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Medical Utilization of 6-Month-Old Infants Born to Adolescent Mothers: Results of the Taiwan Birth Cohort Study

Wei-Ya Wu [1], Wei-Hwa Wu [2], Ching-Pyng Kuo [3,4], Shu-Hsin Lee [3,4], Jin-Fan Luo [1], Hsiu-Chuan Chen [1,5,*], Meng-Chih Lee [1,5,6,7,8,**]

[1] Institute of Medicine, Chung Shan Medical University, Taichung City, Taiwan
[2] Department of Finance, Ming Chuan University, Taipei City, Taiwan
[3] Department of Nursing, Chung Shan Medical University, Taichung City, Taiwan
[4] Department of Nursing, Chung Shan Medical University Hospital, Taichung City, Taiwan
[5] Department of Family Medicine, Taichung Hospital, Ministry of Health and Welfare, Taichung City, Taiwan
[6] Institute of Population Health Sciences, National Health Research Institutes, Miaoli County, Taiwan
[7] College of Management, Chaoyang University of Technology, Taichung City, Taiwan
[8] National Taitung University, Taitung, Taiwan

[*] ***Corresponding Author:*** Department of Family Medicine, Taichung Hospital, Ministry of Health and Welfare, Taichung City, Taiwan. Email: chchuan25@gmail.com
[**] ***Corresponding Author:*** Department of Family Medicine, Taichung Hospital, Ministry of Health and Welfare, Taichung City, Taiwan. Email: mengchihlee@gmail.com

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Abstract

Background: Adolescent pregnancy is known to cause serious consequences for the health of the mother and her infant.

Objectives: This study aimed to investigate birth outcomes and medical utilization factors for 6-month-old infants born to adolescent mothers compared to those born to adult mothers.

Methods: Data were obtained from the Taiwan Birth Cohort Study (TBCS), a nationally representative population-based cohort study in Taiwan. The present analysis used data collected between July 1, 2005 and June 30, 2006. A total of 818 adolescent mothers (younger than 20 years old) and 16,996 adult mothers (20 - 34 years old) and their infants with complete birth information were included.

Results: Six-month-old infants born to adolescent mothers had a higher outpatient visit rate when compared to infants born to adult mothers. Some immunization rates were significantly lower among infants born to adolescent mothers. The investigation of birth outcomes of adolescent mothers and factors resulting in a higher health utilization rate of infants may assist in future medical service and public health planning.

Conclusions: Infants born to adolescent mothers showed higher outpatient visit rates and lower immunization coverage compared to those born to adult mothers, underscoring the need for targeted healthcare support and educational interventions for adolescent mothers. These findings should be interpreted in light of the observational study design and are primarily generalizable to similar populations and healthcare contexts.

Keywords: Birth Cohort, Birth Outcomes, Medical Utilization Rate, Maternal Factors, Infancy Factors

1. Background

Adolescent pregnancy remains an important public health issue in many countries, including Taiwan. Although overall fertility rates have declined in recent decades, adolescent childbearing continues to persist and remains a concern for governments, healthcare systems, and social services (1). Infants born to adolescent mothers are also more likely to experience adverse birth outcomes, including preterm birth and low birth weight (2). These complications may contribute to increased healthcare utilization and may place additional burdens on families and healthcare systems. Pregnant adolescents are therefore considered a high-risk group, with higher risks of abortion, miscarriage, low birth weight, and premature birth (3-

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6). Due to limited parenting experience and insufficient infant care knowledge, adolescent mothers may also face challenges in providing adequate infant care, potentially leading to increased risks of infant illness and accidents (7, 8).

Previous studies have primarily focused on pregnancy outcomes among adolescent mothers, while relatively fewer studies have examined the health and healthcare utilization of infants born to adolescent mothers after birth. Differences in early infant medical utilization—including outpatient visits, emergency care, and hospitalization during the first months of life—may be related not only to biological vulnerability associated with maternal age but also to maternal behaviors and infant care practices. Recent studies have suggested that adolescent mothers may face greater challenges during the transition to motherhood compared with young adult mothers, including lower parenting confidence, limited social support, and reduced access to healthcare resources (9). These factors may influence infant health outcomes as well as healthcare-seeking behaviors. Recent studies have also reported lower vaccination coverage and delayed immunization timeliness among children born to adolescent mothers (10, 11). Recent reviews have also highlighted the importance of providing specialized antenatal and postnatal care models to improve health outcomes among adolescent mothers and their children (12, 13). Nevertheless, although adolescent fertility has been widely recognized as an important demographic and public health issue, relatively few population-based studies have specifically examined healthcare utilization patterns among infants born to adolescent mothers (10, 14-16).

2. Objectives

A comprehensive investigation of the health of adolescent mothers and their children was performed with data collected by the Taiwan Birth Cohort Study (TBCS). The purpose of the study is to investigate the medical utilization difference between infants born to adolescent mothers and adult mothers. We hope that the results from this study can be used in formulating constructive suggestions for the government and society to create an environment that ensures the safety of each childbirth and the health of each child.

3. Methods

3.1. Research Design and Study Population

This study employed a cross-sectional analytical design using data derived from the TBCS, a nationally representative, population-based birth cohort in Taiwan (17). The present analysis was based on infants followed from birth to 6 months of age as part of the cohort framework.

The TBCS enrolled a nationally representative sample of newborns through a multistage stratified random sampling process. Infants included in this analysis were born during the study recruitment period and had complete birth and follow-up information at 6 months of age.

3.2. Data Collection and Follow-up

Data were collected through standardized, structured questionnaire interviews conducted by trained field interviewers during home visits. Birth-related information, including gestational age, birth weight, and mode of delivery, was obtained from official birth certificates.

Follow-up data on infant healthcare utilization and immunization status were collected at 6 months of age through face-to-face interviews with the primary caregivers, primarily the mothers, as part of the routine follow-up procedures of the TBCS.

The study protocol was approved by the institutional review board, and written informed consent was obtained from all participants prior to data collection.

3.3. Data Analysis

The completed questionnaires were entered into the computer database for consolidation. The consolidated data were analyzed with SPSS PC 18.0, and the performed statistical analysis is detailed as follows: (1) Single variable descriptive and dual variable statistical analysis: In this study, descriptive analysis of categorical and continuous variables was performed to compare number, percentage, and mean ± standard deviation; *t* test and χ^2 test were performed for dual variable analysis, and the deviations were assessed with Z verifications; (2) The variables of medical utilization (outpatient, emergency, and inpatient services) that were determined to be significant by the single variable analysis were further analyzed by logistic regression or multilevel logistic regression to determine their correlations.

4. Results

The cases recorded during the first phase investigation consisted of 818 and 16,996 adolescent (between the ages of 12 to 19) and adult (between the

Table 1. Socio-demographic and Health Behaviors of Mothers [a]

Variables	Adolescent Mothers (N = 818); No. (%)	Adult Mothers (N = 16996); No. (%)	P-Value [b]
Age; mean ± SD	18.15 ± 1.08	27.35 ± 3.74	< 0.001
Education level			< 0.001
Below middle school	396 (48.50)	2272 (13.40)	
Above high school	421 (51.50)	14697 (86.60)	
Cigarette use			< 0.001
Non-smoker	702 (85.90)	15896 (93.60)	
Smoker	115 (14.10)	1093 (6.40)	
Alcohol use			0.656
Drinker	739 (90.50)	15445 (90.90)	
Non-drinker	78 (9.50)	1544 (9.10)	
Betel use			0.001
Non-user	801 (98.20)	16858 (99.30)	
User	15 (1.80)	126 (0.70)	
Financial status [New Taiwan Dollars (NTD)]			< 0.001
Below 30,000	353 (43.40)	1781 (10.50)	
Above 30,000	461 (56.60)	15166 (89.50)	
Marital status			< 0.001
Married	668 (81.70)	16484 (97.00)	
Single	150 (18.30)	512 (3.00)	
Nationality			< 0.001
Taiwan	526 (64.30)	14755 (86.80)	
Foreign	292 (35.70)	2241 (13.20)	
Delivery			< 0.001
Regular	671 (82.00)	11560 (68.00)	
Cesarean section	147 (18.00)	5436 (32.00)	
Parity			< 0.001
Multiple	113 (13.80)	8297 (48.80)	
First born	705 (86.20)	8699 (51.20)	
Prenatal examination			< 0.001
More than 10 times	622 (76.00)	14448 (85.00)	
Less than 10 times	193 (24.00)	2548 (15.00)	
Weight increase (kg)			< 0.001
More than 12	504 (61.60)	11848 (69.70)	
Less than 12	314 (38.40)	5142 (30.30)	
Birthing complications			0.014
No	720 (88.00)	14424 (84.90)	
Yes	98 (12.00)	2571 (15.10)	

[a] Excluded artificial insemination, multiple births, and congenital anomalies.

[b] Verified with χ^2 test and *t*-test.

ages of 20 to 34) mothers, respectively. The basic demographic information and health behaviors comparison between the two groups are listed in Table 1. The comparison showed the following findings: compared to adult mothers, infants born to adolescent mothers have significantly lower weight (3136.28 g ± 518.09 and 3035.83 g ± 498.07, respectively). The rate of premature births is also higher in adolescent mothers than adult mothers.

The comparison of outpatient, emergency, and inpatient service usage of 6-month-old infants between the two groups is listed in Table 2. The medical utilization rate for infants born to adolescent mothers was 2.1, 17.1, and 11.9% for outpatient, emergency, and inpatient services, respectively. The medical utilization

Table 2. Utilizations of Outpatient, In-Patient, Emergency and Immunizations [a]

Variables	Adolescent Mothers (N = 818)	Adult Mothers (N = 16996)	P-Value [b]	All Mothers
Outpatient	17 (2.10)	198 (1.20)	0.019	229 (1.20)
Emergency	140 (17.10)	2611 (15.40)	0.175	2965 (15.20)
Inpatient	97 (11.90)	2092 (12.30)	0.701	2360 (12.10)
Number of inpatients; mean ± SD	1.11 ± 0.35	1.16 ± 0.57	0.395	1.16 ± 0.55
Vaccination				
Hepatitis B immunoglobulin	21 (2.60)	1051 (6.20)	< 0.001	
Bacillus Calmette-Guérin	809 (99.50)	16912 (99.60)	0.625	
Hepatitis B	810 (99.60)	16953 (99.90)	0.103	
Polio(oral or injectable)	799 (98.30)	16862 (99.30)	0.001	
Diphtheria tetanus pertussis vaccine	797 (98.00)	16838 (99.20)	0.001	
Haemophilus type B vaccine (premium)	238 (29.30)	9031 (53.20)	< 0.001	

[a] Values are expressed as No. (%) unless otherwise indicated.

[b] Verified with χ^2 test; P-values less than 0.05 are considered significant.

rate for infants born to adult mothers was 1.2, 15.4, and 12.3% for outpatient, emergency, and inpatient services, respectively. Infants born to adolescent mothers have a higher rate of outpatient service visits (2.1%) than those born to adult mothers (1.2%). There were no statistical differences between the groups for emergency and inpatient services. Furthermore, there was no statistical difference for inpatient frequencies between the two groups (adolescent group: 1.11 ± 0.35 times versus adult group: 1.16 ± 0.57 times).

The comparison between the two groups revealed that infants born to adolescent mothers had a lower rate of receiving hepatitis B immune globulin vaccine, diphtheria tetanus pertussis vaccine, polio vaccine (oral), and B-type haemophilus vaccine than those born to adult mothers (shown in Table 2).

The comparison of outpatient service visit rate predicting factors between the two groups revealed that education level is a significant factor in the adolescent group (OR = 3.12, 95% CI 1.01, 9.66). The higher the adolescent mother's education level, the higher rate of outpatient service visits was observed for their children.

The comparison of emergency service rate predicting factors between the two groups revealed that infants born to foreign adolescent mothers had a significantly lower rate of emergency service visits (OR = 0.6, 95% CI 0.4, 0.9). Furthermore, those infants whose daytime caretaker were their parents are associated with a higher rate of emergency service visits (OR = 1.69, 95% CI 1.08, 2.63).

The comparison of inpatient service rate predicting factors between the two groups revealed that infants born to adolescent mothers who were of foreign nationality, whose education level, maternal parity, the infant's primary daytime caregiver, breastfeeding, and vaccinations were not significant factors for predicting the inpatient rate of infants.

All the related factors that are related to the outpatient service utilization rate of 6-month-old infants were analyzed with the logistic regression model and the data are shown in Table 3, Model I. These factors include maternal influences such as age, education level, nationality, cigarette or betel use during pregnancy, number of prenatal examinations, financial status, marital status; infancy factors such as gender, premature birth, birth weight, and maternal parity; and upbringing factors such as day/nighttime primary caregivers, and vaccination. Aside from the aforementioned maternal and infancy factors, the effect of parenting education factors was also investigated. These factors include daytime and nighttime primary caregiver and complete vaccination. The data are shown as Model III. The mother's age is significantly related to the outpatient service utilization rate of 6-month-old infants, where the older the mother, the higher the rate of outpatient service utilization (OR = 0.96, P = 0.03). Other affecting factors include alcohol usage during pregnancy (OR = 1.72, P = 0.005), first-borns (OR = 1.7, P < 0.001), less than 10 prenatal examinations (OR = 1.52, P = 0.015), and foreign mothers (OR = 0.43, P = 0.001). Those infants whose primary nighttime caretaker were their parents also had a higher rate of outpatient service utilization (OR = 1.70, P = 0.016) (Table 3).

All the related factors that are related to the emergency service utilization rate of 6-month-old infants were analyzed with the logistic regression model and the data are shown in Table 4, Model I. Despite the

Table 3. Logistic Regression Analysis for Utilization of Outpatient Services

Variables	Model I		Model II		Model III	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Age	0.95 (0.90, 0.99)	0.009			0.96 (0.93, 1.00)	0.030
Education level (above high school vs. below middle school)	1.26 (0.77, 2.06)	0.354				
Cigarette use (yes vs. no)	1.02 (0.62, 1.69)	0.943				
Alcohol use (yes vs. no)	1.69 (1.14, 2.50)	0.009			1.72 (1.17, 2.52)	0.005
Number of prenatal examinations (less than 10 vs. more than 10)	1.43 (1.02, 2.01)	0.038			1.52 (1.08, 2.13)	0.015
Financial status (more than 30,000 vs. less than 30,000)	0.79 (0.53, 1.20)	0.272				
Marital status (single vs. married)	1.40 (0.79, 2.49)	0.249				
Nationality (Foreign vs. Taiwanese)	0.57 (0.33, 1.00)	0.050			0.43 (0.26, 0.72)	0.001
Infant gender (female vs. male)			0.96 (0.73, 1.26)	0.775		
Low birth weight (yes vs. no)			1.08 (0.49, 2.38)	0.856		
Pregnancy terms (preterm vs. non-preterm)			1.29 (0.68, 2.44)	0.436		
Parity (first born vs. multiple)			1.76 (1.32, 2.33)	< 0.001	1.70 (1.27, 2.28)	< 0.001
Complete vaccination (no vs. yes)					1.04 (0.51, 2.13)	0.907
Daytime care giver (parents vs. others)					1.13 (0.83, 1.52)	0.442
Nighttime care giver (parents vs. others)					1.70 (1.10, 2.61)	0.016
-2Log Likelihood	2267.65		2309.09		2266.68	

differences among different mother demographic characteristics, after adjusting for all the related factors, there is no significant difference that was determined between adolescent and adult mothers.

All the related factors that are related to the inpatient service utilization rate of 6-month-old infants were analyzed with the logistic regression model and the data are shown in Table 5, Model I. Despite the differences among different mother demographic characteristics, after adjusting for all the related factors, there is no significant difference that was determined between adolescent and adult mothers.

5. Discussion

This longitudinal investigation for the comparison of adolescent and adult mothers in Taiwan has revealed similar results to other studies. Infants born to adolescent mothers, compared to adult mothers, are often of lower birth weight and have higher chances of premature birth (18). In the present study, the rate of premature birth among infants born to adolescent mothers was 12.7%, and the proportion of underweight infants was 8.3%. These findings are consistent with previous international studies indicating that adolescent pregnancy is associated with increased risks of premature birth and low birth weight, as reported in recent epidemiological studies and systematic reviews (1, 2). Similar trends have been reported in various countries and regions, suggesting that younger maternal age remains an important risk factor for adverse neonatal outcomes. Despite differences in healthcare systems and sociocultural contexts, the patterns observed in Taiwan appear broadly comparable to those reported internationally (1). These results suggest that regardless of the impact of social and cultural factors, the severity of the Taiwan adolescent fertility results is comparable to Western countries (14, 19).

In this study, the rate of outpatient service utilization of 6-month-old infants born to adolescent mothers is higher than those born to adult mothers, which is consistent with recent studies reporting disparities in infant healthcare utilization among children of adolescent mothers (10, 20). However, no significant differences were observed in emergency service utilization or inpatient admission rates between infants born to adolescent mothers and those born to adult mothers. One possible explanation is the relatively young age of the infants included in this study (6 months). At this developmental stage, infants have limited mobility and are less exposed to environmental injury risks compared with older children. Therefore, the risk of accidents or trauma that might require emergency services or hospitalization remains relatively low. This may explain why no significant differences were observed in emergency or inpatient service utilization between the two groups. Literature research revealed that there are very few Taiwanese studies that have focused on infant accidents, and research depicting the patterns of children's healthcare utilization. Future investigations may be useful to

Table 4. Logistic Regression Analysis for Utilization of Emergency Services

Variables	Model I		Model II		Model III	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Age	0.98 (0.97, 0.99)	0.001			0.98 (0.97, 0.99)	< 0.001
Education level (above high school vs. below middle school)	0.88 (0.76, 1.01)	0.064				
Cigarette use (yes vs. no)	1.24 (1.06, 1.45)	0.009			1.30 (1.12, 1.51)	0.001
Alcohol use (yes vs. no)	0.92 (0.79, 1.06)	0.255				
Number of prenatal examinations (less than 10 vs. more than 10)	1.19 (1.07, 1.33)	0.002			1.16 (1.04, 1.30)	0.009
Financial status (more than 30,000 vs. less than 30,000)	0.90 (0.79, 1.02)	0.101				
Marital status (single vs. married)	1.11 (0.90, 1.37)	0.321				
Nationality (Foreign vs. Taiwanese)	0.76 (0.66, 0.88)	< 0.001			0.82 (0.72, 0.93)	0.003
Infant gender (female vs. male)			0.80 (0.74, 0.87)	< 0.001	0.80 (0.74, 0.87)	< 0.001
Low birth weight (yes vs. no)			0.98 (0.76, 1.25)	0.851		
Pregnancy terms (preterm vs. non-preterm)			1.28 (1.06, 1.56)	0.011	1.21 (1.05, 1.38)	0.006
Parity (first born vs. multiple)			1.10 (1.01, 1.19)	0.028	1.07 (0.98, 1.17)	0.113
Complete vaccination (no vs. yes)					0.88 (0.70, 1.11)	0.288
Daytime care giver (parents vs. others)					1.01 (0.92, 1.11)	0.844
Nighttime care giver (parents vs. others)					1.18 (1.05, 1.33)	0.005
-2Log Likelihood	1519.22		1528.61		1521.46	

investigate the difference in medical utilization rate of children of different ages.

Investigation into the predicting factors of outpatient service utilization rate revealed that in the adolescent mothers' group, the higher the mother's education level, the higher the rate of the infants' outpatient service utilization. In the adult mothers' group, mothers of other nationalities, when compared to mothers of Taiwan nationality, have a lower rate of infant outpatient service utilization (OR = 0.58, 95% CI 0.35, 0.96). Furthermore, first born (OR = 1.76, 95% CI 1.31, 2.35), single mothers (OR = 2.49, 95% CI 1.44, 4.32), and parents being the infant's primary nighttime caregivers (OR = 1.69, 95% CI 1.11, 2.57) are associated with a higher rate of outpatient service utilization.

A previous study (14) indicated that significant factors predicting healthcare utilization among infants born to both adolescent and adult mothers included maternal characteristics (age, education level, nationality, cigarette or betel nut use during pregnancy, number of prenatal examinations, financial status, and marital status), infant characteristics (sex, preterm birth, birth weight, and parity), and caregiving factors (daytime and nighttime primary caregivers and vaccination status). Another previous study has also reported lower immunization coverage, delayed vaccination, and vaccination disparities among children born to adolescent mothers, highlighting disparities in preventive healthcare utilization in this population (10, 11, 21). After adjusting for maternal, infant, and caregiving factors, multilevel logistic regression analysis demonstrated that older maternal age was associated with lower outpatient service utilization rates.

Previous studies have suggested that social support plays an important role in helping adolescent mothers adapt to their parenting roles. Adequate family and professional support may improve maternal confidence, increase infant care knowledge, and reduce parenting stress. These factors may influence maternal decision-making and healthcare-seeking behaviors for infants. Recent studies have also emphasized that targeted antenatal education and support programs may improve parenting skills and maternal–infant relationships among adolescent mothers, although the extent to which such interventions affect infant healthcare utilization remains unclear (13, 22).

One limitation of this study is that the data were collected between 2005 and 2006. However, the primary objective was not to describe short-term temporal trends but to examine structural differences in healthcare utilization between infants born to adolescent and adult mothers within a nationally representative birth cohort. The TBCS provides important baseline evidence for understanding caregiving- and behavior-related mechanisms associated with adolescent motherhood, which remain relevant to current healthcare planning and policy development despite changes in healthcare systems over time (23). Although this study was conducted using

Table 5. Logistic Regression Analysis for Utilization of In-Patient Services

Variables	Model I		Model II		Model III	
	OR (95% CI.)	P-Value	OR (95% CI.)	P-Value	OR (95% CI.)	P-Value
Age	0.99 (0.98, 1.00)	0.210				
Education level (above high school vs. below middle school)	0.82 (0.71, 0.96)	0.011			0.87 (0.77, 0.98)	0.026
Cigarette use (yes vs. no)	1.20 (1.01, 1.43)	0.043			1.22 (1.03, 1.45)	0.019
Alcohol use (yes vs. no)	1.04 (0.89, 1.22)	0.608				
Number of prenatal examinations (less than 10 vs. more than 10)	1.10 (0.97, 1.24)	0.123				
Financial status (more than 30,000 vs. less than 30,000)	0.89 (0.78, 1.03)	0.123				
Marital status (single vs. married)	0.85 (0.66, 1.09)	0.205				
Nationality (Foreign vs. Taiwanese)	0.88 (0.75, 1.04)	0.135				
Infant gender (female vs. male)			0.74 (0.67, 0.81)	< 0.001	0.74 (0.67, 0.81)	< 0.001
Low birth weight (yes vs. no)			0.94 (0.73, 1.21)	0.642		
Pregnancy terms (preterm vs. non-preterm)			1.60 (1.31, 1.95)	< 0.001	1.54 (1.34, 1.76)	< 0.001
Parity (first born vs. multiple)			0.82 (0.75, 0.90)	< 0.001	0.83 (0.76, 0.91)	< 0.001
Complete vaccination (no vs. yes)					1.10 (0.86, 1.40)	0.459
Daytime care giver (parents vs. others)					1.05 (0.95, 1.17)	0.310
Nighttime care giver (parents vs. others)					1.19 (1.04, 1.36)	0.011
-2Log Likelihood	1317.96		1317.32		1310.51	

data from Taiwan, the TBCS is a nationally representative birth cohort. Therefore, the observed patterns of healthcare utilization among infants born to adolescent mothers may be generalizable to populations in settings with similar healthcare systems and sociodemographic contexts.

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Footnotes

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Conflict of Interests Statement: The authors declare no conflict of interest.

Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after publication. The data are not publicly available because the research data are part of the national survey data which have not been opened to the public yet.

Ethical Approval: Ethical approval was obtained from the Research Ethics Committee of the National Health Research Institutes (IRB No. EC1020102-F), dated March 5, 2013.

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References

1. Abate BB, Sendekie AK, Alamaw AW, Tegegne KM, Kitaw TA, Bizuayehu MA, et al. Prevalence, determinants, and complications of adolescent pregnancy: an umbrella review of systematic reviews and meta-analyses. *AJOG Glob Rep*. 2025;**5**(1):100441. [PubMed ID: 40103846]. [PubMed Central ID: PMC11915151]. https://doi.org/10.1016/j.xagr.2025.100441.

2. Lam TD, Dau NTT, Nguyen Pham TN, Le BH, Pham LD, Phan NV, et al. Socioeconomic risk factors and obstetric outcomes of adolescent pregnancies in Vietnam. *AJOG Glob Rep*. 2025;**5**(2):100473. [PubMed ID: 40231189]. [PubMed Central ID: PMC11994393]. https://doi.org/10.1016/j.xagr.2025.100473.
3. Chen YJ, Li CR, Lee SH, Hsu BQ, Wu WY, Kuo CP, et al. Growth changes in infants born of adolescent mothers: Results of a national cohort study in Taiwan. *Iran J Reprod Med*. 2014;**12**(11):737-46. [PubMed ID: 25709629]. [PubMed Central ID: PMC4336671].
4. Tiruneh SA, Zeleke EG, Animut Y. Time to death and its associated factors among infants in sub-Saharan Africa using the recent demographic and health surveys: shared frailty survival analysis. *BMC Pediatr*. 2021;**21**(1):433. [PubMed ID: 34607560]. [PubMed Central ID: PMC8489062]. https://doi.org/10.1186/s12887-021-02895-7.
5. Wang SC, Wang L, Lee MC. Adolescent mothers and older mothers: who is at higher risk for adverse birth outcomes? *Public Health*. 2012;**126**(12):1038-43. [PubMed ID: 23158057]. https://doi.org/10.1016/j.puhe.2012.08.014.
6. United Nations. *The Millennium Development Goals Report*. UN Department of Public Information; 2015. Available from: https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/backgrounders/MDG%202015%20PR%20Bg%20SSA.pdf.
7. Orr C, Fisher C, Sims S, Preen D, Glauert R, O'Donnell M. Hospitalisations for maternal assault are associated with increased risk of child protection involvement. *Child Abuse Negl*. 2019;**95**:104014. [PubMed ID: 31325682]. https://doi.org/10.1016/j.chiabu.2019.05.007.
8. Gayatri RV, Hsu YY, Damato EG. Utilization of Maternal Healthcare Services among Adolescent Mothers in Indonesia. *Healthcare (Basel)*. 2023;**11**(5). [PubMed ID: 36900683]. [PubMed Central ID: PMC10000571]. https://doi.org/10.3390/healthcare11050678.
9. World Health Organization. *Global childhood vaccination coverage holds steady, yet over 14 million infants remain unvaccinated – WHO, UNICEF*. Geneva, Switzerland: World Health Organization; 2025. Available from: https://www.who.int/news/item/15-07-2025-global-childhood-vaccination-coverage-holds-steady-yet-over-14-million-infants-remain-unvaccinated-who-unicef.
10. Wittesaele C, Toska E, Cluver L, Weiss HA, Collins C, Amponsah-Dacosta E, et al. Vaccine coverage and timeliness among children of adolescent mothers: A community-based study in the Eastern Cape, South Africa. *Vaccine*. 2024;**42**(26):126318. [PubMed ID: 39293297]. https://doi.org/10.1016/j.vaccine.2024.126318.
11. UNICEF. *How Early Motherhood Shapes Access to Life-Saving Vaccines for Children*. New York, USA: UNICEF; 2025. Available from: https://www.unicef.org/documents/early-motherhood-vaccines-access-children.
12. Shakeri Z, Farid M, Akbari Kamrani M. Comparison of Quality of Infant Care and Transition Difficulty to Motherhood Between Adolescent and Young Mothers. *J Nurs Midwif Sci*. 2023;**10**(4). https://doi.org/10.5812/jnms-142375.
13. Lanyo TN, Lori JR. Identifying health outcomes and future research directions of group antenatal care among adolescents in low and middle-income countries: a scoping review. *BMJ Glob Health*. 2025;**10**(3). [PubMed ID: 40086802]. [PubMed Central ID: PMC11907052]. https://doi.org/10.1136/bmjgh-2024-017961.
14. Tolossa T, Gold L, Dheresa M, Turi E, Yeshitila YG, Abimanyi-Ochom J. Adolescent maternal health services utilization and associated barriers in Sub-Saharan Africa: A comprehensive systematic review and meta-analysis before and during the sustainable development goals. *Heliyon*. 2024;**10**(15). e35629. [PubMed ID: 39170315]. [PubMed Central ID: PMC11336889]. https://doi.org/10.1016/j.heliyon.2024.e35629.
15. Dadras O, El Saaidi C. Vaccination Coverage and Determinants Among Children Aged 12-35 Months Following Internal Conflict in Yemen: Insights from a Nationwide Population-Based Survey. *Matern Child Health J*. 2025;**29**(12):1696-706. [PubMed ID: 40889054]. [PubMed Central ID: PMC12675556]. https://doi.org/10.1007/s10995-025-04156-w.
16. Wongnaah FG, Aboagye RG, Osborne A, Seidu AA, Ahinkorah BO. Full vaccination coverage for children aged 12-23 months in Madagascar: Analysis of the 2021 Demographic and Health Survey. *BMC Public Health*. 2025;**25**(1):727. [PubMed ID: 39984894]. [PubMed Central ID: PMC11846278]. https://doi.org/10.1186/s12889-025-21397-0.
17. Chang LY, Lin YH, Lin SJ, Chiang TL. Cohort Profile: Taiwan Birth Cohort Study (TBCS). *Int J Epidemiol*. 2021;**50**(5):1430-1431i. [PubMed ID: 34263321]. https://doi.org/10.1093/ije/dyab048.
18. Lee SH, Yen CH, Wu WY, Lee MC. A review on adolescent childbearing in Taiwan: its characteristics, outcomes and risks. *Asia Pac J Public Health*. 2007;**19**(1):40-2. [PubMed ID: 17784658]. https://doi.org/10.1177/10105395070190010801.
19. Su YY, Chen CJ, Chen MH, Lin CC, Hsieh WS, Chang H, et al. Revisiting maternal age and child health: A nationwide birth cohort study in Taiwan. *J Formos Med Assoc*. 2025. [PubMed ID: 40253261]. https://doi.org/10.1016/j.jfma.2025.04.018.
20. Wittesaele C, Toska E, Cluver LD, Weiss HA, Doyle AM. Factors Associated with Retention in Routine Well-Care Visits Among Children of Adolescent Mothers Living With and Without HIV: A Community-Based Study in the Eastern Cape, South Africa. *BMJ Open*. 2025;**15**(12). e106412. [PubMed ID: 41475822]. [PubMed Central ID: PMC12766768]. https://doi.org/10.1136/bmjopen-2025-106412.
21. Dahil A, Hardisty D, Simpson G, Dambha-Miller H. Variations in vaccination coverage by social care need: a scoping review. *Vaccine: X*. 2025;**27**. https://doi.org/10.1016/j.jvacx.2025.100754.
22. Rokhanawati D, Salimo H, Andayani TR, Hakimi M. The Effect of Parenting Peer Education Interventions for Young Mothers on the Growth and Development of Children under Five. *Children (Basel)*. 2023;**10**(2). [PubMed ID: 36832465]. [PubMed Central ID: PMC9954868]. https://doi.org/10.3390/children10020338.
23. Liang X, Zhang D, Wang H, Tahir MF, Chen L, Zhao X, et al. Importance of cohort and target trial emulation in clinical research. *Cell Rep Med*. 2025;**6**(4):102081. [PubMed ID: 40239630]. [PubMed Central ID: PMC12047467]. https://doi.org/10.1016/j.xcrm.2025.102081.