

ORIGINAL ARTICLE

PRETERM BIRTH: A CONCEPT ANALYSIS

Judith Musona- Rukweza¹, Clara Haruzivishe², Muchabayiwa Francis Gidiri³, Pasipanodya Nziramasangae⁴
Babill Stray- Pedersen⁵

¹Ph.D Student, University Of Zimbabwe, College of Health Sciences, Department of Nursing Science, P O Box A178
Avondale Harare, rukwezajudith@gmail.com

²Lecturer, University Of Zimbabwe, College of Health Sciences, Department of Nursing Science

³Chairperson and lecturer, University of Zimbabwe, Department of Obstetrics and Gynaecology

⁴Lecturer, University of Zimbabwe, Department of Medical Microbiology

⁵Institute of Clinical Medicine, University of Oslo, Norway.

ABSTRACT

Important foetal growth occur throughout pregnancy, including the last months and weeks of pregnancy. Preterm birth occurs when a new- born baby have not had adequate time to develop fully whilst in the mother's womb. Preterm birth is one of the major challenges in the world. The objective of this analysis is to clarify meaning of preterm birth by identifying its attributes in order to increase understanding of the concept. Walker and Avant's 2005 traditional method of concept analysis was used in the analysis of the concept. We searched 54 articles from databases including Google Scholar, PubMed, HINARI, MEDLINE and Google Search. Thirty of the articles were used in this analysis. The meaning of preterm birth has since shifted from the 18th century. Delivery of a new- born before 37 complete weeks was identified as one of the critical defining attributes of preterm birth. Preterm premature rupture of membranes is one of the important antecedents of preterm birth. Consequences of preterm birth include neonatal and under five mortality, morbidity and permanent neurological disabilities. Model, contrary, illegitimate, related and invented cases were included in this analysis to add clarification and understanding of meaning of preterm birth. Preterm birth, a delivery of a live baby before 37 complete weeks of gestation, is a leading challenge in the world as it is contributing to majority of neonatal deaths and lifetime neurological disabilities to survivors. Understanding meaning of preterm birth is required to promote knowledge development, education, research and policy development.

INTRODUCTION

Preterm birth remains one of the biggest challenges in perinatal health care globally. Every year 15 million preterm babies are being born [1]. At least one million of these babies die annually from conditions related to preterm birth [2]. Preterm birth rate is on the rise in almost all countries worldwide [3]. The rate ranges from 5% to 18% [2]. The greatest percentage (35%) of the neonatal deaths worldwide is a result of preterm birth [4]. Preterm birth is the second leading cause of under 5 mortality [1]. More than 60% of these births occur in Sub Saharan Africa and South Asia [2]. Malawi has the highest (18.1%) preterm birth rate followed by Comoros (16.8%), Congo (16.7%) and Zimbabwe (16.6%) [2]. In Africa 24% of neonatal deaths are directly a result of complications of preterm birth which include breathing difficulties, intracranial bleeds, and jaundice [5].

In high income countries almost all preterm babies survive as 1 out of 10 dies whilst 9 out of 10 babies die [2]. Preterm babies born in Africa have a risk of death that is around 13 times higher than full term babies [5]. This disparity could be due to lack of feasible, cost effective interventions like warmth, breastfeeding support, basic care for infections and breathing difficulties in the developing countries are the main reasons for the difference in preterm baby survival rate [2].

There are several reversible and non- reversible risk factors that put the pregnant woman at risk of a preterm birth [6]. A strongest risk factor is a history of preterm birth [7]. Multiple pregnancy, chronic medical conditions like hypertension, diabetes and adolescent pregnancy are other identified factors [2]. Low socioeconomic status, low body mass index, tobacco and alcohol use, urinary tract infection and vaginal bleeding are some of the factors associated with premature rupture of membranes [3]. The other factors include intrauterine infection, decidua haemorrhage, excessive uterine stretch and maternal or foetal stress [7]. The risks for spontaneous preterm births also include black race, periodontal disease, and low maternal body mass index [8]. Lifestyle factors like smoking, taking recreational drugs and drinking alcohol also increase the risk of delivering a preterm baby [2].

A challenge maybe with accurate measurement of gestation which is a very important aspect in the determination of preterm birth. However several methods are available to determine gestational age. There are several factors known to influence accuracy of these methods in measuring gestation [9].

Preterm birth is an issue of concern because almost all babies born too soon miss out on their valuable time to grow and develop. An understanding of preterm birth will guide education, research, knowledge development, and

policy development. Identification and implementation of prevention strategies for preterm birth need emphasis to improve care before, between and during pregnancy to prevent preventable preterm deliveries and preventable neonatal deaths and child disabilities.

The purpose of this analysis is to clarify meaning of preterm birth by identifying its attributes in order to increase understanding of the concept. This analysis is intended to clarify the meaning of preterm birth by breaking down its internal structure into simpler elements of defining attributes, antecedents, consequences and empirical referents.

MATERIALS AND METHODS

Concept analysis is defined as an activity where concepts, their characteristics and relations to other concepts are clarified [10]. This enables concept development, knowledge enhancement and use in research and clinical practice [11]. A total of 54 articles were reviewed and 33 articles were eligible for this analysis. We identified the selected articles from databases including Google Scholar, PubMed, HINARI, MEDLINE and Google Search were used in this analysis. These are ethically proven, reviewed articles. Dictionaries were used for definitions of key concepts in this analysis.

The Walker and Avant (2005) method of concept analysis is founded on realism where concepts are viewed as static entities independent of context. In this case the concept has clear and distinct boundaries. Walker and Avant's traditional method of concept analysis was used in this analysis to clarify the meaning and increase understanding of the concept of preterm birth. This seems to be the most influential model in Nursing Science [12]. Walker and Avant concept analysis model reduced Wilson's 13 step procedure to 8 steps [10]. The 8 step procedure observes the basic elements of a concept. This helps to develop a consistent operational definition that increases the validity of the construct within practice.

1. Selection of concept to analyse
2. Determining purpose of concept analysis
3. Identification of all uses of concept
4. determining defining attributes of the concept
5. Identifying a model case,
6. Identifying borderline, related, contrary, invented and illegitimate cases,
7. Identifying antecedents and consequences
8. Identifying empirical referents

Table 1: The eight step Concept analysis method (Adopted from Walker and Avant, 2005)

A great deal of ambiguity exists around the definition of preterm birth, especially within nursing. Use of this method will help to clarify meaning of the vague concepts of preterm birth. This analysis will help with identification of defining attributes and empirical referents for preterm birth. In this analysis ethically proven and published books and research articles from several databases were used as source of relevant information. Dictionaries were also used to clearly define preterm birth.

RESULTS

History of preterm birth

In the 17th century, a huge birth weight of 12 pounds, 14 and even 16 pounds was mentioned to be the expected birth weight. Diagnosis of prematurity on the basis of birth weight of less than 2300 grams was first mentioned by Alexandre Gueniot between 1832 and 1935 [13]. In these homes infant mortality was very high. During 1777 to 1796, 96% infants died in Dublin, 85% in Paris and in America up to 97% died [13].

Before the 19th premature, and weak infants and congenital weaklings were grouped under "tiny new-borns" [14]. The words preterm and premature were not equivalent to what they mean now. There was uncertainty regarding whether this state of weakness reflected immature development or some kind of hereditary taint [14]. These infants were conceptualised as suffering from a lack of energy or vitality. Those dying from respiratory distress were diagnosed as having congenital atelectasis secondary to feeble breathing [14].

Care of neonates including premature babies was regarded traditionally as the province of mothers who were assisted by midwives, wet nurses, wise grandmothers [13]. In the late 1800 breastfeeding and full maternal care of these infants were encouraged with good results [15]. At the time doctors in their specialties felt they were better situated to deal with problems of prematurity [14]. Doctors shunned, feeling unprepared to cope with the high infant mortality and morbidity and incompetent to diagnose and cure these babies [16]. There were no effort spared to assist the weakling infant in the first few weeks of life. There were no hospitals for the infants but they were nursed in foundling homes [13]. This means that preterm birth was a neglected area in this era.

In 1866 Crede established his double walled Warme-Wanne in the Maternity at Leipzig at Moscow and St Petersburg [16]. In 1880 Tarnier introduced his incubator known as couveuse, in the regular practice of the Maternité of Paris [16]. The incubator set into motion a three-way contest between mothers, obstetricians and paediatricians regarding who should care for the premature infant. However, the first physician who attempted to treat premature babies following invention of the incubator found that it was gaining mother's confidence and cooperation [14].

In the 1940s the premature babies were cared for by nurses but mothers were not allowed in to touch their babies [17]. Nurses were all powerful, with their nursing techniques of gavage feeding, maintaining warmth, and watching for apnoea sustaining the infants [17]. The parents and physicians were barred from handling the babies. In the 1950s dramatic medical interventions were introduced including exchange transfusions for jaundice, gastrostomies for feeding, new antibiotics, mist inhalations and oxygen use for respiratory distress syndrome, which made the physicians' role become more important [15].

Some series of disasters occurred following introductions of procedures and medications with blinding and brain damage and other handicaps occurring [14]. These prob-

lems have stimulated a lot of research into preterm birth and premature baby care. Neonatal intensive care units have also been established.

Definitions and use of concept

Dictionary meaning of preterm is occurring before the expected time, being at the end of a full term pregnancy [17]. This will be referring to an infant born prematurely. Preterm means occurring earlier in pregnancy where a baby is born prematurely, that is before the 37th week of pregnancy [19].

Birth is defined as a time when a baby comes out from the body of its mother [19]. This means a beginning or origin of something. In another dictionary birth is defined as an act of being born, a process of bringing forth an offspring [19]. Acronyms for birth include childbirth or parturition [19].

Preterm birth is defined as delivery of a live baby before 37 complete weeks of gestation [2]. Preterm birth is also defined as birth of baby before 37 weeks of gestation or fewer than 259 days since the first day of a woman's last menstrual period (LMP) [6, 21]. Preterm birth occurs when a baby is born too soon [1]. The baby emerges from the mother's womb into the world at more than 3 weeks before the expected date of delivery (EDD). Therefore preterm birth means that birth of a baby occurs before the start of the 37th week of pregnancy whilst a normal pregnancy lasts 40 weeks [2].

Based on gestational age there is a further categorization and subcategorization of preterm birth into extremely preterm, very preterm and moderate preterm [25]. Moderate preterm birth is further divided into early and late preterm [21].

Category	Gestation (weeks)
1. Extremely preterm	Under 28
2. Very preterm	28 to under 32
3. Moderate preterm	32 to under 37
a) Early moderate preterm	32 to under 34
b) Late moderate preterm	34 to under 37

Table 2: Categories of preterm birth

Defining attributes

Determining defining attributes is regarded as the heart of concept analysis. Defining attributes are characteristics that appear over and over on different usages of the concept [11]. The goal of this stage is to underscore a cluster of attributes most frequently associated with the concept. The following characteristics of preterm birth have been identified in this analysis:

1. Live baby emerges from its mother's womb.
2. Baby emerges before 37 completed weeks
3. Gestation of baby is accurately calculated using last menstrual period
4. Expected date of delivery is accurately calculated using last menstrual period.

Live baby emerges from its mother's womb

This means that a live baby is brought forth, delivered and introduced onto the earth. After delivery, the baby is seen

and received. A beginning of a new human life on earth therefore occurs. The baby comes out from the uterus which is a reproductive organ in the body of its mother. The delivery may be by normal vaginal or caesarean section.

Baby is delivered before 37 complete weeks of pregnancy

The baby is delivered prematurely when the baby comes out of its mother's womb before 37 completed weeks (259 days) of gestation [23]. This means that the gestation will not be rounded off to the nearest week. Even when baby is delivered at 36 weeks and 6 days it is a preterm baby. The expected time of delivery of a baby is therefore from 37 complete weeks of gestation and on-wards. If mother delivers a baby before she reaches 37 complete weeks of gestation, the birth is preterm.

The expected date of delivery (EDD) is calculated using the first date of the mother's last menstrual period (LMP). The first day of the LMP is recorded. Seven days are added to the number. Then count back 3 months from the months of LMP. A whole year is then added to the final date and that will be the EDD. Use of the LMP will be very accurate if the mother has a history of a regular menstrual cycle [24]. Another method of calculating EDD using LMP is by noting the first day of the LMP, add 7 to the number and count on 9 months from the LMP month. This will give the same EDD with the previous method.

Gestation of baby is accurately calculated

Gestational age is the number of weeks and or days a baby has lived in her mother's womb [2]. When a women has a history of having regular period, her first day of last menstrual period is used to calculate gestation of baby. An early ultrasound examination especially done between 8 to 18 weeks gives an accurate gestation [25]. The most accurate way to determine gestational age however, is by using the first day of the mother's last menstrual period and confirming with an early ultrasound examination [25]. However, degree of immaturity varies even if gestational age is the same. Therefore, foetal size may not indicate similar levels of maturity [9].

Expected date of delivery is accurately calculated

When using the LMP, EDD is estimated by adding 7 to the first day of LMP, count back 3 months then add a full year [24]. An early ultrasound scan of pregnancy is a reliable method when calculating EDD [9]. This is reliable because there will be little variation in foetal growth [25]. Use of both LMP and ultrasound is the most accurate method of calculating EDD. Other methods like using uterus size, first foetal movements and heart tones are less accurate to estimate EDD [24].

Theoretical perspective of preterm birth

An embryo matures in its mother's uterus where important growth of the foetus takes place. The final months and weeks of pregnancy are very crucial for full maturity of organ systems [9]. These developments and maturity of organs which often take place during the final weeks of pregnancy will prepare the infant for capability to sustain extra uterine conditions. Many system organs including the brain, lungs and the liver fully develop in the last few

weeks of pregnancy [9]. If the infant is born prematurely there will be challenges with breathing, crying, sucking from the nipple and digesting milk, gas exchange, blood pressure control, glucose metabolism and regulation of body fluids [9].

At 35 weeks the brain weight for a foetus is only 2/3 of the weight at 39 to 40 weeks [1]. If these vital organs fail to fully grow as it occurs when a baby is born too soon, chances are high that serious disability or death occurs [6]. However, degree of maturity varies even when the gestational ages are similar [9].

Preterm birth has no one specific cause. Most preterm births occur spontaneously but some of them are provider initiated for medical or non- medical reasons [1]. Spontaneous preterm birth is regarded as a syndrome resulting from multiple causes [26]. Preterm labour which often precedes preterm birth may be a result of accumulative effect of several environmental and genetic factors [9].

Model case

A model case is developed to represent a real life example of use of the concept that includes all the critical attributes of the concept [11]. A 26-year-old pregnant woman reported at a family clinic for initial registration of her second pregnancy 12 October 2015. Her LMP was 7 July 2015. Her gestation was 11 weeks and 5 days and expected date of delivery was calculated to be on 14 April 2017. Her blood pressure was 120/75mmHg, pulse 78 beats per minute, respirations 16 breaths per minute and weight 64 kilograms. The foetus was bulky on palpation but foetal heart was not heard on auscultation. On examination vaginal discharge was clear and odourless. She had an ultrasound on 15 October 2015 which reported a gestation of 11 weeks 4 days. Urinalysis was done to screen for diabetes, proteinuria and urinary tract infection. None of these problems were detected.

The woman had a history of a regular menstrual cycle which always started after every 28 days. She reported a history of a previous one preterm delivery at 30 weeks gestation, which was preceded by preterm labour and premature rupture of membranes in July 2012. The baby then died in the NICU 2 days after her birth. The woman however had no history of bleeding and known illness with the current pregnancy.

The woman was reporting at the local clinic for antenatal care services after every 4 weeks. There were no health problems identified. At 36 weeks and 2 days the woman was admitted at the clinic with a history and diagnosis of preterm premature rupture of membranes. She started having contractions and a backache on the next day. She was in preterm labour with her cervix dilated to 4 centimetres. The woman delivered at exactly 36 weeks 4 days. The baby Apgar score was 8/10 and weight was 2400 grams, height at 48 centimetres and head circumference 32 centimetres. The baby was having a difficulty in breathing and was assessed by the paediatrician who recommended admission into NICU for oxygen supplement and close monitoring. The baby was nursed in an incubator. Temperature and weight were frequently assessed and recorded. Both were within normal ranges.

The mother and baby were admitted in a Kangaroo care unit where they stayed for a week. Her weight had increased to 2500grams. They both were discharged home after a week. The mother was encouraged to report at the clinic every second week for monitoring of baby development and disease screening. Within the second week after discharge the child developed a high fever of 38^oC and was vomiting. She was admitted in a paediatric high care unit. Her chest was recessing with fast breathing at 52 breaths per minute. The baby lost weight by 300grams. Two days later the baby and mother were discharged. Baby however, was having recurrent upper respiratory infections, diarrhoea and poor growth and development. At 18 days after discharge the baby was admitted with severe Diarrhoea. The baby could not feed adequately and had severe dehydration. On day three after admission the child died.

Analysis

This is a typical case of preterm birth when a baby was delivered at 36 weeks and 2 days, which was before 37 complete weeks. A history of preterm birth being a major risk factor of preterm birth was raised. The use of LMP and the early ultrasound is the best strategy to accurately calculate gestation and EDD. The mother reported preterm rupture of membranes and the nurses established the woman was in preterm labour when she reported at the clinic. Both preterm premature rupture of membranes is one of antecedents of preterm birth. Deaths of both preterm babies following history of illness and admissions of preterm babies are common consequences of preterm birth.

Identifying additional cases

Step 6 of Walker and Avant model of concept analysis involves identification of cases including borderline, related, contrary, and invented and illegitimate [10]. The purpose of this step is to decide which defining attributes best fit for the concept of interest. Case presented may or may not be found in our work places.

Borderline case

A borderline case contains most of the critical attributes of the concept but not all of them [11]. A 32-year-old woman reported at a maternity unit on 10 February 2016 with a history of vomiting and backache. The woman was not sure of dates she provided of her LMP as 2 August 2015. Her menstruation cycle was irregular. She had vaginal bleeding in her 1st and 2nd month of pregnancy. The bleeding was very light in the 2nd month. Her EDD was 9 May 2016. Gestation was calculated using the LMP. An ultrasound was done at week 18 which indicated an EDD of 6 May 2016.

The woman was admitted for observation. She had preterm rupture of membranes which progressed to preterm labour on day 1 after admission. On 12 February she delivered a baby boy. Gestation at delivery was 28 weeks and 3 days. The baby had an Apgar score of 8/10. Baby was having breathing difficulties and was admitted in the NICU. On day 3 baby had a temperature of 38.2^oC and was commenced on intravenous Gentamycin and Benzyl penicillin. Temperature dropped to 36^oC from day 3 after treatment was commenced. The child continued to have breathing difficulties with 4 or more apnoeic attacks. The baby was

also having a feeding challenge. Birth weight was 1200 grams but it dropped to 1000g in the first week. The child remained in NICU with breathing and feeding problems. The baby was in and out of Hospital with cardiorespiratory problems. The baby grew up with a small stature. His performance at in class and behaviour was behind those of his age.

Analysis

In this case the baby was a preterm being born before 37 complete weeks of gestation. The mother could not establish the exact LMP date due to irregular menses and vaginal bleeding which occurred after conception. Gestation and EDD calculated were therefore not accurate. Baby was delivered 10 weeks before the EDD. However, an early scan was done and this provided an EDD which was 3 days behind that obtained using LMP.

Breathing and feeding challenges that the baby experienced are typical to preterm birth challenges. Problems with growth, development and low performance at school are possible consequences of preterm birth. This scenario presents a case of preterm birth except that the woman was not sure of LMP date and her irregular and pregnancy bleeding. This is a borderline case because it presents most of the typical attributes and a few that are not present.

Related case

A related case has similar defining characteristics to the concept [11]. A 28-year-old woman delivered at gestation 35 weeks. Her baby did not cry and was not breathing at delivery. When she was in labour the nurse did not hear any foetal heart-beat. The mother last had baby kicks two days back at the onset of labour. Baby was delivered dead.

Her LMP was well remembered and recorded at her initial visit at the antenatal clinic. A scan was done at 16 weeks of pregnancy which indicated that EDD was on 6 August 2016. Apgar score was 0/10 with a weight of 2200g.

Analysis

This is a case of a stillbirth where the baby is delivered dead. This case is related to preterm birth as gestation at birth according to LMP and scan was 35 weeks. The baby was delivered before 37 complete weeks of gestation. However, the baby was delivered dead and this is a related case to preterm birth but it is a stillbirth.

Contrary case

A 30-year-old woman delivered on at gestation 39 weeks. Apgar score was 9/10. Baby initiated breastfeeding immediately and was feeding well. Baby's weight was 3400g. She remembered exact dates of her LMP. The EDD was calculated using LMP and an early scan which was done at week 12. September. The woman had a history of regular periods. She did not experience any vaginal bleeding after conception.

Analysis

This is a case where a full term baby was delivered as the baby was delivered after 37 complete weeks of gestation. This is contrary to preterm birth where a baby is delivered before 37 complete weeks of gestation. The history of regular menstrual period and the early scan that was done con-

firms the accuracy with which EDD calculation was done.

Invented case

An invented case is a constructed case which does not exist in real life [11]. A 38-year-old woman reported at a clinic after she had delivered a baby boy at home. The baby weighed 1900g. The baby cried at birth and was breathing effectively. Head circumference was 30 centimetres and length 45 centimetres.

The mother did not remember her LMP and she never had an ultrasound during her pregnancy. She never visited the clinics for antenatal care. The child was breastfeeding well. This baby was considered a preterm baby due to his low birth weight and small stature. Term infants may be of low birth weight because of small for gestation or light for gestation.

Analysis

It is not acceptable to label delivery as preterm basing on birth weight alone. Term babies can also be delivered with a small stature and low birth weight. Two thirds of low birth weight infants are extremely and very preterm babies [27]. One third of the low birth weight infants are term babies [2].

Illegitimate case

An illegitimate case is when the concept is improperly used [11]. An 18-year-old pregnant high school student was admitted with a history of vaginal bleeding following an attempted abortion at 24 weeks 4 days gestation. She was given traditional herbs in the village. She provided accurate date for her LMP. She did not have an ultrasound for her pregnancy. She was treated with antibiotics and iron supplements. Three days later she had preterm premature rupture of membranes and later progressed to preterm labour. On day 4 gestation was 25 weeks, she delivered a baby boy whom they dumped and left to die in a bush.

The mother was very sick with anaemia (haemoglobin 8mg/dl), high temperature (38°C to 39.4°C) and low blood pressure (80/60 to 95/65mmHg). She was treated with intravenous metronidazole and erythromycin. The woman then died 5 days after delivery date.

Analysis

This is an illegitimate case as abortion and baby dumping are crimes in Zimbabwe. The baby was delivered preterm at 25 weeks following preterm premature rupture of membranes and preterm labour. When a baby is delivered preterm the baby has right to be treated and cared for at a clinic or hospital.

Identifying antecedents and consequences

Antecedents and consequences define those events or incidents that happen prior to or as a result of the occurrence of the concept [10].

Antecedents of preterm birth

Preterm birth is often preceded by either preterm labour with intact foetal membranes preterm premature rupture of foetal membranes or iatrogenic preterm delivery [8]. Preterm birth may occur spontaneously or provider initiated for maternal or foetal indication [27]. Most of the preterm births are however spontaneous [7].

Preterm labour is defined as a regular contractions of uterus resulting in changes in the cervix that occur before the beginning of the 37th week of pregnancy [9]. Warning signs of preterm labour include contractions where abdomen tightens every 10 minutes, a significant increase in amount of vaginal discharge, leaking of fluid or vaginal bleeding, low dull backache, abdominal cramp that feels like a menstrual period and pelvic pressure when the woman feels like baby is pushing down [6]. Preterm labour may be a result of several environmental and genetic factors [8].

Preterm premature rupture of membranes is rupture of membranes that hold amniotic sac and fluid breaks open before labour and before 37 weeks' gestation [3]. It may occur spontaneously or artificially when indicated [22]. Most preterm births are preceded by preterm premature rupture of the membranes. This most often prompts onset of preterm labour.

Consequences of preterm birth

Consequences of preterm birth are categorised as early and late [6]. Being born too soon increases the risk of neonatal death and neurological disability related to the nervous system in children [9]. Although babies born a few weeks early often do well and have no health problems, most have more problems than full term [2].

There have been an increase in survival rate of premature infants due to evidence based intervention strategies being implemented [27]. However, the survivors of preterm birth are at high risk for poor quality of life due to neurological hence medical disabilities [27]. Preterm babies are therefore prone to serious illnesses, organ injury and chronic illness especially during the neonatal period [9].

This means that preterm birth is responsible for emotional and economic burdens. Impact of preterm birth also include high medical and health care costs, special education services to those with developmental and learning disabilities, poor performance at school, and can affect an individual's ability to work as one can do [1].

Preterm birth is of great concern also as it causes great emotional and economic burdens for families [6]. It often results in families staying more frequently and for a longer period in the hospital. Preterm birth therefore has high cost implications for health services. All the consequences of preterm birth are associated with heavy burden on families, communities and the health care system [21].

Timing	Consequences
Early	Early neonatal death Late neonatal death Illness Hospital admission or detention Prolonged hospital stay Sudden infant death syndrome

Late Physical	Visual impairment Myopia Retinopathy of prematurity Hearing impairment Lung Disease Chronic lung disease of prematurity Reduced exercise tolerance Home oxygen required Reduced lung function Increased rates of asthma Cardiovascular ill health Increased blood pressure Growth failure in infancy Accelerated weight gain in adolescence Lifelong disability Infections Risk of non- communicable diseases
Behavioural	Specific learning problems Reduced academic achievement Moderate to severe cognitive impairment Motor impairment Cerebral palsy Attention deficit hyperactivity disorder Autism Increased anxiety and depression
Family, societal and Economic	High cost of care for acute and ongoing illnesses

Table 3: Consequences of preterm birth (As presented in March of Dimes, 2013)

There is no fixed set of outcomes of preterm birth and the consequences do not always occur to all premature infants [9]. Some of them occur in extremely preterm only whilst others occur in very preterm and moderate preterm. The same may also occur in term infants but the premature baby will have a higher risk.

Empirical referents

Empirical referents are measurable ways to demonstrate occurrence of a concept [11]. Empirical referents are clear and observable phenomena by which a diagnosis of the concept is made [10]. For diagnosis of preterm birth, the first day of the LMP must be clearly and consistently stated. An early scan done between a gestations of 5 to less than 20 weeks will be useful for more accuracy on calculation of gestation and expected date of delivery. The best way to estimate EDD therefore is by using both LMP and the early scan. A clear method of calculating EDD must be clearly described. Gestation of baby at birth is accurately calculated to be below 37 complete weeks from the LMP date provided.

DISCUSSION

The definition of preterm birth in this analysis means birth of a baby before 37 complete weeks gestation which is equivalent to 259 days [2]. This definition was cited in several articles. In the 19th century preemies included all "tiny

babies” including delivery of those with a weight below 2300 grams [13, 14]. Currently it has been observed and agreed that not all babies born tiny and with a low birth weight (<2500grams) are preterm babies [1]. The full term baby can also be of low weight as the preterm baby. However, majority of preterm babies will have a low birth weight. Considering the current definition, a challenge still lies with accurate calculation of gestation due to weaknesses of the methods available. An early ultrasound is most accurate especially when done at gestation between 5 and 20 weeks. The use of both the LMP and an early scan is the best to obtain the most accurate gestation. However, in developing countries pregnant women are booking late and this have impact on accurate estimation of expected date of delivery [2]. In this case remembering LMP is difficult.

Defining attributes of preterm birth were identified which increase an understanding of the concept being analysed. Preterm birth involves delivery of a live baby whose gestation is below 37 weeks following accurate calculation by LMP and or early scan. The correct LMP is to be identified and recorded which was used to calculate gestational age [29]. This therefore means it will be inaccurate to label a new-born as preterm basing on body stature and weight especially when the mother did not have a scan and did not know her LMP. This is because even term babies will have small body and low birth weight [21].

Several risk factors may contribute to preterm birth but a cause and effect relationship needs to be established through research [6]. Preterm birth therefore has no one specific cause. The cases presented in this analysis including model, borderline, related, contrary and illegitimate were expected to help increase understanding of preterm birth. The cases were presented based on experience and observations made during nursing practice.

Preterm birth is associated with an increased risk of developmental disability, health and growth problems [30]. An estimated 75% of perinatal deaths and 50% of neurological disabilities are directly related to with preterm birth [30]. Consequences of preterm birth are however based on the category of preterm birth which may be extreme, very or moderate preterm [2].

CONCLUSION

Preterm birth, a delivery of a live baby before 37 complete weeks of gestation, is a leading challenge in the world as it is contributing to majority of neonatal deaths and lifetime neurological disabilities to survivors. There are several risk factors to preterm birth and of importance is the history of previous preterm birth. The Walker and Avant model of concept analysis was used in this study to clarify meaning and increase understanding of preterm birth. Knowledge and understanding of preterm birth is necessary to guide education, stimulate more research, for development of preventive strategies and policy revision.

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REFERENCE

1. March of Dimes. Fighting premature birth. March of Dimes Foundation. A fighting chance for every baby. 2016.
2. World Health Organization. Preterm birth. Media Centre Factsheet. 2016: 363
3. Jazayeri A. Premature rupture of membranes. Medscape. Drugs and Diseases > Obstetrics and Gynaecology. 2016.
4. Shriver. Health Research throughout life. National Institute of child health and development. U.S Department of Health and Human Services. 2016. National institute of Health. NIH.
5. Lawn JE, Gravett MG, Nunes TM, Rubens CE & Stanton C. Global report on preterm birth and stillbirth (1 of 7): definitions, description of the burden and opportunities to improve data. BMC Pregnancy Childbirth. 2010; 10 (supp 1): S1
6. Centres for Disease Control and Prevention. Preterm Birth. CDC > > Reproductive Health > > CDC Maternal and Infant Health. 2016: 24|7: Saving lives, protecting people.
7. Robinson JN & Norwitz ER. Preterm birth: Risk factors and Interventions for risk reduction. Wolters Kluwer UpToDate. 2017: 6761 (60).
8. Gravett MG, Reubens CE and Nunes TM and the GAPPS Review Group. Global report on preterm birth and stillbirth: discovery science. BMC Pregnancy Childbirth. 2010: 10 (Supp 1): S2.
9. Behrman RE & Buttler AS. Preterm birth, Causes, Consequences, and Prevention. The national academies Press. 2007. Washington, DC
10. Reed J. eHealth: A concept analysis from a nursing perspective. Canadian Journal of Nursing Informatics. 2014: 9 (1 and 2).
11. Walker LO & Avant KC. Strategies for theory construction in nursing (4th edition). 2005. Upper Saddle River. NJ. Pearson/Prentice Hall.
12. Nuopponen A. Methods of concept analysis- a comparative study. LSP Journal. 2010: 1(1)
13. Cone TE. Perspective in Neonatology. Historical Review and recent advances in Neonatal and perinatal Medicine. Mead Johnson Nutritional Division. Chapt 2. 1980: 1-17.
14. Baker JP. Historical Perspective. The Incubator and the Medical Discovery of the Premature Infant. Journal of Perinatology. 2000; 5: 321- 328.
15. Silverman W. Incubator Baby- Baby Side Shows. Paediatrics. 1979; 64(2): 127- 141.
16. Bettman HW. Premature Labour and the New-born child. American Journal of Obstetrics and Disease of Women and Children. 1892; 25: 315- 328.
17. Harrison H. Premature care in the 1950s- An Interview with Dr William Silverman, Father of Neonatal Intensive Care Unit. The Premature Baby Book. 1983. Premature baby Premature Child.

-
18. Preterm. The American Heritage- Steadman's Medical dictionary. 2002. Houghton Mifflin Company
 19. Preterm. The Dictionary. Com. Thesaurus
 20. Birth. Merriam Webster Dictionary
 21. El Beltagy NS, Rocca MM, Teha EL, Weshai HM & Hamid Ali MSA et al. Risk factors for preterm labour among women attending El Shatby Maternity University Hospital, Alexandria, Egypt. Archives of Nursing Practice and Care. 2016; 2(1): 045- 049.
 22. Blencowe H, Cousens S, Chou M, Say L, Moller, AB, Kinney M et al. Born too soon: The epidemiology of 15 million preterm births. Reproductive Health. 2013. 10 (Supplementary 1): S2
 23. Beck S, Wojdyla D, Say L, Betran AP, Merialdi M, Requejo JH, et al. The worldwide incidence of preterm birth: A systematic review of maternal mortality and morbidity. Bulletin of the World Health Organisation 2010. 88: 31- 38.
 24. Enkivillage. Expected Date of Delivery: 5 Effective calculation methods. Health & Wellness. 2017.
 25. American Pregnancy Association Promoting pregnancy wellness. Calculating conception. American pregnancy.org/while-pregnant/calculation-conception-due-date. 2012.
 26. Goldenberg RL, Gravett MG, Iams J, Papageorghiou AT, Waller SA, Kramer M et al. The preterm birth syndrome: Issues to consider in creating a classification system. American Journal of Obstetrics and Gynaecology. 2012; 206 (2): 113-118.
 27. Tucker J & McGuire W. Epidemiology of preterm birth. BMJ ABC of preterm birth. 2004; 329 (7467): 675- 678
 28. Moster D, Lie RT & Markestad T. Long- term medical and social consequences of preterm birth. New England Journal of Medicine. 2008; 359 (3): 262-273.
 29. Newnham J, Dickinson JE, Hart RJ, Pennell CE, Arrese CA and Keelan JA et al. Strategies to prevent preterm birth. Frontiers in Immunology. 2014; 5: 584
 30. Gebreslasie K. Preterm birth and associated factors among mothers who gave birth in Gonda town Health Institutions. Advances in Nursing. 2016; 2016 (2016): 1-5.