

A Narrative Review to Identify Risk Factors Associated With Pregnancy Complications in Young Women under the Age Of 20

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Abstract: Adolescent pregnancy has existed over the past centuries and it stills remains a significant public health problem in the world today. The aim of this paper was to identify and explore the risk factors that are associated with pregnancy complications in young women under the age of 20. In this paper, a systematic approach was used to search electronic databases for English language and human based studies from January 2000 to July 2013. Quality assessment of the included studies was assessed using the CASP and BestBETs checklists. A narrative synthesis was conducted on data extracted from included studies. A total of 832 studies were retrieved from all the databases out of which 21 studies were included for the review. The review found a significant association between the identified risk factors and pregnancy complications in adolescents. The risk factors emerged as themes during the thematic analysis in the review. The associated risk factors identified include young maternal age, height, parity, inadequate weight gain, low income level, low educational status, ethnicity, marital status, visit by health worker, inadequate prenatal care, unplanned pregnancies, smoking and co-morbid pregnancy complications. Young maternal age was the most common risk factor found to have a strong significant effect on pregnancy outcomes, while preterm birth and LBW were the most common pregnancy complications significantly associated with the risk factors. The possible reasons that emerged from the association between the risk factors and adolescent pregnancy complications was the physical development and pubertal growth of pregnant adolescents which were majorly attributed to young maternal age. However, it was viewed that socio-demographic, behavioural and medical factors further strengthened the association between adolescents and pregnancy complications. Future research needs to be conducted to investigate the risk factors attached to the younger adolescents as they constitute the most vulnerable group.

Keywords: Risk factors, Pregnancy complications, Adolescent pregnancy, narrative synthesis.

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I. Introduction

In recent years, adolescent pregnancy has become a significant health and social issue, in developed and developing countries, due in part to a number of risk factors associated with complications in pregnancy and childbirth among young females. WHO defines young women between the ages of 10 – 19 years as adolescents [1, 2]. However, the literature reviewed during this work identifies adolescent girls as those between the ages of 13-19 years, this age group can also be referred to as teenagers.

Pregnancy in this paper is defined as the period of conception to birth [3] regardless of the outcome- live birth, abortion or death. Pregnancy can occur in adolescent females any time after menarche (or from the onset of puberty) [4]. Pregnancy complications reported to be associated with this age group include preterm labour and delivery, pre-eclampsia, intrauterine growth restriction (IUGR), obstructed and prolonged labour, infections such as HIV-infections, anaemia, obstetric fistulae, low birth weight (LBW) and still births [4, 5]. Risk factors such as age and cultural factors have been identified to link adolescents to these complications [6,7,8]. These factors are defined as the individual behaviour or social circumstances surrounding adolescents that increases the risk of pregnancy either to the adolescent, her foetus or both beyond the usual level of pregnancy risk [6].

This paper has been conducted to understand the factors that predispose adolescent girls to an increased risk of pregnancy complications. It will disclose their vulnerability as adolescents to these pregnancy complications in a way to improve maternal and child outcome. Currently, more attention seems to be given to the reduction in the incidence of adolescent pregnancy than the care of the pregnant adolescents and their newborn [1]. For instance, the president's Teen Pregnancy Prevention Initiative (TPPI) in the United States focuses more on the reduction of teen pregnancy rates in targeted areas than the care of pregnant teens

[9]. Therefore, exploring the theme of the paper will give a clearer understanding to their various health needs which in turn will contribute to a better understanding of how to improve support and health services to pregnant adolescents and their newborn.

Evidence from both qualitative and quantitative studies will be examined in a narrative synthesis for this paper and thematic analysis has been carried out to explore the risk factors associated with pregnancy complications of adolescents.

II. Methods

A narrative review of literature was used as the methodology in this paper. Narrative review was identified as most suitable because the diversities and pluralities of the theme was explored to provide a detailed background for understanding recent knowledge and identifying the importance of new research [10]. Hence, it is best to address the issue with an exploratory approach to allow for a comprehensive coverage of all the factors placing adolescents at risk of pregnancy complications. Studies were described and appraised to give a broad and clear understanding of these risk factors in a way to improve pregnancy outcomes of adolescent females.

The method adopted in this paper demonstrated how themes and methods were developed within the key areas of the study and took into account ideas that have resulted from studies to explain the specific factors associated with complications related to adolescent pregnancy [10]. One of the advantages of the method is that it explains the theme of the paper, pointing out the reasons why the research topic is both important and relevant [11].

Data were extracted in a standardised manner and the quality of studies was critically appraised using a recognised criteria- Critical Appraisal Skills Programme [12] and Best Evidence Topics (BESTBETs) [13].

Study Eligibility Criteria

Inclusion and exclusion criteria were set to act as a guideline to obtain literature using a search that is sensitive and retrieves specific literature needed to address the research question, regardless of how many studies that may be. Due to changing policies related to adolescent pregnancy, date for searching has been limited to the past decade in order to obtain relevant data. Language restriction was also set due to the cost of obtaining a translator as this is a masters dissertation. The inclusion and exclusion criteria are shown in Table 1 below.

Table 1: Inclusion and Exclusion Criteria

Review Protocol	Inclusion Criteria	Exclusion Criteria
Population	Pregnant adolescents (13 – 19 years)	Only pregnant women (>20years) and non-pregnant adolescent.
Exposure	Studies dealing with risk factors related to pregnancy	Studies not dealing with risk factors related to pregnancy
Outcome	Studies dealing with pregnancy complications	Studies dealing with non-pregnancy complications
Study Design	Primary research such as primary studies, articles. Reports	Editorials, discussion, expert opinion, reviews. Dissertations (due to the cost of obtaining data)
Language	English	Not English
Humans	Human based studies	Not human
Time	January 2000 – July 2013	< January 2000

Information Sources

Searches were developed using electronic databases MEDLINE via OvidSP, CINAHL, POPLINE, EMBASE via OvidSp; nongovernmental databases WHO regional database- African Index Medicus (AIM), WHO library database (WHOLIS), WHO's institutional repository for information sharing (IRIS). Websites of international non-governmental organisations (NGOs) including United Nations and UNICEF, Web Of Knowledge (WOK) and Google Scholar. However, some databases were excluded from the final search as they either returned a lack of data relevant to the paper theme or generated a large amount of literature despite a specific and sensitive search strategy.

Manual searching of journals was conducted to identify relevant articles that may have been missed from searching of electronic databases. The Journal of Adolescent Health was chosen for this purpose.

Therefore, the articles retrieved for the research were obtained from the following databases: MEDLINE and EMBASE via OvidSp, POPLINE, CINAHL, WHOLIS and WHO IRIS, and Journal of Adolescent Health.

Search Strategy

Searching was more elaborate in MEDLINE and EMBASE, whilst some databases like WHOLIS only allowed for two keywords and a Boolean operator. The search terms include adolescent pregnancy, teen pregnancy, adolescent childbirth, pregnancy complications, childbirth complications, obstetric complications, labour complications. Boolean operators such as ‘OR’, ‘AND’, and truncation symbols like quotation marks (“”) and parentheses were used to either link, group or truncate terms where appropriate. The restriction of the search to only English language excludes other studies written in other languages hence, language bias may have occurred but was unavoidable. Also, the exclusion of dissertations and reviews may have led to loss of relevant evidence for the research topic.

The Mendeley reference manager software (version 1.9.2) was used as a bibliographic database management system to record references obtained from the search and to identify duplicates that might have resulted from the combination of different databases. Identified literature were exported directly into the reference manager from the selected databases if the exportation tool was provided (e.g. MEDLINE). However, literature that were obtained from other sources without this tool (e.g. WHOLIS) were entered manually.

Data Extraction

A data extraction table was developed to acquire relevant information from the final included studies appropriately [14]. The table was sectioned into eight components: author and year of publication, objective of study, design and type of study, sample population, country of origin, outcome of interest, main findings, and the strengths and limitations. The outcome of interest dealt with the pregnancy complications that were investigated in the studies, while the main findings captured the risk factors involved and their association/effect with/on the pregnancy complications that occurred.

Data Synthesis

A narrative synthesis was conducted on data extracted from included studies, as the acquired literatures were expected to be heterogeneous. The relationship between each of the included studies were described, compared and contrasted towards combining and interpreting relevant information to achieve the aim of the research. Themes were identified and developed as part of the narrative synthesis to aid the interpretation of result.

Data Quality Assessment

The quality of included studies was assessed according to the research design adopted, using critical appraisal checklists such as the critical appraisal skills programme (CASP) [12] and best evidence topics (BestBETs) [13]. CASP checklists were used to critically examine research such as cohort and case-control studies for the value and relevance of each research (CASP) [12]. However, CASP did not have a checklist to analyse surveys within the included studies thus, BestBETs checklist was used to do so. The checklist of each study design consisted of about 10 screening questions, an example of a question is- ‘How precise are the results?’.

A scoring table was also developed to aid interpretation of quality assessment for each of the included studies as shown in Table 2.

Table 2: Quality Rating Standard for the Included Studies

Scores	Ratings
7-10	Good
4-6	Fair
1-3	Poor

III. Results

Study Selection

A total of 832 studies were retrieved from the selected databases. A total number of 202 duplicates were removed through the reference manager and 630 studies were included for the title and abstract screening. At this stage, 533 studies were rejected because they did not meet the inclusion criteria. A total of 97 of the studies were included for full text screening with 76 studies further excluded based on design, language, pregnancy risk factors, developed countries and a few others could not be retrieved. Finally, a total of 21 studies which met the inclusion criteria and were included in the review. The flow chart for this study selection is represented in figure 1 below.

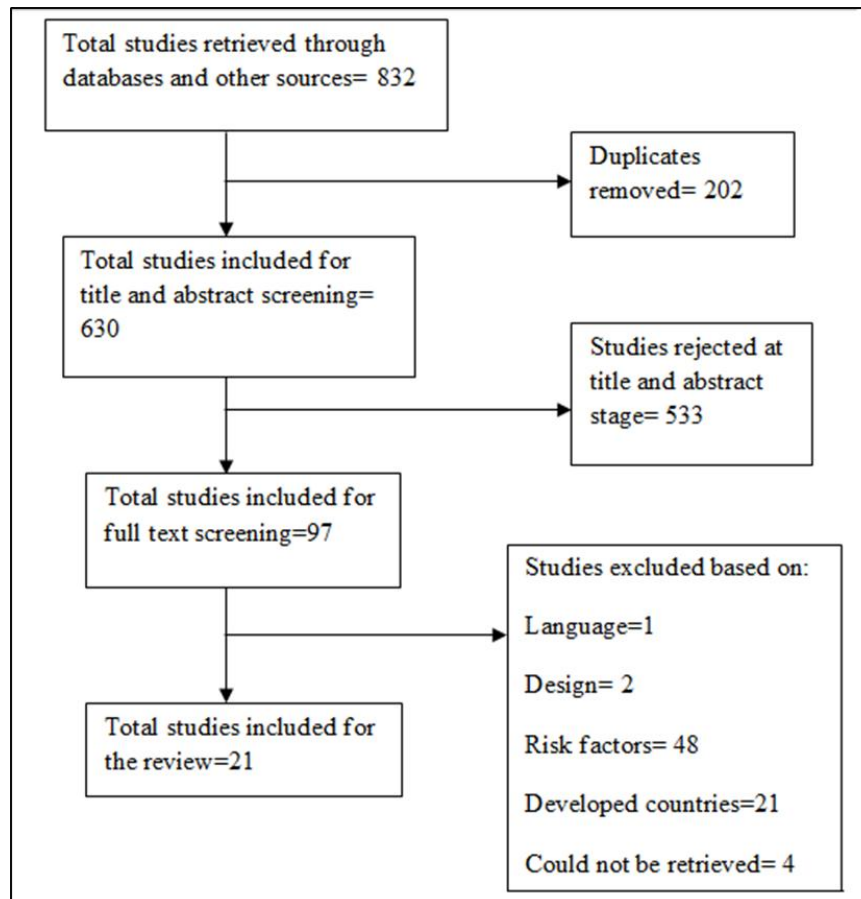


FIGURE 1: PRISMA Flow Chart

Outcomes of studies

Among the 21 included studies for the review, 17 studies focused majorly on different factors and the general adverse pregnancy outcomes associated with adolescent pregnancy [15-31], while few studies focused on some specific factors and/or specific complication with regards to adolescent pregnancy [32-35]. One study investigated the relationship between maternal height and preterm delivery [32], another examined the influence of weight gain on adolescent pregnancy outcome [35], while a separate study evaluated the impact of antenatal care on pregnancy outcome [33] and another identified the specific health problems linked with pregnant adolescents and the effect on pregnancy wastage [34]. For the outcome of interest which deals with the pregnancy complications, all the included studies looked at some of the pregnancy complications that can result from adolescent pregnancy. However, two studies were comprehensive in the number of possible complications that might have occurred for the study group [21, 23]. The most common complications that were studied are low birth weight, still births, preterm delivery, pregnancy induced hypertension (PIH) and the mode of delivery. However, one study was specific with an outcome of interest- preterm delivery [32].

Setting

A total of 18 studies were hospital-based consisting of general, public, private, and tertiary-care hospitals. Three studies were conducted in Nigeria [18,33,35] and India [33, 41, 43] respectively, while two studies each were conducted in China [31, 32], Israel [16,24] and Taiwan [22,25]. One study was conducted in each of the following countries respectively: Turkey [15], Botswana [17], Sri Lanka [20], Jordan [23], Malaysia [26], Thailand [28] and Brazil [30]. One study was conducted in Latin America [21], as a region of America which consisted of various countries- Uruguay, Argentina, Peru, Colombia, Honduras, Paraguay, El Salvador, Chile, Bolivia, Costa Rica, Panama, Dominican Republic, Nicaragua, Brazil and Venezuela.

Design

In terms of study design, two studies were population surveys [25, 34] and one was based on a public health database [21]. There were also 7 cohort studies, 6 cross-sectional studies, 6 case-control

studies, 1 qualitative study and 1 descriptive survey. A quantitative data collection method was used in all the studies apart from the qualitative study [34] and another study which used mixed methods involving both quantitative and qualitative methods of data collection [25]. The data collection of 5 studies involved interviews and the use of questionnaires, while 16 studies obtained data directly from hospital records and 2 studies used a combination of both [19, 27].

Population

The limitation of most of the studies was small sample size and this limited the generalisability of the studies. There were two studies with relatively large sample size [16,30] especially the one conducted in Latin America which had the largest [21], This may however be due to the number of countries involved in the study region. All the studies also obtained ethical approval from appropriate sources and consent from subjects or parents of subjects were stated.

Quality Assessment of Included Studies

A quality assessment of the included studies was conducted to determine if the methods, outcomes and findings of these studies were valid and reliable. Also, the weakness of each study was identified and the impact on the review was considered.

The summary of the quality assessment of the included studies conducted with reference to CASP [12] and BestBETs [13] quality checklists and the individual scores for all of the study designs are displayed in the table 3 below.

TABLE 3: Scores of the studies using the checklists

Study Design	Checklists	Studies	Scores
1) Cohort	CASP	a) Lao T.T. et al	7/10
		b) Malviya M.K. et al	6/10
		c) Loto O.M. et al	8/10
		d) Goonewardene I. et al	7/10
		e) Geist R.R. et al	5/10
		f) Kuo C. et al	7/10
		g) Lao. T.T. et al	8/10
2) Case-Control	CASP	a) Bukulmez O. et al	8/10
		b) Oboro V.O. et al	8/10
		c) Al-Rahahi M. et al	7/10
		d) Omar K. et al	8/10
		e) Thaithae S. et al	9/10
		f) Muhil M. et al	7/10
3) Cross-sectional	CASP	a) Gortzak-Uzan L. et al	7/10
		b) Conde-Agudelo A. et al	8/10
		c) Lin C. et al	7/10
		d) Mukhopadhyay P. et al	7/10
		e) Fadupin G.T. et al	7/10
		f) Alves J.G.B. et al	7/10
4) Descriptive Survey	BestBETs	a) Letamo G. et al	8/10
5) Qualitative	CASP	a) Rahmann M.M. et al	6/10

Almost all the studies were of good quality (scores 7-10) except three studies that were of fair quality (scores 4-6) [19,24,34]. A case-control study [28] stood out as the best in quality with a score of 9.

Synthesis of Results

The risk factors for complications in adolescent pregnancy were categorized under the following four broad themes to aid interpretation:

- Biological factors
- Socio-demographic factors
- Behavioural factors
- Medical factors

These themes were derived from the included studies reviewed. Table 4 shows all the identified risk factors associated with adolescent pregnancy complications according to the developed themes.

TABLE 4: Identified Risk Factors

Biological	Socio-Demographic	Behavioural	Medical
Age	Weight	Prenatal care	Co-morbid pregnancy complications
Height	Education	Unplanned pregnancies	
Parity	Income	Substance abuse- Smoking	
	Marital status	Diet	
	Ethnicity		
	Parents' marital status		
	Health worker visit		

BIOLOGICAL FACTORS

Many studies (81%) have cited biological factors as the major risk factor of adolescent pregnancy complications. Young maternal age (<20 years), height, and parity constitute the group of biological factors identified in this review.

From the synthesis of results, a significant association between young maternal age and pregnancy complications was identified. Young maternal age is the reason for most biological risk factors found in the review.

One possible reason for the association is the physical development of adolescent mothers. Conde-Agudelo A. *et al* suggests that the pelvic bones and the birth canals are presumed to be still growing in early adolescence, placing females at an increased risk of pregnancy complications such as obstructed and prolonged labour [21]. Thus, pelvic development has been noted as a risk factor of birth complications especially preterm births. Adolescent mothers have a smaller pelvis size than adult mothers which lacks behind the statural growth of adolescents [31]. Lao T.T. *et al* suggests that the pelvis size may have compelled an individualised upper limit of tolerance of the maximum foetal size, in this way the preterm birth represents a type of adaptation and a concession between the mother and foetus to guarantee the best outcome for both of them [31]. On the other hand, Thaithae S. *et al* suggests that the uterine or cervical blood supply of adolescent mothers may be underdeveloped exposing them to subclinical infections and this underdevelopment may activate prostaglandin production resulting to preterm births [28].

However, younger maternal age was found to contribute the most risk to the adolescent group. Younger adolescent mothers are associated with a limited uterine space leading to impairment of foetal growth and the growth rate of younger adolescents may have also added to the insufficient supply of nutrients in the body which further limits foetal growth [30]. Oboro V.O. *et al* suggests that the magnitude of the health problems associated with adolescent pregnancy may have normalised in older adolescents but continues to increase quickly in younger adolescents [18].

Maternal height was also associated with the physical development of adolescent mothers. Lao T.T. *et al* suggests that in the group with the shortest adolescent mothers, the length of the foetus may have attained the maximum size relative to maternal height, that is possible for vaginal delivery at the start of labour [32]. Thus, if the mother is small in size and of young age, she is more likely to deliver a small and weak infant with minimal chances of survival [34].

Parity was also found to significantly affect adolescent pregnancy outcome [15,24,35]. The reason for parity (either nulliparity or multiparity) as a risk factor was not clearly stated by any of the studies. But, nulliparity as a risk factor may be due to the same physical immaturity of adolescent mothers. Geist R.R. *et al* suggests that the reproductive immaturity (gynaecological age of <3 years after menarche) predisposes younger adolescents to adverse pregnancy outcomes; the short cervix (<25mm) of younger adolescents increases the risk of premature deliveries [24]. However, longitudinal growth can occur in pregnant adolescents where the growth occurs more in nulliparas than in multiparas, thus the risk of short gestational duration in nulliparas is reduced [32].

SOCIO-DEMOGRAPHIC FACTORS

Socio-demographic factors consists of extrinsic factors that affect the outcome of adolescent pregnancy. They include: maternal weight gain, occupation, income, education, marital status and ethnicity, partner, family support, being raised by a single parent and visit by health worker.

A significant association between maternal weight gain and pregnancy complications in adolescents was identified from the synthesis of results. Poor weight gain during pregnancy was found to be a risk factor of some pregnancy complications. One reason for this could be the pubertal growth of adolescents. Lao T.T. *et al* suggests the current pubertal growth makes adolescent mothers lighter than adult mothers [31]. Adolescent mothers compete for nutrients and energy with the foetus which contributes to the lower weight gain of adolescents, in turn this leads to LBW infants and IUGR [25,35]. On the other hand, the lower BMI of adolescent mothers at booking indicates a smaller

maternal built in adolescent mothers, and combined with a small pelvic size leads to preterm birth [31]. Lao T.T. *et al* also suggests parity as a possible reason for poor weight gain [31]. Adolescent mothers who are nulliparous (first-time mothers) have a lower gestational weight gain than those who are multiparous [31].

Low education attainment and low income level were identified to be significantly associated with adolescent pregnancy complications. One possible reason for low education attainment among adolescent mothers is childbirth. Mukhopadhyay P. *et al* suggests low education level to lead to lower job opportunities which affects the income level of adolescent mothers [26,27]. Lin C. *et al* suggests adolescent mothers with low level of literacy to lack cognitive ability to prepare for delivery placing them at increased risk of precipitate labour [22]. The lack of reproductive and sexual awareness leads to the inadequate care of adolescent mothers and foetus, this makes adolescents careless with the pregnancy leading to adverse outcomes [26,27]. However, Malviya M.K. *et al* suggests that marriage at an early age affects education and earning capacity of adolescents leading to poor standard of life and malnutrition, which culminates in adverse pregnancy outcomes [29].

Studies also found significant association between marital status and adolescent pregnancies. Adolescent mothers were found to be single and this contributed to adverse pregnancy outcomes. Letamo G. *et al* suggests the characteristics of unmarried adolescents to be the reasons for pregnancy complications. Unmarried women are viewed as irresponsible and are less respected than married women, this may lead to unwanted pregnancies which are usually terminated through concealed abortions that can cause pregnancy complications. Unmarried adolescents are more likely to be poor, less educated and unemployed putting them at an increased risk of pregnancy complications [17]. Also, Omar K. *et al* suggests unmarried adolescent mothers to be psychologically immature, not understanding the process of pregnancy and the adverse outcomes attached to it [26]. Although, Muhil M. *et al* found adolescent mothers to be married, marriage at an early age is suggested to have adverse effect on their education, health awareness and occupation leading to a low standard of life and malnutrition which in turn leads to pregnancy complications such as LBW and preterm deliveries [29]. In contrast, Geist R.R. *et al* suggests marriage as a reason for the positive pregnancy outcomes among adolescent mothers in the study. Married adolescent mothers were suggested to have planned pregnancies with reasonable prenatal care explaining the positive outcomes [24].

A significant association between ethnicity and adolescent pregnancy complications was found. One possible reason for this is the characteristics of the ethnic group. Gortzak-Uzan L. *et al* suggests that although most of the Bedouin adolescents were married and had good family support, Bedouin adolescents were poorer and less educated than the Jewish adolescents hence, making them more prone to adverse pregnancy outcomes such as LBW [16].

The regular visit of health worker during adolescent pregnancy was found to have a positive effect on pregnancy outcomes [34]. Rahman M.M. *et al* suggests health care workers give pregnant adolescents the adequate knowledge required to meet the health needs of adolescents during pregnancy such as nutrition requirements, vaccines and the pregnancy complications adolescents may face thus, avoiding or reducing adverse pregnancy outcomes.

BEHAVIOURAL FACTORS

Behavioural factors are also extrinsic factors that affect adolescent pregnancy outcomes. These consist of prenatal care, unplanned pregnancies and substance use. From the results, there is an agreement that adolescent pregnancy is associated with adverse outcomes due to late or inadequate prenatal. Letamo G. *et al* suggests the early and regular attendance of prenatal care clinics by adolescents would decrease the risk of pregnancy complications [17]. The clinics conduct necessary screening tests that will assist health care workers to foresee pregnancy complications that may occur and allow the time to provide the required obstetric interventions. The clinics also give pregnant adolescents advice on certain habits that should be avoided such as non-consumption of alcohol or smoking during pregnancy, or the habits to incorporate like eating a well-balanced diet, to reduce the risk of adverse birth outcomes. Furthermore, the clinics supply appropriate drugs/treatment such as malaria prophylaxis to adolescent mothers to reduce infections and complications [33]. In addition, certain barriers such as late discovery and concealment of pregnancy, financial inadequacy and poor access to health services are possible reasons for lack of adequate prenatal care [18]. However, Kuo C. *et al* suggests unwillingness or total dismissal among pregnant adolescents as possible reasons for delayed prenatal care visit [25]. On the contrary, booked adolescents were still associated with LBW and increased augmentation labour rate. Loto O.M. *et al* suggests the association with LBW to be due to the small maternal size of adolescents, and augmentation labour rate to be linked with the increased intervention rate to avoid obstetric complications [33].

Few studies found association between smoking and adverse pregnancy outcomes in adolescents. Lin C. *et al* found that tobacco affects both mother and foetus. The rate of tobacco exposure is higher in adolescent mothers compared to adult mothers [22]. LBW was the complication found to be independently linked with smoking [25]. However, none of the studies gave any reason as how smoking or tobacco leads to pregnancy complications.

Intake of nutritious foods was found to have significant association with adolescent pregnancy complications. The lack of nutritious foods was stated to result to malnutrition which in turn leads to adverse pregnancy outcomes such as anaemia. Thaithae S. *et al* suggests that the low income level of adolescent mothers may hinder the ability to acquire nutritious foods needed during pregnancy [28]. However, an increased rate of anaemia was found among adolescent mothers who took folic acid and iron tablets [29]. A possible reason for this is that adolescent mothers have a higher iron requirement than adult mothers during pregnancy. Muhil M. *et al* suggests the higher iron requirement to be both for the growth of adolescents and the foetus [29]. Lin C. *et al* adds the onset of menstruation combined with the metabolic costs of pregnancy as possible reasons for higher iron requirement among adolescent mothers [22].

MEDICAL FACTORS

Some pregnancy complications have been reported to be risk factors of other pregnancy complications experienced in adolescent mothers. A total of five studies found a significant relationship between some pregnancy complications and the complications that occurred in the individual studies [15,16,19,31,34]. From the results, some pregnancy complications were found to significantly affect other pregnancy complications in adolescents [15,16,19,31,34]. Reasons for these association was not elucidated by any of the included studies, but it is thought that the individual effect of each of the responsible complication leads to the product of another related complication. For example, the malformations in infants of adolescent mothers from the study by Gortzak-Uzan L. *et al*, consisted of infants with neural tube defects, chromosomal abnormalities and hereditary disorders which may have led to LBW among the infants [16]. Also, preterm delivery (<34 weeks) is suggested as a reason for LBW babies of adolescent mothers [28,31] since babies born several weeks before the due date will be immature, hence the babies will have a small stature.

IV. Conclusion

The main finding in this paper has been the identification of the risk factors associated with adolescent pregnancy complications. This can be broadly categorised into biological, socio-demographic, behavioural and medical factors. Each of these risk factors found were significantly associated with adolescent pregnancy complications, although the association of some factors were stronger or more common than others. The biological factor especially young maternal age had a very strong association with adverse pregnancy outcomes such as preterm delivery and LBW. However, it was also found that the younger the maternal age, the higher the risk of adverse pregnancy outcomes. On the other hand, inadequate prenatal care was also found as a behavioural factor that had the most influence on adolescent pregnancy outcomes. An interesting finding was the identification of medical factors that led to adverse pregnancy outcomes among this age group. A pregnant adolescent with obstetric historical factors or preterm delivery was found to lead to other pregnancy complications such as LBW. The socio-demographic factors such as weight gain and marital status were also found to be associated with adverse pregnancy outcomes in adolescents.

A thematic analysis was conducted in this review to develop themes that will capture the various risk factors to understand how adolescents are placed at a higher risk of pregnancy complications. The analysis led to the understanding of how these factors interact with each other to produce adverse pregnancy outcomes showing that the risk factors are not independent but interlinked. For instance, young maternal age was suggested to place pregnant adolescents at an increased risk due to immaturity of their reproductive organ (uterus) and pubertal growth, but the lack of adequate prenatal care and weight gain also increases this risk as adolescents may not have requisite knowledge about the required nutritious foods needed to reduce the competition of nutrients between themselves and the foetus. The pregnancy complications may also not be identified on time by health care providers as a result of social barriers in developing countries. Furthermore, pregnant adolescents maybe unmarried, poorly educated and unemployed, thereby lacking financial capability to access appropriate prenatal services or afford the required provisions for healthy upkeep.

Researcher bias is the main limitation of this review however the use of systematic approach reduces such bias making its findings more valid and robust. Future recommendations have been suggested to reduce the identified risk factors through a collaborative care approach. Also, further

studies are required to investigate the risk factors attached to the younger adolescents as they constitute the most vulnerable group.

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