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ORIGINAL ARTICLE

Teenage Pregnancies and Cerebral Palsy Prevalence in Zambia: A Quality Improvement Study

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ABSTRACT

Purpose: This quality improvement study aimed to exploring how the high burden of teenage pregnancies in Zambia's Eastern Province relates to CP prevalence.

Participants and Setting: The study included care givers of children with cerebral palsy attending outpatient physiotherapy at St. Francis' Hospital, a 490-bed facility located in Katete District, Zambia.

Methods: Facility data from January to December 2023 were retrospectively analyzed, focusing on children with cerebral palsy (CP) who attended physiotherapy services. During this period, a total of 283 children received care. Descriptive statistics were generated using Microsoft excel, with particular attention to CP types and caregiver categories. To examine associations between risk factors and maternal age groups, the Chi-square test was employed. Quality improvement interventions were guided by the Plan-Do-Study-Act (PDSA) cycle

Results: Caregivers ages ranged from 18 to 65 years, with the majority being teenage mothers 67%; approximately 2% were grandmothers. Most caregivers (70%) were from a rural background. Asphyxia (35.45%) and prematurity (25.45%) were the main risk factors of CP with spastic type being the most prevalent type (77.50%).

Utilizing the PDSA cycle to implement interventions a family-centred rehabilitation approach was employed. Multi-sectoral involvement was identified as critical in addressing the complications associated with teenage pregnancies.

Conclusion: This study underlines the importance of family-centred care. Managing CP in children born to teenage mothers poses unique challenges, necessitating educational interventions targeting caregivers. Regions with high teenage pregnancy rates, such as Zambia's Eastern Province, should expect a proportional rise in neonatal complications like CP. The equitable allocation of rehabilitation resources and a multidisciplinary approach are vital to addressing both teenage pregnancies and their associated complications.

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INTRODUCTION

Teenage pregnancies pose significant challenges to adolescent parents, their children, and extended families.[1] Despite a global decline in teenage pregnancy rates[2,3] the associated complications remain a public health concern.[2,4] Sub-Saharan Africa bears one of the highest burdens, with an estimated 33% of girls giving birth before the age of 18.[5] Within the regional averages some countries have higher rates. In 2021 Niger had the highest rates of teenagers who gave birth before the age of 18 at 170.5 birth per 1000 live births; in Malawi a 29 % prevalence was reported and in South Africa 16 % teens aged 15-19 years are either pregnant with their first child and/or have given birth.[6] In 2020, Zambia ranked 12th in Africa, with 115 births per 1,000 live births, and the 2018 Zambia Demographic and Health Survey reported a teenage pregnancy rate of 29%, translating to one in three girls becoming pregnant before 18 years[7]. Zambia's Eastern Province reported rates as high as 39.5%, with 35% of rural girls giving birth by age 18.[8, 9, 10] The high prevalence of teenage pregnancies in Zambia is of particular concern due to the well-documented complications associated with teenage childbirth. These perinatal complications can have lasting consequences on neonatal health, increasing the likelihood of developmental disorders.

Among these disorders, Cerebral Palsy (CP) is one of the most common and severe, affecting motor function and quality of life.[11,12] Studies suggest that maternal age, particularly under 20 years, is associated with an increased risk of CP.[11,12, 13] The association has been attributed to teenagers being more likely to give birth to preterm and/or low-birth-weight infants[1, 3,10,14,15] because of their physically and psychologically immature bodies for reproduction.[6,17] Studies have further shown that infants born to teenagers are more likely to have low Apgar scores (under 7) at one or five minutes after birth compared to those born to mothers aged 20 to 39.[16,17] These complications significantly raise the likelihood of developing CP. These outcomes are worsened if the teenage mother is from a low socioeconomic status.

Important to note that young mothers often encounter significant educational, economic, and social challenges that can impact their long-term well-being and opportunities.[18,19] These challenges can affect their ability to provide optimal care and support during rehabilitation. Acquisition of functional abilities during rehabilitation are closely linked with contextual factors including the role of care givers and access to rehabilitation.[10] The rehabilitation process for a child with CP typically requires substantial care giving often throughout childhood.[20-22] Rehabilitation for children with CP relies on collaboration between healthcare professionals and caregivers with outcomes greatly influenced by the guidance caregivers receive from healthcare professionals.[10, 17, 21] Teenage parenthood is associated with mental health problems such as depression, substance abuse, and posttraumatic stress disorder[6]. Further teenage mothers being children themselves have less information about parenting, childcare and stimulation. While these rehabilitation practices are crucial for improving outcomes, primary prevention through improved maternal care remains equally important.[23,24]

Advances in neonatal care have improved infant survival rates[11,24] but often leave unanswered questions about the long-term quality of life for affected children. Better antenatal and postnatal care can reduce both neonatal mortality and CP incidence.[11] However, while teenage pregnancies and CP have been studied independently, the link between teenage births and CP prevalence remains underexplored. There was a need to improve service delivery that would have a specific focus for organising the overall management and governance of care for this special group of children. QI was chosen as a suitable approach to address the gap as it involved analysing a problem to understand its' characteristics and causes, setting clear improvement goals, proposing changes, objectively measuring data during implementation, and ensuring the a solution becomes a standard practice.[24] This study addresses this gap by exploring how the high burden of teenage pregnancies in Zambia's Eastern Province relates to CP prevalence.

METHODS

Study design

This single-site (QI) study was conducted at St. Francis' Mission Hospital in Katete District, Zambia. The hospital's physiotherapy department treats over 3,000 patients annually, supported by eight physiotherapists and one support staff member. The study focused on caregivers of children with cerebral palsy (CP), reviewing the records of all 283 children registered for rehabilitation. Caregivers were included based on their child's CP diagnosis, with teenage status defined by the caregiver's age at the time of delivery. Records with missing significant information were excluded, and the base line study followed a retrospective design using facility data. Pre intervention data was collected using a checklist that captured variables such as patient demographics, CP types, and caregiver details.

Data was entered and analysed using SPSS version 24. Descriptive statistics were used to summarize demographic characteristics. The association between maternal age group was (teen mothers Vs adult mothers) and the identified risk factors was assessed using the chi square test. Statistical significance was set at $p<0.05$, and 95% confidence interval.

The PDSA cycle, a QI framework that promotes increased effectiveness, efficiency, and learning, was used to guide planning and implementation of the team's improvement efforts. With an aim of improving local process, the PDSA cycle has been applied quality improvement work elsewhere.[15] The approach focused on 3 questions:

1. what are we trying to accomplish,
2. how will we know that a change is an improvement, and
3. what changes can we make that will result in improvement?

The fishbone analysis was used to brainstorm ideasfor potential root cause for the quality gap and interventions tested using PDSA cycles.

Ethical consideration

Data collection adhered to ethical guidelines, ensuring patient confidentiality. Permission was obtained from the hospital's Quality Improvement Committee. Ethical clearance was not needed as this study was undertaken as a quality improvement study. The study was primarily intended to improve local care and not to generalize knowledge. Anonymity was assured since the participants' names were not to be written or mentioned in the study. Verbal consent was gained from each participant before including her in the study/intervention. Mothers were assured that the collected data would remain confidential and that no personal identification was needed by any means.

Outcome Measure

The main outcome measure was family coaching during physiotherapy sessions and length of the interactions.

Implementation of changes

The first step involved collecting baseline information on the current burden of children with CP. Following root cause analysis and prioritization of possible interventions (see figure 2) , a PDSA cycle was used to implement intervention that were designed as a comprehensive, family-centred support program with several core components:

PDSA cycle 1; Enhanced Support for Teenage Mothers

Recognizing that most caregivers were teenagers, the rehabilitation approach was adjusted to meet their specific needs.[25]Additional time was allocated during sessions for teenage mothers to help them and their families better understand their children's condition.[11,21] Since many teenage mothers lacked the capacity to manage care independently[15], the program emphasized building their care giving skills while acknowledging their unique circumstances as young parents.

PDSA cycle 2; Family-Centered Care Model)

The intervention prioritized family-centred care, emphasizing family strengths, mutual respect, and effective communication between families and healthcare providers. [17,25,26] Rather than working solely with teenage mothers, physiotherapists collaborated with entire families, involving them in service planning and evaluation while offering flexible support tailored to their needs.[27]

PDSA cycle 3; Administrative and Communication Improvements

Facility records were updated to include phone numbers, enabling follow-ups with caregivers and providing reminders for upcoming appointments.(see figure 2) The physiotherapy personnel underwent orientation sessions to ensure consistent care practices across the program.

PDSA cycle 4: Socioeconomic Support

Recognizing that many mothers came from rural areas and faced significant socioeconomic challenges as they were just starting their lives, the project facilitated linkages with existing social protection systems to provide additional support.[22] To be more available for the child, mothers or families may need to sacrifice their personal goals, discontinue their education or reduce their economic activities.[28] A good support system can help to ensure the best health for mother and child. Since many teen moms do not have this support system at home, the project facilitated linkages with the social cash transfer program.

RESULTS

Demographics

In 2023, a total of 283 children with CP attended

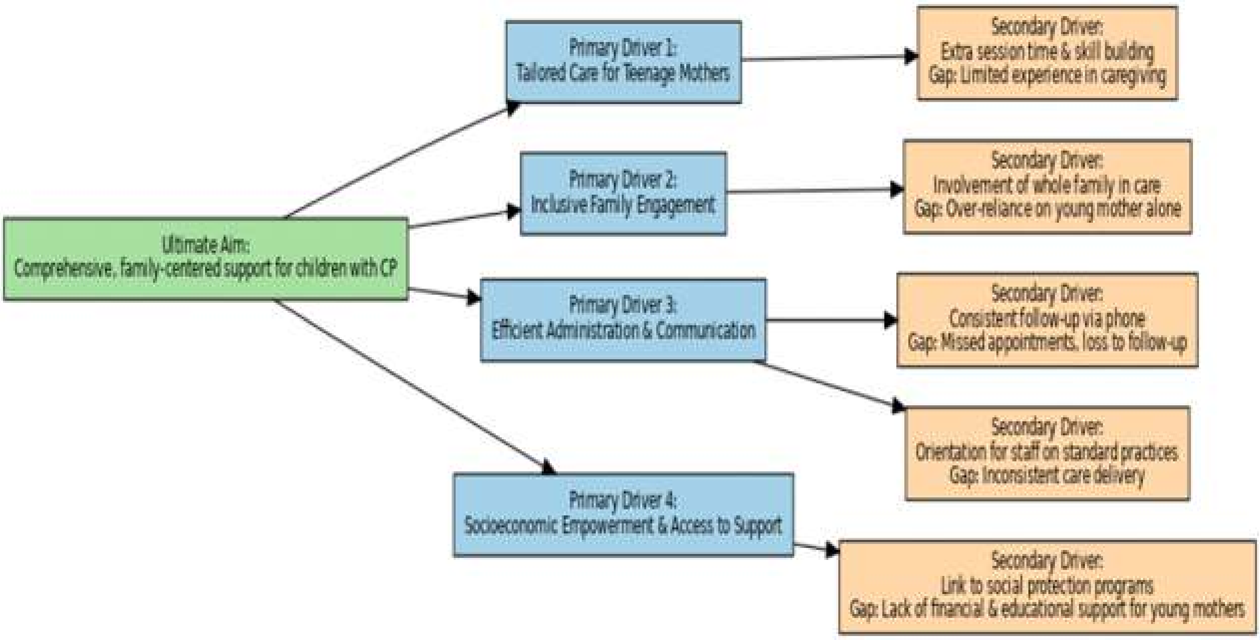

Figure 1: driver diagram

physiotherapy, 74.5% of whom were male, as shown in Figure 2. Most children (76.4%) were under five years old, with a median age of three. Approximately 46% had never received rehabilitation services prior to this. Caregivers' ages ranged from 18 to 65 years, with a mean age of 32.4 years. The majority of caregivers (67%) were teenage mothers at the time of childbirth, and 70% lived in rural areas. This demographic information is presented in Table 1.

Cerebral Palsy Subtypes:

In terms of topographical presentation, quadriplegia

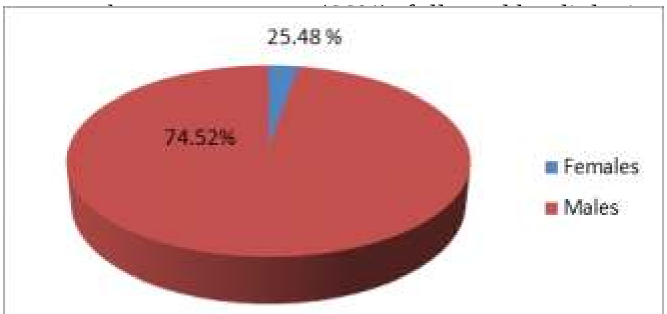

Figure 2: Sex distribution of Cerebral palsy children

Table 1: Care giver categories by age

	No	Percentage (%)
15 - 19	190	67
20 -29	65	23
30 - 39	19	7
40 -	6	2
Relationship with child		
Mother	178	63
father	7	2
Grand mother	93	33
Others	2	0.7
Residence of caregivers		
Urban	85	30
Rural	198	70

(17%) and hemiplegia (14%). As shown in Figure 1, spastic CP accounted for 77.5% of cases, while athetoid CP was the least common, comprising 5%.

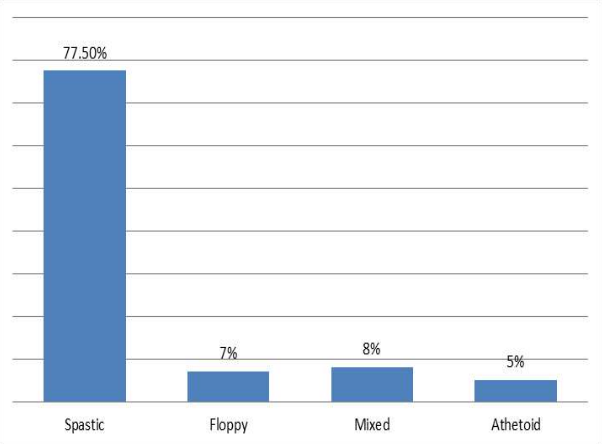

Figure 3: Cerebral Palsy types

Of the 283 medical records reviewed the most commonly reported risk factors included birth asphyxia (35.4%), prematurity (25.45%), and neonatal infections (20.9%). This indicates that perinatal factors were most common. 1.4% (n = 4) of the records had unknown risk factor.

Table 2 : Common risk factors by maternal age

Variable	Adult Mothers	Teen Mothers	Number	Percentage (%) Total	P value
Asphyxia	34	66	100	35.45	0.002
Prematurity	14	58	72	25.45	<0.001
Infection	27	32	59	20.90	0.081
Others	28	20	48	16.90	0.049

Follow up and outcome

This project did not have an immediate impact on the prevalence of cerebral palsy related to teenage births. However it does bring to light the need for a multi-disciplinary long term follow up for children who have a suggestive history. Re-evaluation is planned for in the year ending 2026 to assess any targeted care improvements following the implementation of the key change ideas.

DISCUSSION

This study highlights the complex interplay between teenage pregnancies and CP.[6, 11, 17] Majority of the caregivers in this study were mothers to the children. In line with literature the responsibility of caring for the child is traditionally the responsibility of the mother.[29,30] This is in contrast with another study that found more male caregivers than females highlighting the significant role men also play in caring for children with CP.[30, 31] Young mothers made up the largest proportion of the group. Consistent with other studies, this study found a higher occurrence of CP among children born to teenage mothers.[12,32] The higher occurrence of CP in this population has been associated to factors like complications during pregnancy and childbirth, developmental immaturity and limited access to healthcare or support systems.[12, 20] There are, however, studies that did not show such a relationship between risk of CP in teenage pregnancies.[33] Studies on the link between teenage pregnancy and the risk of CP has produced mixed results. Some studies suggest a higher risk in children born to teenage mothers,[5,12] while others do not find a significant association.[12, 33] This variability could be attributed to differences in study design, confounding variables, and the characteristics of the populations studied.

Most of the caregivers (70%) in this study were from a rural background. The high prevalence of CP among rural families reflects limited access to antenatal and neonatal care.[10] Teenage mothers face unique challenges, including limited resources and developmental immaturity,[20] which affect their care giving capacity.[8] Male dominance among children with CP aligns with existing literature.[12,32] Males are more likely to have neurodevelopment disabilities, such as intellectual disability and CP, making up to 70% of cases.[12] Differences in brain organization, genetic factors, and the protective effects of female hormones have been suggested to explain the higher prevalence of CP and other disorders in males.[12, 17] The findings also emphasize birth asphyxia as a major risk factor for the development of CP,[12,17] underscoring the critical need to strengthen neonatal resuscitation practices and improve the management of at-risk newborns[7, 11]. In this study birth asphyxia was significantly common among children born to teenage mothers(p = 0.002). Birth asphyxia, which occurs when a newborn's brain is deprived of oxygen during or shortly after delivery, is a well-established contributor to CP, especially in cases involving premature or low birth weight infants. This finding aligns with previous research,[11,17,30] which consistently identifies birth asphyxia as a significant risk factor for CP development, particularly in children born to teenage mothers, who are more likely to experience complications during childbirth.[34] Birth asphyxia has been documented as a challenge in low-resource settings.[12]

In our study, prematurity was observed in 25.45 % of the cases, which is consistent with findings from similar studies,[28] but higher than the rates reported by Soumya et al.[29] The analysis also showed that teenage motherhood was significantly associated with prematurity (< p = 0.001). These results align with a report by Mann *et al.*, which found that infants born to teenage mothers were more likely to be preterm and have low birth weight.[35] Prematurity and low birth weight are common outcomes in pregnancies among teenage mothers and are key mediators of CP.[3, 12, 28] Addressing these factors during prenatal care is essential to improve outcomes for premature infants.[28] This finding emphasizes the significant role of birth weight in predicting CP and highlights the importance of early screening and intervention.[28] Infection was identified as a significant risk factor for CP. Previous research has also highlighted a significant link between infection and the development of CP.[30] It is important to recognize that these risk factors do not act independently but are often interconnected. The emergence of risk factors typically results from the interplay of multiple conditions.[30,36] For example, pregnancy-induced hypertension and premature rupture of membranes can lead to preterm birth, which, in turn, raises the likelihood of complications such as low birth weight and infections in infants.[36]

This study found that the majority (77.5%) of children had spastic CP, which is consistent with the findings of Awoala *et al.*, who reported spastic quadriplegia as the most frequent type of CP (35.5%) and noted a significant association with asphyxia.[37] These results suggest that most children with CP have potentially preventable risk factors.[4, 5] Despite improvements in neonatal care, studies have shown that these advances have not led to a decline in the overall prevalence of CP. In fact, a growing number of very preterm and very low birth weight infants are surviving with CP.[12, 35] In this quality improvement study, family-centred care emerged as a promising approach, emphasizing the involvement of caregivers in both rehabilitation and education to improve outcomes for children with CP.[25, 38] This model places the family at the centre of decision-making for their child. Family-centred models that promote collaboration between parents and professionals, along with parent education, have been associated with faster developmental progress in children with disabilities.[25, 38] Physiotherapy interventions for children born to teenage mothers must be tailored.[32] This is because these children present with unique environmental and developmental challenges. It has also been suggested that when parents are fully involved it enhances the quality of life for the children.[39] Early intervention is essential with a strong emphasis on family centred care and parental education to enhance care giving skills.

Adverse outcomes for both the teenage mother and newborn are exacerbated when the mother comes from a low socioeconomic background.[18, 23] This may explain why the majority (70%) of mothers in this study were from rural areas, which are typically characterized by lower socioeconomic status. The integration of community-based support systems and social protection mechanisms is crucial, especially in resource-limited settings.[40] Establishing support linkages is essential for both the teenage mother and the child with CP.[41] Families of children with CP are also significantly impacted in terms of psychological, financial, and social well-being.[18, 35]

Clinical Implications

Addressing the complications associated with teenage pregnancies requires a multisectoral approach. This involves collaboration across multiple sectors including health, education, community leadership and policy makers to tackle the multifaceted challenges posed by teenage pregnancies. Regions with high teenage pregnancy rates, such as Zambia's Eastern Province,[7, 23] should expect a proportional rise in neonatal complications like CP. Therefore an equitable allocation of rehabilitation resources and a multidisciplinary approach are vital to addressing both teenage pregnancies and their associated complications.[42]

Rehabilitation services should align with the trends in neonatal complications, ensuring resource distribution matches demand.[23] Managing CP in children born to teenage mothers poses unique challenges, necessitating educational interventions targeting caregivers.[43,45] Family-centred care models must be prioritised, empowering caregivers through education and collaboration with healthcareproviders.[25,44,26,32] Efforts to reduce teenage pregnancies should incorporate holistic strategies targeting both maternal and neonatal health. Public health campaigns that are targeted at preventing teenage pregnancies must be targeted.

Limitations

This study's findings are limited by its single-centre design and small sample size. Larger, multicentre studies are needed to validate these results and explore additional variables influencing CP prevalence.

CONCLUSION

This study reveals a significant association between teenage pregnancies and CP prevalence, emphasizing the need for public health interventions to address teenage pregnancies' multidimensional impact. Raising awareness about the risks of teenage pregnancies and strengthening antenatal and neonatal care can mitigate the incidence of CP. Rehabilitation services must adopt family-centred care models to improve outcomes for children with CP, particularly those born to teenage mothers. Growth monitoring efforts must be emphasized in the health care packages as we have seen more children survive, this will ensure an early start of rehabilitation effort. Aligning these efforts with universal health coverage principles will ensure no child or caregiver is left behind.

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