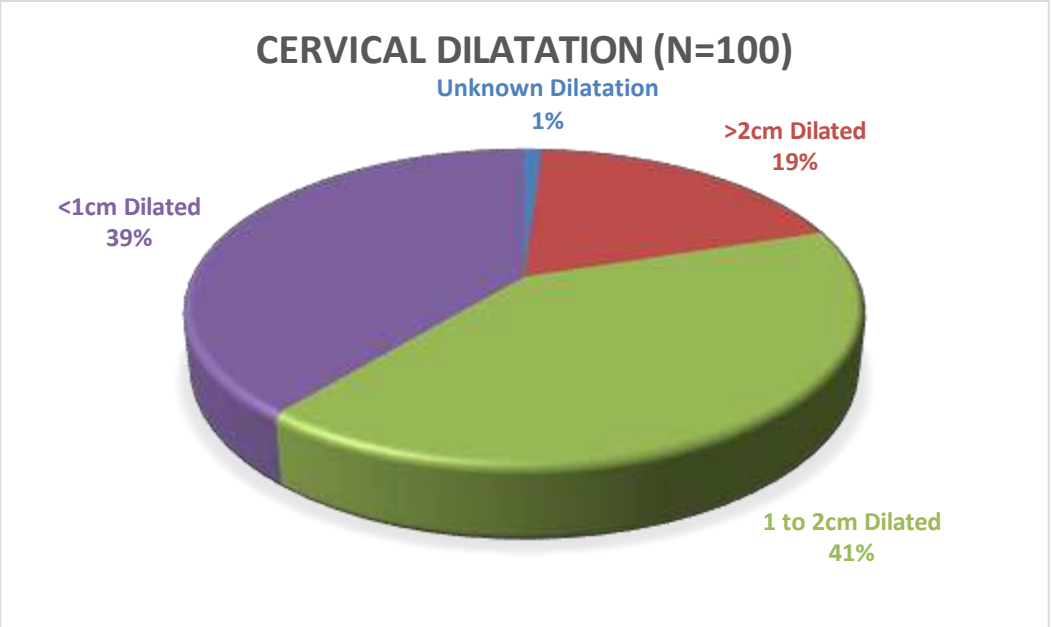

Figure 10.3.3 – Cervical Dilatation at Presentation

Twenty six percent (26%) of women had a cervical length of greater than 30mm at initial evaluation. Twenty percent (20%) of women had a cervical length of less than 10mm. In total 50% of the women had a cervical length less than 20mm.

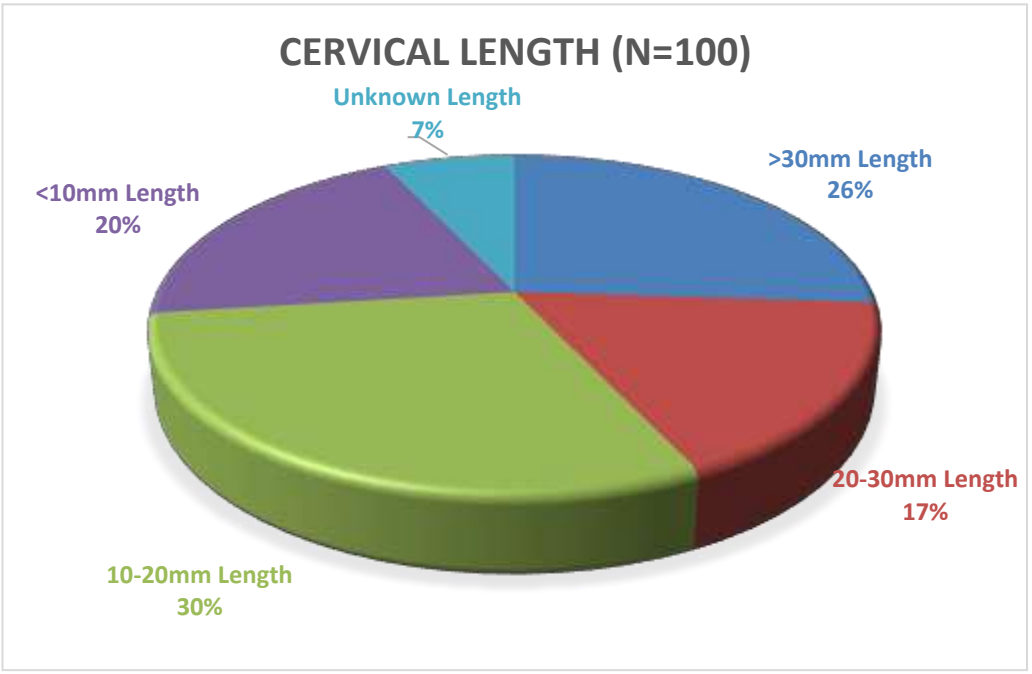

Figure 10.3.4 – Cervical Length at Presentation

10.4. Management of The Selected Population of Women Included in The Study Comparing Those Admitted as True Preterm Labour Versus Those Diagnosed as False Preterm Labour and Discharged Home After Initial Evaluation

In total 68% of the women were diagnosed with preterm labour and admitted for further management. The differences in management strategies are noted in the table below.

Characteristic	Women Diagnosed with False PTL and DC Home (n=32)	Women Diagnosed with PTL and Admitted (n=68)	p Value
Criteria Met for PTL			**<0.001**
Yes	1(3)	27(40)	
No	30(94)	41(60)	
Unknown	1(3)	0	
Diagnostic Tests Used			**<0.001**
None	5(16)	44(65)	
Ultrasound Cervical Length	0	7(10)	
Clinical Cervical Change	27(84)	17(25)	
Steroids Given			**<0.001**
Yes	2(6)	61(90)	
No	30(94)	7(10)	
Suppression Given			**<0.001**
Yes	1(3)	53(78)	
No	31(97)	15(22)	
Antibiotics Given			**<0.001**
Yes	1(3)	59(87)	
No	31(97)	9(13)	
Data are n(%) unless otherwise specified			

Table 10.4.1 – Management Characteristics

Of the 68 women admitted, 27(40%) fulfilled the Tygerberg protocol for diagnosis of preterm labour. Of the 32 women discharged home, 1(3%) met the criteria for preterm labour.

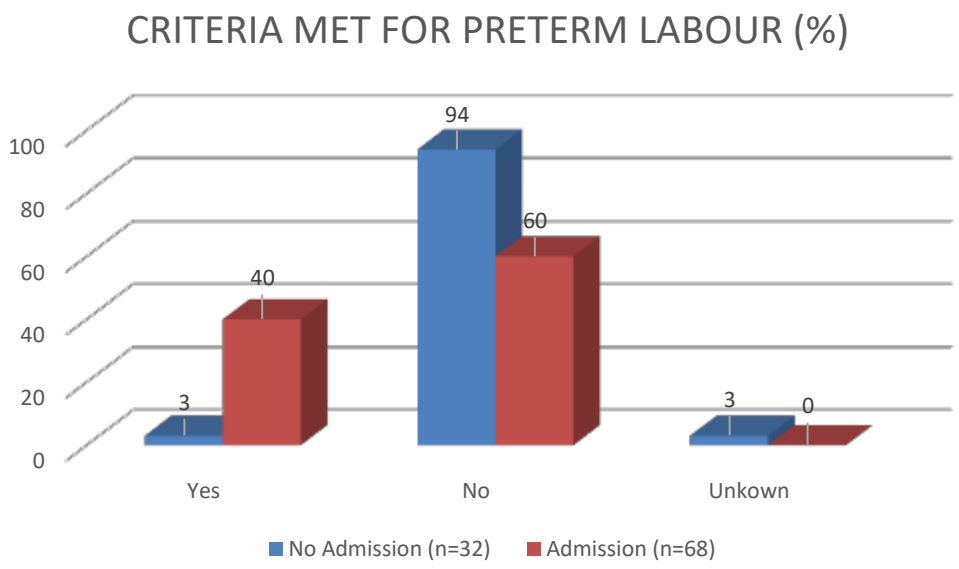

Figure 10.4.1 – Criteria Met for PTL Comparing False PTL vs True PTL

Forty nine percent (49%) of the women had no diagnostic tests done to assess if preterm labour was present. Seven percent (7%) of women had a cervical length performed by ultrasound. Forty four percent (44%) of women had assessment of cervical change over a time period. For the women admitted, 65% had no diagnostic tests done to confirm preterm labour.

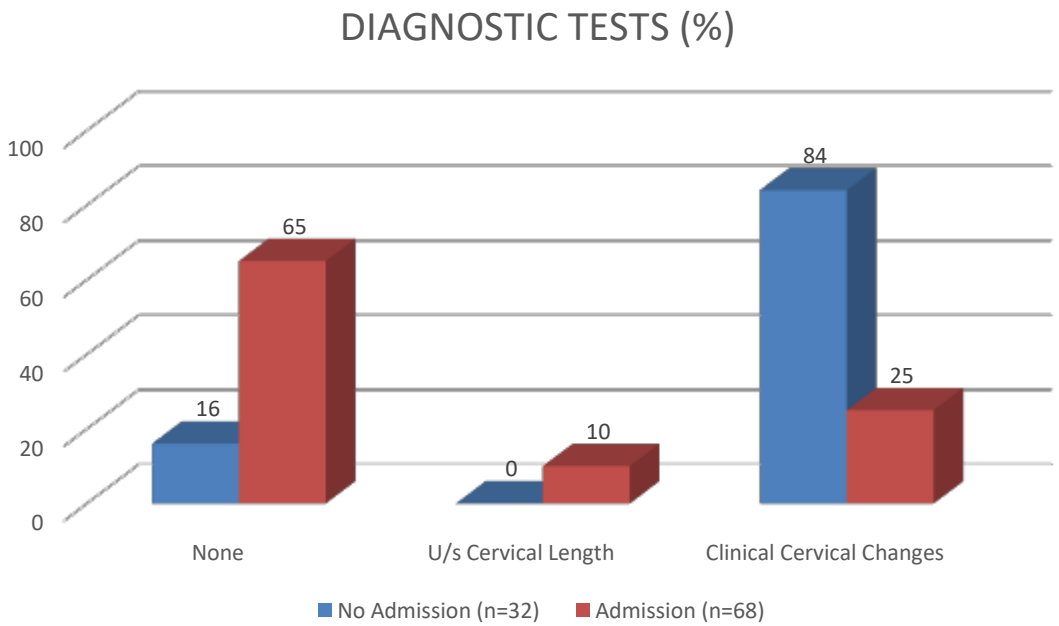

Figure 10.4.2 – Diagnostic Tests Used Comparing False PTL vs True PTL

Of the 68 women admitted, 61(89.7%) had betamethasone given, 53(77.9%) had labour suppressed, and 59(86.7%) had antibiotics administered.

For the 32 women not admitted, betamethasone was given to 2(6%), labour suppression initiated in 1(3%), and antibiotics given to 1(3%).

10.5. Obstetric Outcome of The Selected Population of Women Included in The Study Comparing Those Admitted as True Preterm Labour Versus Those Diagnosed as False Preterm Labour and Discharged Home After Initial Evaluation

Characteristic	Women Diagnosed not to Have PTL and DC Home (n=32)	Women Diagnosed with PTL and Admitted (n=68)	p Value
Gestational Age at Delivery			**<0.001**
Mean	37 ± 3.5	33.7 ± 4.1	
<34 weeks	6(19)	36(53)	
34 - 37 weeks	5(16)	13(19)	
>37 weeks	21(65)	19(28)	
Interval to Delivery			**0.001**
>4 weeks	26(81)	29(43)	
2-4 weeks	3(9)	5(7)	
1-2 weeks	1(3)	5(7)	
<1 week	2(6)	29(43)	
Route of Delivery			**0.001**
NVD	13(41)	50(74)	
C/s	19(59)	18(26)	
Data are n(%) or mean ± standard deviation unless otherwise specified			

Table 10.5.1 – Obstetric Outcomes Comparing False PTL vs True PTL

The mean gestation at delivery for those women discharged home as false preterm labour after initial evaluation was 37 weeks with a standard deviation of 3.5 weeks. The mean gestation of delivery for those women admitted as true preterm labour was 33.7 weeks with a standard deviation of 4.1 weeks. There was a statistically significant difference in the mean gestation at delivery between those women admitted as preterm labour and those women discharged home after initial evaluation($P<0.001$). Thirty-six (52.9%) of the women admitted delivered at a gestation less than 34 weeks. Six (18%) of the women discharged home after initial evaluation delivered less than 34 weeks gestation.

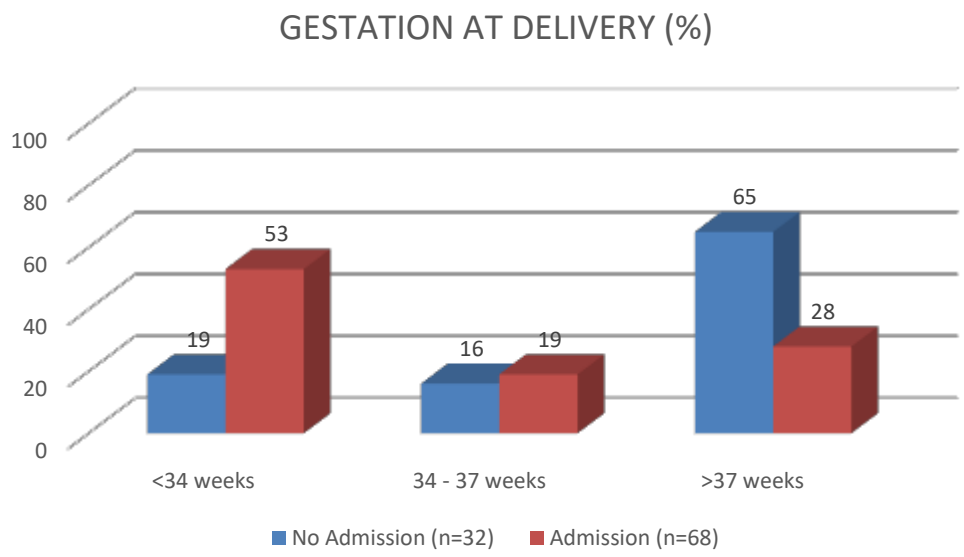

Figure 10.5.1 – Gestational Age at Delivery Comparing False PTL vs True PTL

There was a greater than 4-week interval to delivery time from time of presentation to time of delivery in 26 (81.2%) of women discharged home after initial evaluation. Of those admitted 29 (42.6) had an interval to delivery time of greater than 4 weeks.

Two women (6.25%) discharged home after initial evaluation had an interval to delivery time of less than 1 week. Twenty-nine women (42.6%) admitted had an interval to delivery time of less than 1 week.

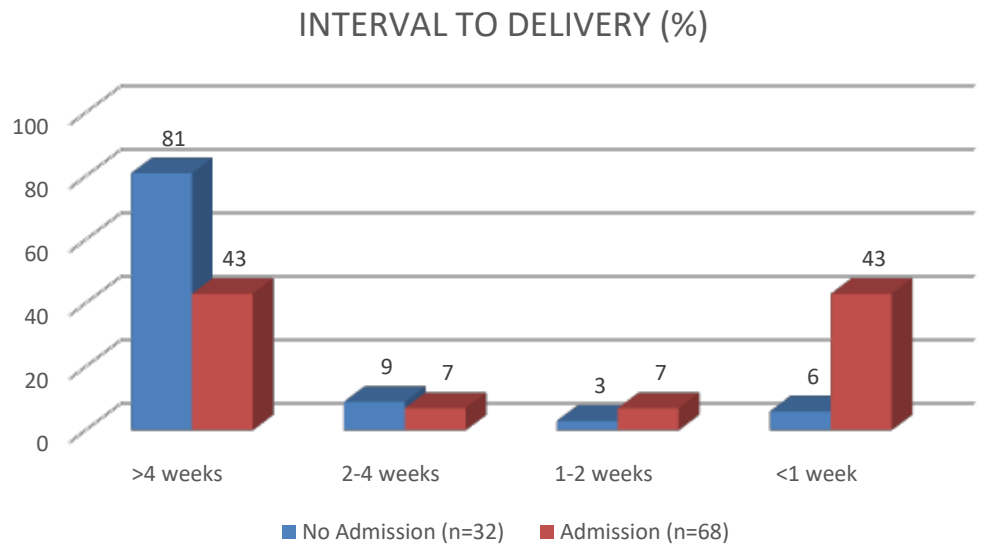

Figure 10.5.2 – Interval to Delivery Comparing False PTL vs True PTL

Fifty (73.5%) of the women diagnosed with preterm labour and admitted delivered via normal vaginal delivery. Thirteen (40.6%) of the women discharged home after initial evaluation delivered via normal vaginal delivery.

10.6. Neonatal Outcomes of The Selected Population of Women Included in The Study Comparing Those Admitted as True Preterm Labour Versus Those Diagnosed as False Preterm Labour and Discharged Home After Initial Evaluation

Characteristic	Women Diagnosed not to Have PTL and DC Home (n=32)	Women Diagnosed with PTL and Admitted (n=68)	p Value
Birth Weight			**<0.001**
Mean	2982 ± 916g	2184 ± 852g	
<1500gr	2(6)	17(25)	
1500-2500gr	9(28)	28(41)	
>2500gr	21(66)	23(34)	
NICU Admission			**<0.001**
Yes	6(19)	29(43)	
No	26(81)	39(57)	
Stillborn			
Yes	0	0	
No	32(100)	68(100)	
APGAR<7 at 5 min			**0.9**
Yes	1(3)	5(7)	
No	31(97)	63(93)	
Data are n(%) or mean ± standard deviation unless otherwise specified			

Table 10.6.1 – Neonatal Outcomes Comparing False PTL vs True PTL

Mean birth weight of the babies of women discharged home after initial evaluation was 2982g with a standard deviation of 916g. There was a statistically significant lower mean birth weight of 2184g for the babies of the women admitted as preterm labour with a standard deviation of 852 g.

Seventeen (25%) of the women admitted delivered a baby with a birthweight of less than 1500g. Two (5.25%) of the women discharged home as false preterm labour delivered a baby with birth weight less than 1500g. A third (33.8%) of the women

admitted as true preterm labour delivered a baby with a birthweight of more than 2500g. Twenty-one (65.6%) of the women discharged home as false preterm labour delivered a baby with a birth weight of more than 2500g.

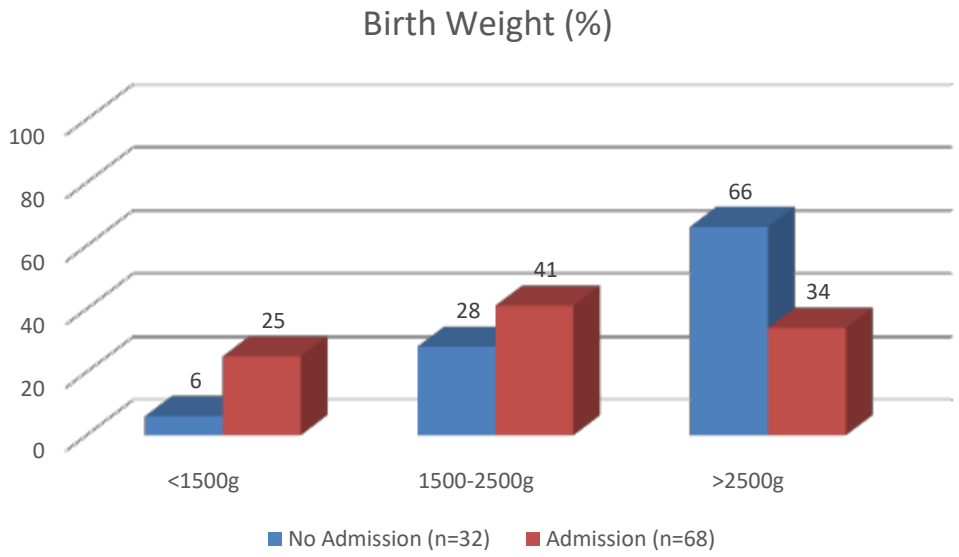

Figure 10.6.1 – Birth Weight Comparing False PTL vs True PTL

There was a statistically significant difference in NICU admission comparing babies delivered to mothers that were not admitted versus those admitted. Twenty-nine (29) (42.6%) babies delivered to mothers admitted had NICU admissions. Six (6) (18.75%) babies delivered to mothers discharged after initial evaluation needed NICU admission.

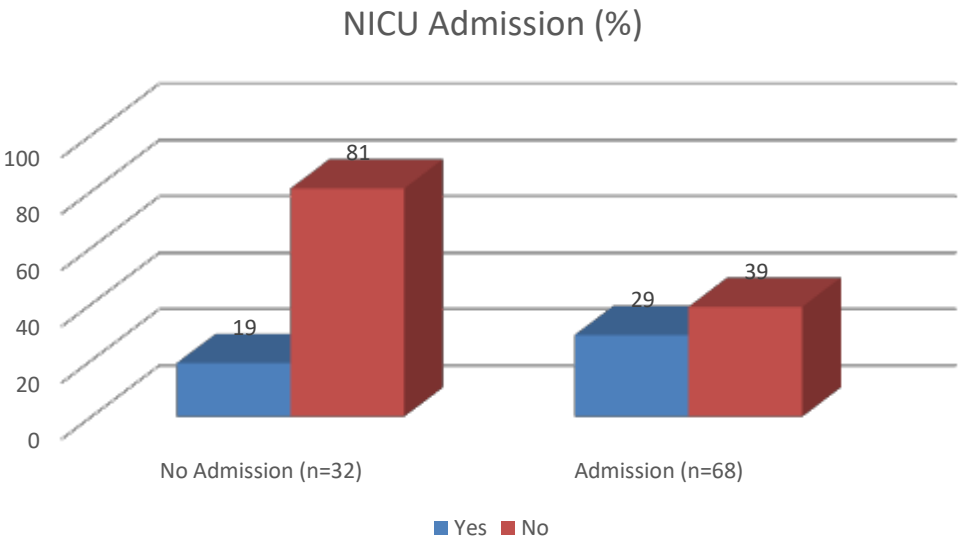

Figure 10.6.2 – NICU Admission Comparing False PTL vs True PTL

All the babies in the sample population were born alive.

One (3%) of the babies in the group of women not admitted had a 5-minute APGAR of less than 7 points, whilst 5(7%) babies had a low APGAR in the group of women admitted. This was not statistically significant.

10.7. Findings Predicting Interval to Delivery in Women Presenting with Suspected Preterm Labour

	Interval from Presentation to Delivery					
Characteristic	>4 Weeks (n=55)	2-4 Weeks (n=8)	1-2 Weeks (n=6)	<1 Week (n=31)	Total	p Value
Demographic Characteristics						
Age						**0.133**
<20 years	4	1	0	8	13	
20-29	29	3	4	17	53	
≥30	22	4	2	6	34	
Total	55	8	6	31	100	
Gravidity						**0.006**
1	9	2	0	17	28	
2	11	2	2	5	20	
>2	35	4	4	9	52	
Total	55	8	6	31	100	
Previous T2 Loss/PTL						**0.014**
0	39	4	4	25	72	
1	9	3	1	4	17	
>1	7	1	1	2	11	
Total	55	8	6	31	100	
HIV Status						**0.429**
Unknown	0	0	0	0	0	
Positive on Rx	13	0	1	7	21	
Positive, no Rx	0	0	0	0	0	

Negative	42	8	5	24	79	
Total	55	8	6	31	100	
ANC Visits						**0.005**
<4	9	4	4	12	29	
≥4	46	4	2	19	71	
Total	55	8	6	31	100	
Smoking						**0.164**
No	42	5	3	17	67	
Yes	13	3	3	14	33	
Total	55	8	6	31	100	
Alcohol						**0.827**
No	48	6	5	26	85	
Yes	7	2	1	5	15	
Total	55	8	6	31	100	
Drugs						**0.690**
No	51	8	5	28	92	
Yes	4	0	1	3	8	
Total	55	8	6	31	100	
Poly-substances						**0.763**
No	47	6	5	24	82	
Yes	8	2	1	7	18	
Total	55	8	6	31	100	
Previous Cerclage						**0.843**
No	54	8	6	31	99	
Yes	1	0	0	0	1	
Total	55	8	6	31	100	

Characteristic	>4 Weeks (n=55)	2-4 Weeks (n=8)	1-2 Weeks (n=6)	<1 Week (n=31)	Total	p Value
Obstetric Characteristics						
Symptoms						**<0.001**

None	2	0	1	0	3	
Pain and Show	10	0	2	20	32	
Pain only	42	8	2	10	62	
Show only	1	0	1	1	3	
Total	55	8	6	31	100	
Cervical Dilatation						**0.001**
Unknown	1	0	0	0	1	
>2cm	3	1	2	13	19	
1 to 2cm	20	4	2	15	41	
<1cm	31	3	2	3	39	
Total	55	8	6	31	100	
Cervical Length						**0.006**
Unknown	5	0	1	1	7	
>3cm	19	2	1	4	26	
2-3cm	12	2	1	2	17	
1-2cm	16	3	2	9	30	
<1cm	3	1	1	15	20	
Total	55	8	6	31	100	
Show Present						**<0.001**
Unknown	1	0	0	0	1	
No	48	7	3	13	71	
Yes	6	1	3	18	28	
Total	55	8	6	31	100	

Characteristic	>4 Weeks (n=55)	2-4 Weeks (n=8)	1-2 Weeks (n=6)	<1 Week (n=31)	Total	p Value
Management Characteristics						
Criteria Met For PTL						**<0.001**
Unknown	1	0	0	0	1	
No	51	7	4	9	71	
Yes	3	1	2	22	28	

Total	55	8	6	31	100	
Diagnostic Tools						**0.167**
None	24	2	4	19	49	
U/s Cervical Length	2	1	1	3	7	
Clinical Cervical Changes	29	5	1	9	44	
Total	55	8	6	31	100	
Admission						**0.001**
No	26	3	1	2	32	
Yes	29	5	5	29	68	
Total	55	8	6	31	100	
BMZ Administration						**<0.001**
No	30	4	0	3	37	
Yes	25	4	6	28	63	
Total	55	8	6	31	100	
Suppression Given						**<0.001**
No	35	6	0	5	46	
Yes	20	2	6	26	54	
Total	55	8	6	31	100	
Antibiotics Given						**<0.001**
No	31	6	0	3	40	
Yes	24	2	6	28	60	
Total	55	8	6	31	100	

Table 10.7.1 – Factors Predicting Interval to Delivery Time

Maternal age had no significant effect on interval to delivery and preterm birth (P0.133).

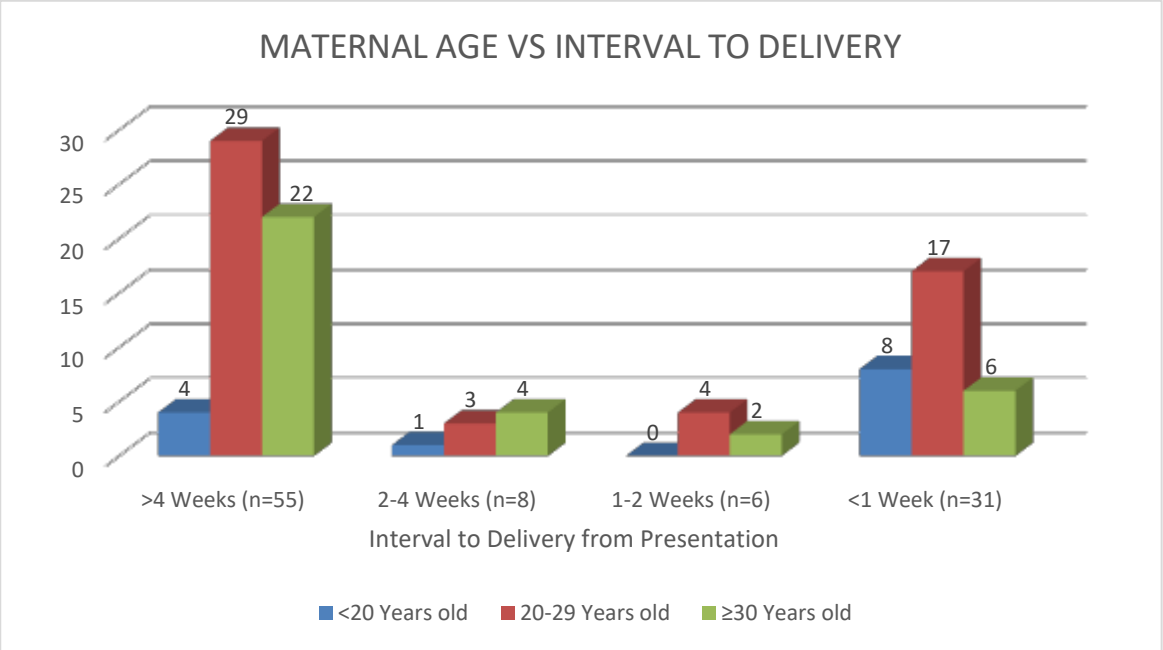

Figure 10.7.1 – Maternal Age as a Risk Factor for Interval to Delivery

Seventy one percent (71%) of deliveries happening within 1 week of presentation were first and second pregnancies. The multigravida women represented 64% of those that delivered more than 4 weeks from presentation.

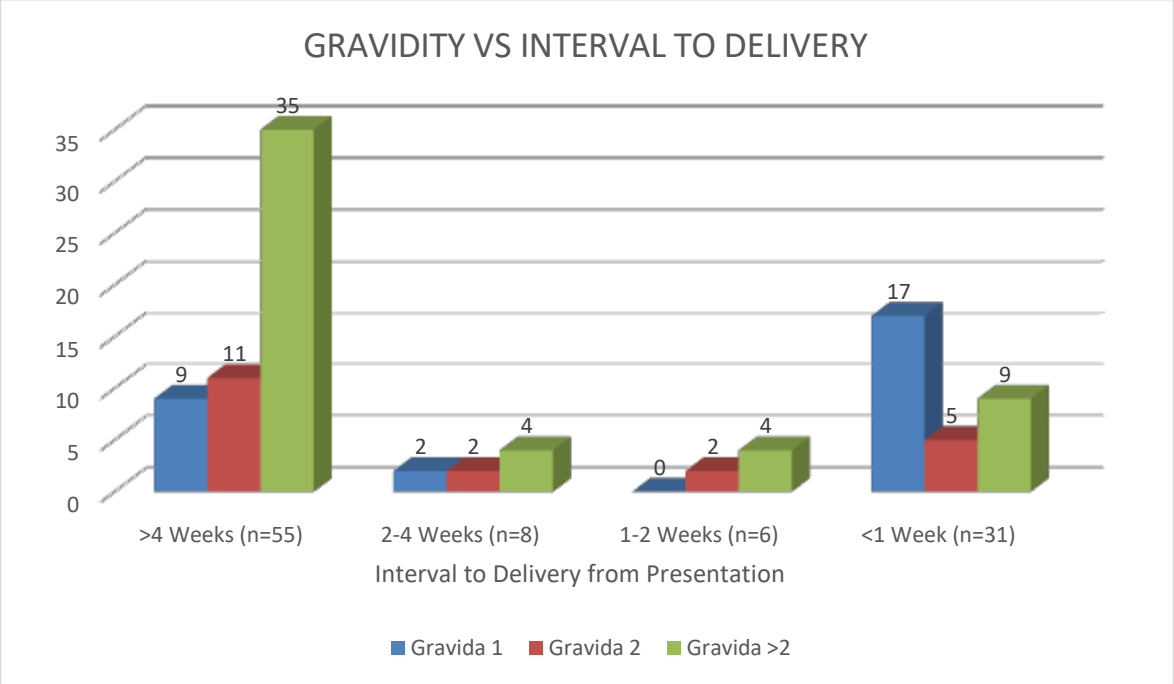

Figure 10.7.2 – Gravidity as a Risk Factor for Interval to Delivery

Eleven women in the sample population were high risk for preterm labour based on previous preterm birth or previous T2 losses. Two (18%) of these women delivered less than one week from presentation. Most (94%) of women who delivered less than one week from presentation had either no previous losses or only one previous loss (P0.014).

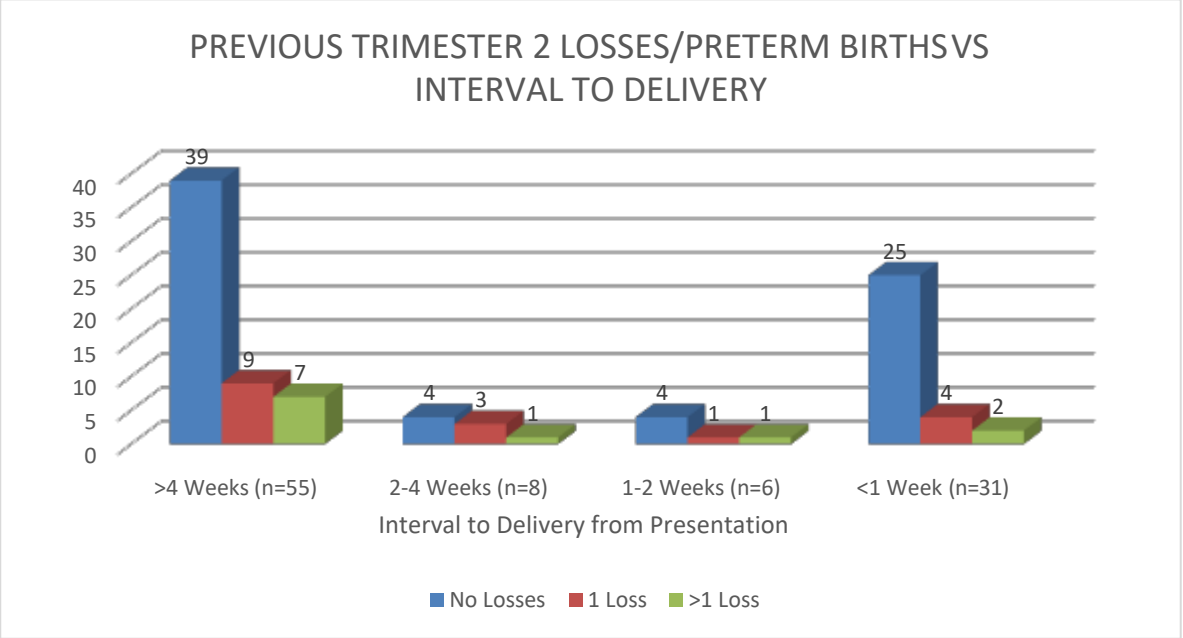

Figure 10.7.3 – Previous Trimester 2 Losses/Preterm Births as a Risk Factor for Interval to Delivery

Most women (84%) who delivered more than 4 weeks from presentation had more than 4 antenatal visits (P<0.001). Of the women that delivered less than one week after presentation, 12 (42%) had less than 4 antenatal visits.

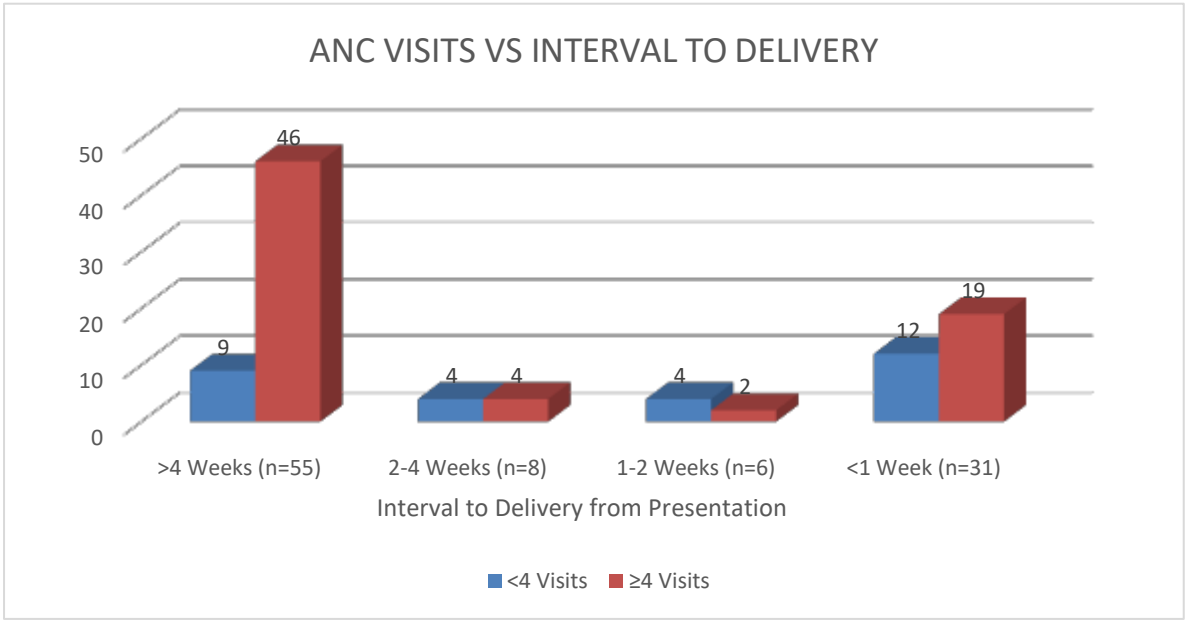

Figure 10.7.4 – Number of Antenatal Clinic Visits as a Risk Factor for Interval to Delivery

Pain and Show together as presenting symptoms significantly decreased the interval to delivery time (62.5%) (P<0.001).

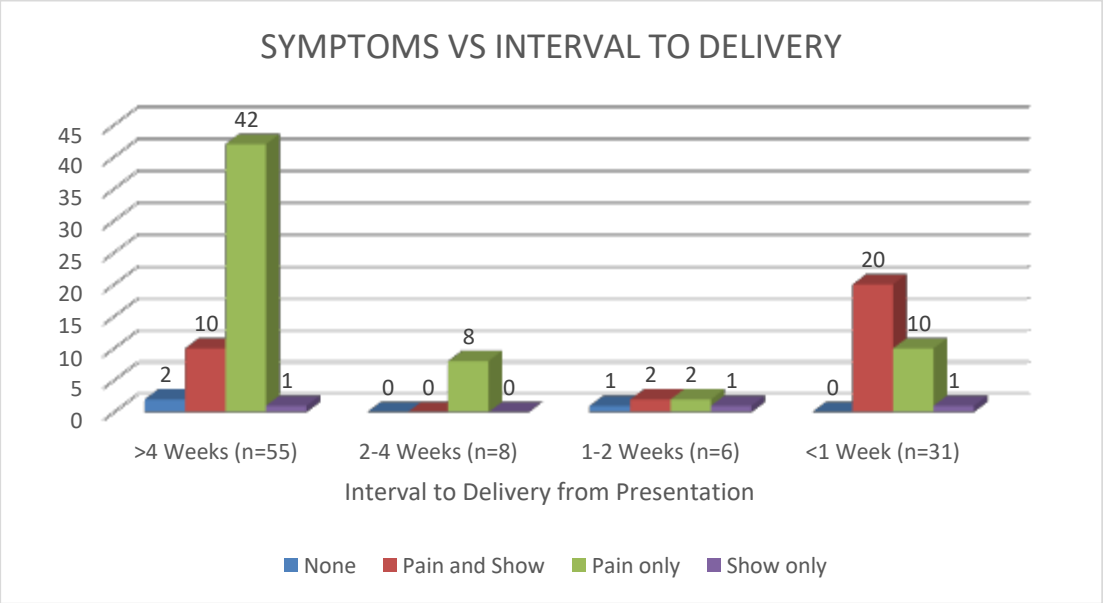

Figure 10.7.5 – Presentation Symptoms as a Risk Factor for Interval to Delivery

Cervical dilation of greater than 2cm resulted in 68.4% of all deliveries that occurred in less than 1 week from presentation. Delivery occurred more than 4 weeks from presentation in 79.4% of women when the cervix was less than 1cm dilated (P0.001).

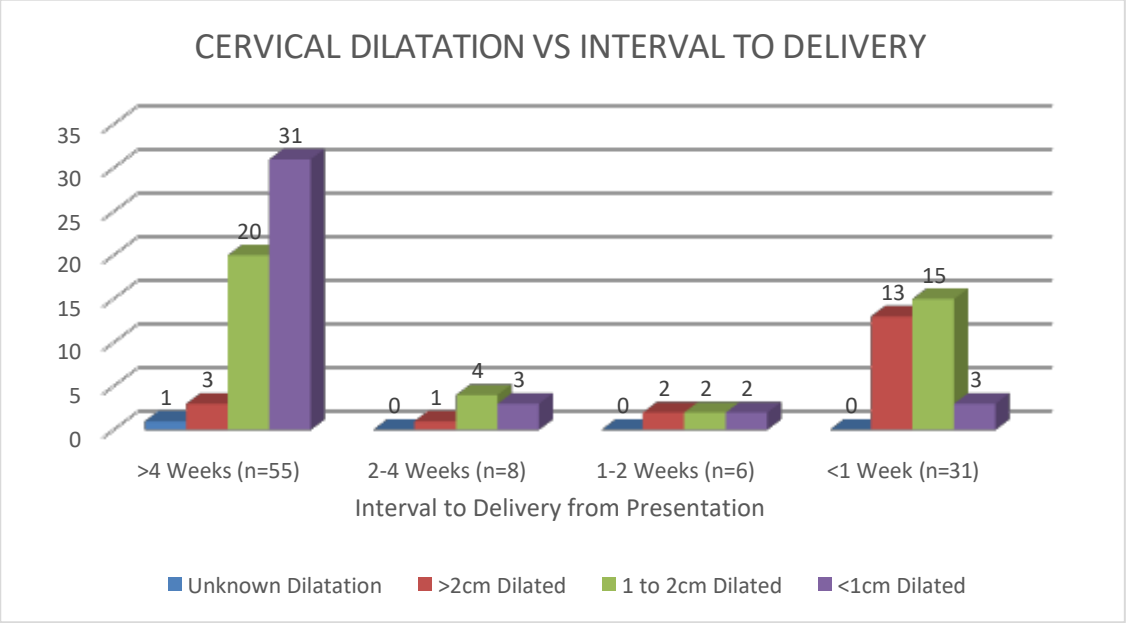

Figure 10.7.6 – Cervical Dilatation as a Risk Factor for Interval to Delivery

When cervical length was less than 20mm, subsequent delivery occurred in less than 1 week from presentation in 75% of the women (P0.006).

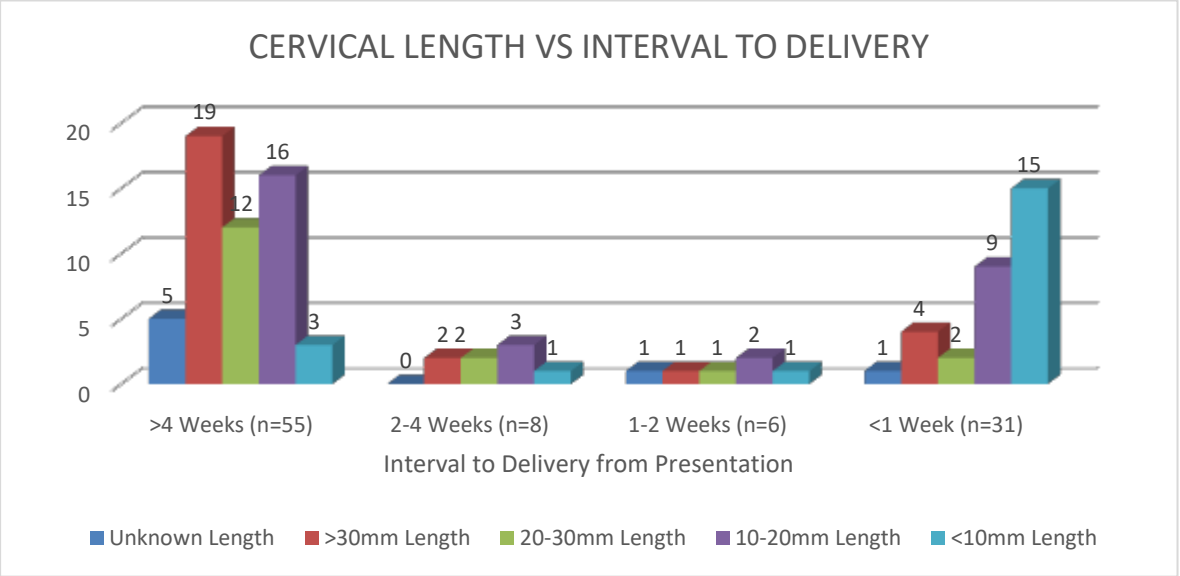

Figure 10.7.7 – Cervical Length as a Risk Factor for Interval to Delivery

In 67.6% of women when a clinical show was absent, delivery interval from presentation was more than 4 weeks. When a clinical show was present, delivery occurred in less than 1 week in 64.29% of these women (P<0.001).

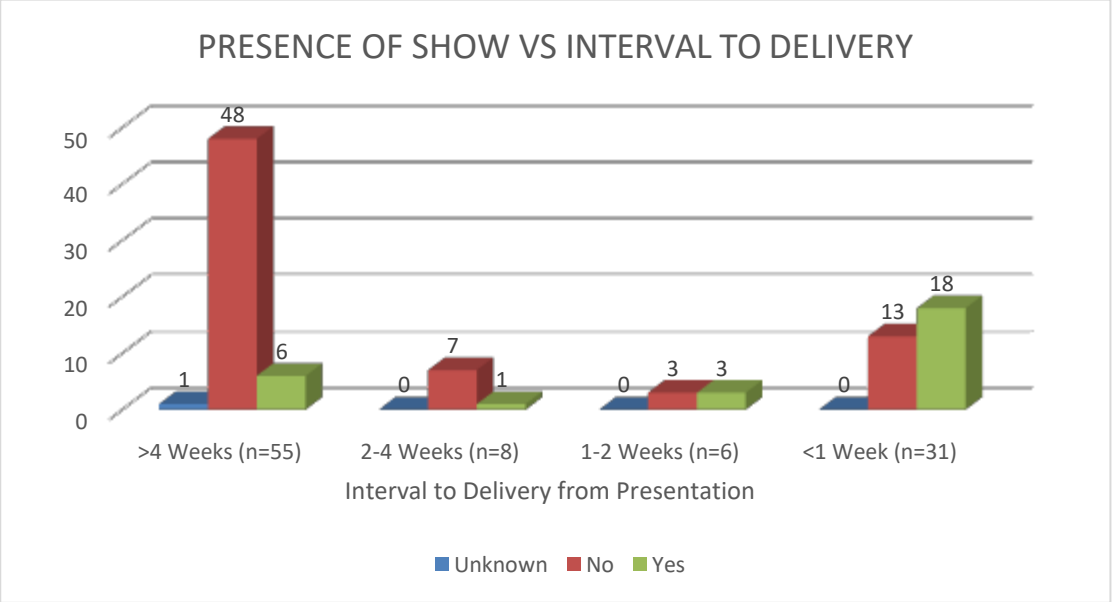

Figure 10.7.8 – Clinical Show as a Risk Factor for Interval to Delivery

For the women that delivered greater than 4 weeks after presentation, 93% did not meet the criteria for diagnosis of preterm labour. When assessing women that delivered in less than one week from presentation, 71% fulfilled the criteria for diagnosis of preterm labour (P<0.001).

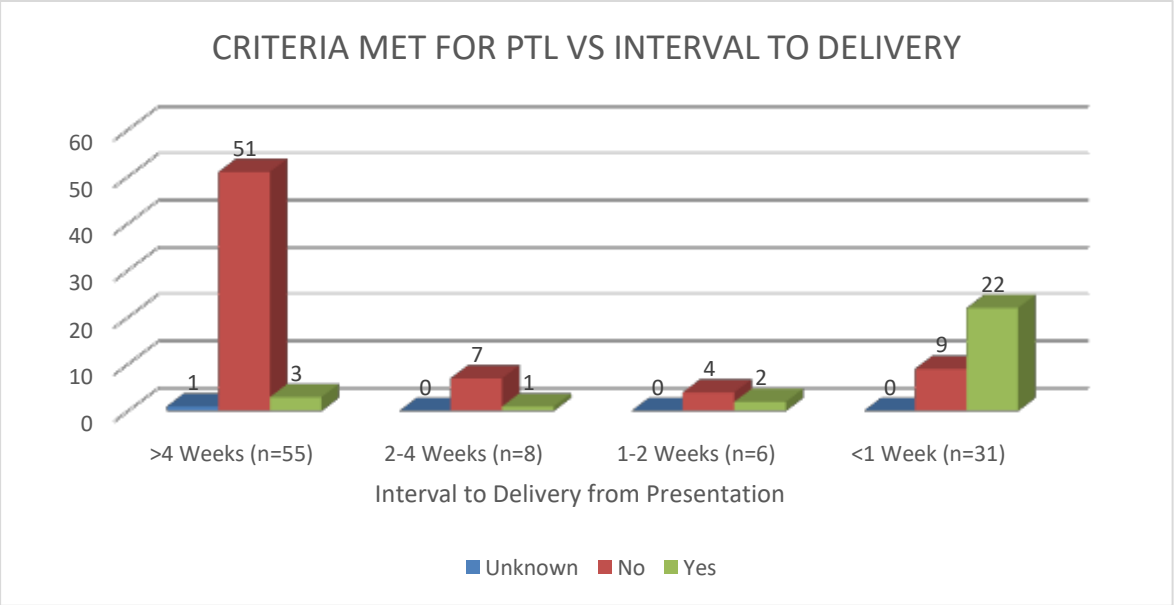

Figure 10.7.9 – Criteria Met for PTL as a Risk Factor for Interval to Delivery

Most of the women (93.5%) that delivered in less than 1 week from presentation were admitted. Most of the women (81%) that were diagnosed as false preterm labour and discharged home delivered more than 4 weeks after presentation (P0.001).

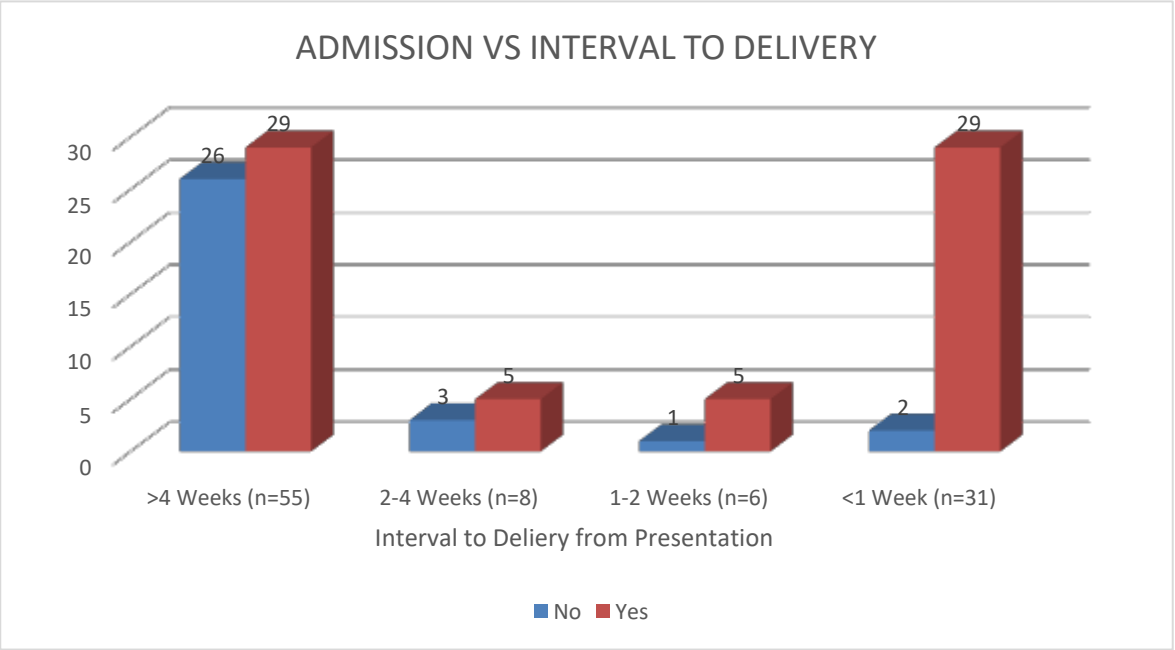

Figure 10.7.10 – Admission as a Risk Factor for Interval to Delivery

11. DISCUSSION

It is important to note that the setting of the index study, Tygerberg Hospital, is the main referral hospital for the entire Metro East section of Cape Town. The referral radius also extends to many sites north of Cape Town for approximately 650km. As such, the majority of women presenting to the hospital are high risk patients with multiple medical and obstetrical co-morbidities.

11.1. Risk of Preterm Birth

In the index study, the incidence of preterm birth from low risk women presenting in suspected preterm labour was 2.59%. This is much lower than any of the international literature on the incidence of preterm birth. Blencowe et al in the Lancet Journal estimated a worldwide incidence of 5-18% (3) and the WHO estimated about 15 million babies born preterm annually (5). These estimates, though, don't differentiate the different aetiologies of preterm birth. Iatrogenic causes due to significant maternal and foetal diseases are not discerned from true spontaneous preterm labour and subsequent preterm birth. The distinction with the index study is that all the women included in the analysis were low risk. These women presenting with suspected preterm labour were identified and the possible causes for preterm birth were investigated. Population based studies that evaluate this distinction are not readily available, either internationally or nationally. This makes the findings quite valuable.

11.2. Demographics

The extremes of age, including teenage pregnancies and advanced maternal age, are established risk factors for preterm birth (23,24). This is evident in the study with 21% of the women being in these two groups. The other main established risk factors for preterm birth include previous history of preterm birth or second trimester losses. This is even after adjustment for other confounding factors like demographics and behavioural factors (24). It is, thus, of specific interest to note that almost half (48%) of the women in the study sample were only in their first or second pregnancy. Only 11% of the women would have been considered high risk using the established risk factors on history. The remaining women would have not had any screening performed to evaluate risk of preterm labour and preterm birth. Routine screening for the risk of preterm labour with ultrasound cervical length

assessment in the second trimester was evaluated by Mishra et al (35). The results of the randomised control trial showed no reduction in preterm birth rate but revealed correct identification of those at risk of very preterm deliveries. Its importance in routine antenatal care needs to be further evaluated based on the findings in the index study.

11.3. Obstetric Characteristics

Gestation at presentation is important as more than half (52%) of the women presented from viability (27 weeks gestation) till 31 completed weeks. This is a gestational period where correct diagnosis and intervention is vital for improving the neonatal outcome if true preterm labour is present. To aid with the diagnosis, symptoms at presentation proved to be very important. Less than a third (32%) of the women presented with both pain and a show. These are two of the elements that are present in the Tygerberg protocol for diagnosis of true labour. Pain alone was the presenting symptom in more than half of the women (52%). The clinical component to diagnosis is cervical dilatation and length. The index study revealed that only 19% of patients had a cervical dilatation greater than 2cm. In addition to this, only half (50%) had a cervical length less than 20mm. Thus, the classical findings necessitating diagnosis were not present to make the diagnosis of preterm labour. The subsequent impact on admission and management strategies were also significant.

11.4. Management Comparing Admission versus Discharge

Importantly, using the clinical findings at presentation, only 40% of women admitted fulfilled the criteria met for preterm labour. On the other hand, 94% of women that were found to be in false preterm labour and discharged did not meet the criteria for preterm labour. This could be a marker of rather erring on the side of caution, even though the clinical diagnosis was not made. This does, though, increase the burden of patient load on the health system. The use of diagnostic testing to assist with the diagnosis was also lacking with less than half (48%) of the women having additional tests done to confirm the diagnosis of preterm labour. Concerningly, 65% of women admitted had no further testing done. The use of ultrasound cervical length or clinical cervical change over time could possibly limit these admissions. The tertiary preventative strategies of betamethasone, suppression of labour and antibiotics were given to most of the women admitted as

true preterm labour with 61(89.7%) given betamethasone, 53(77.9%) labour suppressions, and 59(86.7%) antibiotics administrations.

11.5. Obstetric Outcomes Comparing Admission versus Discharge

The index study showed a statistically significant difference in the mean gestation of delivery when comparing those that were admitted as true preterm labour versus those discharged home as false preterm labour (P<0.001). More than half (52.9%) of the women admitted delivered at less than 34 weeks gestation. This is compared to only 18.7% of women who were discharged home as false preterm labour delivering before 34 weeks gestation. This highlights the importance of correctly identifying the clinical characteristics that diagnose true preterm labour. This is further emphasised with the finding that there was a greater than 4-week interval to delivery in 26 (81.2%) of the women discharged home as false preterm labour after initial evaluation. Of the women admitted, 29 (42.6%) had an interval to delivery time of greater than 4 weeks. With the finding in the index study of low rate of criteria met for diagnosis of preterm labour in those admitted (40%), this can be sufficiently explained.

Two women (6.25%) discharged home after initial evaluation had an interval to delivery time of less than 1 week. This also highlights the finding in the index study that 94% of those diagnosed as false preterm labour did indeed not meet the criteria for true preterm labour. Significantly though, only 29 (42.6%) of those admitted had and interval to delivery time of less than 1 week. The value of performing diagnostic tests to confirm is once again emphasized.

11.6. Neonatal Outcomes Comparing Admission versus Discharge

The neonatal outcomes parallel the obstetric outcomes. There was a statistically significant difference in the mean birth weight of the babies of those women that were discharged home as false preterm labour (2982g ± 916g) versus those women that were admitted as true preterm labour (2184g ± 852g). Of importance is that of the 19 babies with a birthweight of less than 1500g, 17(89%) were in the true preterm labour group where the mothers were admitted. These are the neonates at the most vulnerable, and correctly identifying them as true preterm labour is extremely important. For the 32 women that were discharged home as false preterm labour, 2(5.25%) babies had a birth weight less than 1500g. In the other end of the spectrum, 23(33.8%) babies of the women that were admitted had a birthweight of

more than 2500g. This once again highlights the need to correctly diagnose true preterm labour using clinical and diagnostic tools. The safety of diagnosing false preterm labour was displayed with 21(65.6%) of the women discharged home as false preterm labour having delivered babies with a birth weight of more than 2500g.

11.7. Findings Predicting Interval to Delivery

11.7.1. Gravidity

The index study shows a statistically significant shift from the conventional history indicated risk factors of preterm labour. The majority of women (71%) were only in their first or second pregnancies. They, thus, did not have the pre-requisite 2 or more previous T2 losses or preterm births on history to consider them high risk for preterm labour. This would mean that they would have received no further surveillance for preterm labour.

11.7.2. Previous PTB or T2 Losses

To further strengthen this case is the fact that in the index study, there were only 11 women in the sample population who were high risk for preterm labour based on previous preterm birth or previous T2 losses. Only 2 (18%) of the women delivered in less than one week from presentation. Significantly, most (94%) of women who delivered in less than one week from presentation had either no previous losses or only one previous loss.

11.7.3. Antenatal Visits

More frequent antenatal visits significantly increased the interval to delivery time. Eighty four percent (84%) of women that delivered more than 4 weeks after presentation had greater than 4 antenatal visits. This is likely due to increased surveillance and reassurance by medical personal during these visits.

11.7.4. Symptoms

The correlation of the definition of preterm labour and the clinical findings of pain and show together as presenting symptoms significantly decreased the interval to delivery time to less than 1 week (62.5%) ($P<0.001$). The separate features in isolation did not decrease the interval to delivery time.

11.7.5. Cervical Dilatation and Length

Cervical dilation of greater than 2cm resulted in 68.4% of all deliveries in less than 1 week. If the cervix was less than 1cm dilated, delivery was in greater than 4 weeks

in 79.4% of women (P0.001). Cervical length less than 20mm resulted in delivery in less than 1 week in 75% of women presenting in suspected preterm labour (P0.006). These clinical findings are very important when clinically evaluating and diagnosing true preterm labour.

11.7.6. Presence of a Show

The expulsion of the mucus plug in the form of a show is highly significant in the diagnosis of true preterm labour. Its presence resulted in delivery in less than 1 week after presentation in 64.29% of women presenting with suspected preterm labour (P<0.001). Its absence was also significant in that there was a delivery interval of greater than 4 weeks in 67.6% of women where no show was demonstrated.

11.7.6.1. Criteria met for Preterm Labour

Using the clinical definition of preterm labour is essential in diagnosing true preterm labour. If the Tygerberg protocol for preterm labour diagnosis was followed, 71% of those identified as having the features would deliver in less than 1 week (P<0.001) after presentation. In women that delivered greater than 4 weeks after presentation, 93% did not meet the criteria for diagnosis of preterm labour.

12. STRENGTHS AND LIMITATIONS

The review of the literature confirms the need to correctly identify characteristics stratifying risk for preterm birth. Population based studies such as this are not currently available, and the benefit of this study is to obtain population-based findings to improve care for our specific population. The large number of women identified by the study ensures statistically significant findings for our specific population. This can assist with improving protocols of management and thereby reduce morbidity and mortality.

The retrospective review ensured that electronic review of cases did not need reliance on other members of the team to identify and isolate women. The benefit was to reduce additional workload in an already overburdened system. The limitation to this was that there was a reliance on good note taking to identify specific characteristics. The completeness of note taking in the included population of women in the study was commendable. Very few aspects were not easily available.

The main limitation was the lack of notes available for the women that delivered in health facilities outside of Tygerberg. Only first encounter notes of these women were available that identified the gestation at presentation and limited clinical findings, but no maternity care record was available on the system. This meant that no demographic or obstetric characteristics were available, and no record of delivery details. These files, therefore, had to be excluded.

13. AREAS FOR FUTURE RESEARCH

There will now be a possibility of follow-up trials to assess outcomes in women who do not have the specific risk factors and are treated conservatively. There can also be research into surveillance of low risk women to identify those at risk of preterm labour and preterm birth.

14. CONCLUSION

The true incidence of preterm birth in low risk women is not very apparent in the literature. Most of the quoted values are based on the preterm gestation at birth and does not distinguish between the maternal and foetal reasons for the premature delivery. Without this information, assessing the population-based risks factors leading to true preterm labour, and the subsequent complications of preterm birth are not easily identified. The incidence in the index study of 2.59% is a population-based reflection of risk of preterm birth in low risk women that present with suspected preterm labour. The risk factors for preterm birth that were identified are thus invaluable in understanding this condition that is still of global concern.

Relying on the conventional history-based risk factors for preterm labour does hinder the identification of low risk women who are at risk for preterm labour. Routine surveillance of low risk women may prove to be important in identifying those at risk of preterm labour especially as the majority of those that were identified were primigravid or in their second pregnancy. Importantly, correct clinical practices and complying with the definitions for identifying preterm labour are essential to pick up cases of true preterm labour, and safely diagnose false preterm labour. This would decrease the financial burden and bed pressure ever present in the health sector. Highlighting and actively assessing the identified risk factors leading to decreased interval to delivery would also assist in correct diagnosis and further

management. Dissemination of this information to all those involved with pregnant women in the health community will certainly help to minimize the consequences of preterm births worldwide. Further prospective research and randomized trials investigating these risk factors are needed to confirm their importance in identification and management of preterm labour.

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