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ORIGINAL RESEARCH

Health Utility Values and Influencing Factors Among Pregnant and Postpartum Women in Rural Yunnan Province, China

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Purpose: Health utility values (HUVs) are quantifiable metrics used to assess health-related quality of life and reflect individuals' overall physical, psychological, and social well-being. This study measured HUVs using the the five-level EuroQol five-dimensional questionnaire (EQ-5D-5L) among women in rural Yunnan, China, and identify their determinants to inform targeted interventions for improving maternal quality of life and promoting infant development in resource-limited settings.

Patients and Methods: A cross-sectional study was conducted in May 2022 in a rural Yunnan Province, China, enrolling pregnant and postpartum women (within one year after delivery) across six reproductive stages, with a target sample of 50~100 per stage. The Tobit regression model was utilized to analyze the factors influencing the HUVs of pregnant and postpartum women.

Results: The analysis included 1,177 valid questionnaires (response rate 96.7%). The HUVs of pregnant and postpartum women in Yunnan ranged from 0.057 to 1.000, with a mean of 0.955 (*SD* = 0.102). This mean is somewhat lower than the HVUs recently reported in Chinese adults under 40, suggesting a potential decline in health-related quality of life during pregnancy and postpartum period. Depressive symptoms were prevalent in 22.9% of participants, with greater severity inversely associated with HUVs, indicating that mental health burdens may substantially impair health-related quality of life during this critical phase. Tobit regression analyses confirmed perinatal depressive symptoms as a significant predictor of reduced HUVs across all reproductive stages. Additional key factors influencing HUVs included social support, health behaviors, breastfeeding difficulties, postpartum recovery challenges, and infant health status.

Conclusion: This study provides novel quantitative evidence on health-related quality of life among pregnant and postpartum women in rural China. The findings demonstrate the impact of psychosocial and behavioral factors on maternal health outcomes. These insights can inform the development of targeted interventions and guide health policy decisions aimed at improving maternal and child well-being in resource-limited settings.

Keywords: pregnant and postpartum women, health utility values, Rural China, depressive symptoms, influencing factors

Introduction

Health utility values (HUVs) are quantifiable metrics used to assess health-related quality of life and have become a cornerstone in health and medical research and practice.[1] HUVs not only reflect an individual's health status but also serve as a critical tool for evaluating disease burden, capturing societal preferences across various health states, and informing economic evaluations and healthcare resource allocation decisions.[2] Additionally, HUVs play an essential role in cost-utility analysis (CUA) within pharmacoeconomics, serving as a key indicator for calculating quality-adjusted life

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years (QALYs).[3] By assessing HUVs, researchers can more accurately evaluate the health status and disease burden of specific populations, thereby providing foundational data for economic evaluations, guiding healthcare resource allocation, and supporting the development of public health policies.[4]

The pregnant and postpartum period, encompassing pregnancy, childbirth, and postpartum recovery, represents a critical phase in a woman's life. During this time, women experience profound physiological changes and significant transformations in their social roles, often accompanied by a range of stressors.[5,6] These unique characteristics pose multiple health challenges, including perinatal depression, gestational hypertension, diabetes, preeclampsia, and postpartum hemorrhage, all of which contribute to increased healthcare costs.[7,8] Notably, these health challenges can substantially impact HUVs, as lower HUVs during pregnancy and postpartum are associated with poorer health outcomes and higher economic burdens.[9] For instance, perinatal depression (PND), the most prevalent mental health issue during this period,[10] adversely affects maternal physical and mental health[11] while also exerts profound consequences on infant de velopment,[12] family functioning,[13] and societal economic costs.[14] Studies have shown that women with depression incur 87% higher medical expenses than those without.[15] Moreover, lower socioeconomic status, including insufficient family wealth and lower levels of maternal education, heightens the risk of perinatal physical and mental health issues,[16] necessitating early HUV deployment for targeted mitigation of downstream economic and clinical burdens.

Concurrently, psychological-physiological-socioecological stressor interactions[5,6] further potentiate maternal comorbidity vulnerabilities during pregnant or postpartum transitions, underscoring HUVs in multidimensional risk stratification.[11] Empirical evidence demonstrates that HUVs during this period are closely associated with their overall well-being and directly influence key birth health outcomes, including birth weight, preterm birth risk, and long-term infant health. Studies indicate that lower HUVs prior to childbirth correlate with a higher incidence of preterm birth and low birthweight infants.[17] Furthermore, postpartum declines in HUVs are linked to worsening maternal physical and psychological health, negatively impacting mother-infant interactions and family functioning, and potentially long-term infant health and development.[18] Additionally, the determinants of HUVs vary across different stages of childbirth.[19] For pregnant women, key influencing factors encompass family support, depression, pregnancy-related symptoms, exercise, and economic conditions,[20] while for postnatal women, depression,[21] social support,[22] and sleep disturbance[23] are the primary determinants of HUVs.

Previous research has predominantly focused on the HUVs at specific trimesters of pregnancy or the postpartum period, with limited studies examining maternal HUVs across the entire perinatal continuum. Additionally, existing studies pertaining to the health status of pregnant and postpartum women in China have primarily been overwhelmingly concentrated in urban or economically prosperous regions, leading to a notable scarcity of data from ethnically diverse rural area.[24] In particular, ethnically diverse and economically disadvantaged rural areas such as Yunnan Province pose unique challenges. Located in Southwest China, Yunnan Province is marked by significant ethnic diversity, distinctive cultural traditions, and substantial socioeconomic disparities, all of which can affect women's health-related perceptions and healthcare utilization patterns.[25] Pregnant and postpartum women in these areas encounter heightened health risks and reduced quality of life due to limited family resources and lower maternal education levels.[16] The uneven distribution of medical resources, lack of mental health awareness, and pervasive influence of traditional cultural practices further exacerbate these challenges, preventing many women from receiving timely and appropriate psychological and medical support.[26] This not only diminishes their quality of life but also adversely affects the their families health and communities, imposing a significant economic burden.[27] Therefore, examining HUVs within this context is essential to gain a more comprehensive understanding of maternal health and health equity in China.

Globally, an estimated 40 million women annually experience persistent physiological and psychological health challenges associated with pregnancy and postpartum period, imposing a substantial burden on public health systems.[28] These challenges undermine maternal well-being and have far-reaching implications on neonatal health, child development, and family dynamics. The World Health Organization (WHO) underscores the urgent need to strengthen maternal health services, emphasizing that ensuring women's survival during pregnancy and postpartum must be accompanied by the achievement of optimal health and quality of life.[29] In response, the Chinese government has implemented a series of policies aimed at enhancing maternal health, advocating for a shift from a "disease-centered" approach to a "health-centered" approach. These initiatives seek to improve the overall well-being of women throughout pregnancy and postpartum, ensuring comprehensive

protection for their physical, mental and social health.[30] However, evidence from resource-limited, culturally diverse settings remains limited, constraining efforts to design interventions tailored to these populations.

This study aims to assess HUVs among pregnant and postpartum women in rural Yunnan, China, throughout the entire perinatal period, and to analyze the factors influencing HUVs at different stages of childbirth. The findings will provide empirical evidence regarding the health status of rural pregnant and postpartum women, inform the development of targeted interventions to improve their quality of life, and offer policymakers insights into optimizing the balance between health outcomes and resource allocation, thereby enhancing the efficiency and equity of the healthcare system.

Materials and Methods

Research Design and Participants

A cross-sectional study was conducted in May 2022 among pregnant and postpartum (within one year after delivery) in a rural county of Yunnan Province. The study recruited women across six reproductive stages: the first trimester (≤12 weeks of gestation), the second trimester (13–27 weeks of gestation), the third trimester (≥28 weeks of gestation to delivery), the immediate postpartum period (≤42 days after delivery), early postpartum period (7 weeks to 3 months after delivery), and late postpartum period (6–12 months after delivery).

The sample size was estimated using the standard formula for prevalence studies:

$N = \frac{Z^2_{1-\alpha/2}}{d^2} \times pq$, where p represents the estimated prevalence of perinatal depression among women in mainland China, reported as 16.30%.[10] The level of significance was set at a= 0.05, corresponding to $Z_{1-a/2}$=1.96. The allowable margin of error (d) was set at 0.08. Based on these parameters, the minimum required sample size was calculated to be N= 82 participants per stage. Considering an anticipated dropout rate of 10%, the final required sample size was adjusted to 90 participants per reproductive stage, resulting in a total minimum of 540 participants across six stages.

Prior to data collection, a comprehensive list of eligible women was compiled. Face-to-face surveys were then conducted via visits to health institutions, including maternity and child health care hospitals, general hospitals, primary health care facilities, as well as household visits. All interviewers received standardized training covering research ethics, informed consent procedures, questionnaire administration, and confidentiality protection prior to fieldwork. To maintain data quality during face-to-face interviews, daily field supervision and random spot checks were conducted. Control variables—including age, education, household income, and physical activity—were defined a priori based on theoretical relevance and were incorporated into multivariable analyses for consistency with the regression models. For missing data, participants with incomplete responses in key variables were excluded from the final analysis. The number of valid cases was reported for each statistical model to ensure transparency and reproducibility.

The inclusion criteria required participants to meet all the following conditions: (1) residency in the local area for at least three months, (2) being currently pregnant or within one year postpartum, and (3) voluntary participation with written informed consent. Participants were excluded if they met any of the following criteria: (1) presence of severe mental disorders that impair cognitive or communication abilities or (2) inability to comprehend the questionnaire content due to intellectual disability or illiteracy.

Measurements

Health Utility Value

The EQ-5D-5L questionnaire was employed to indirectly assess the HUVs of pregnant and postpartum women on the day of the survey. This instrument comprises five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, each rated on five ordinal levels of severity ranging from none to extreme/unable. Based on the combination of responses across these dimensions, the EQ-5D-5L defines 3,125 distinct health states. For example, the code "11111" represents the absence of any reported health problems, indicating a fully healthy state.[31] In this study, each reported health state was converted to a corresponding HUV using the Chinese EQ-5D-5L value set, applying population preference weights derived from a time trade-off (TTO) valuation study conducted in China.[32] The resulting HUVs range from −0.391 to 1.000, where 1 indicates full health, 0 represents death, and negative values denote health states

considered worse than death.[33] This approach enables a standardized quantification of health-related quality of life among pregnant and postpartum women in the study sample.

Depressive Symptoms

The presence and severity of depressive symptoms status among pregnant and postpartum women were assessed using the 9-item Patient Health Questionnaire (PHQ-9), a widely validated depression screening tool endorsed by the National Health Commission.[34] Each item is rated on a 4-point Likert scale, ranging from 0 (not at all) to 3 (nearly every day), based on the frequency of symptom occurrence over the past two weeks. The total score ranges from 0 to 27, with severity classified as follows: 0~4 points indicate no depressive symptoms, 5~9 points indicate mild depressive symptoms, and 10~27 points indicate moderate to severe depressive symptoms.[35]

Basic Information of the Respondents

The survey encompasses four primary domains: (1) demographic information, including age, marital status, ethnicity, place of residence, educational level, occupation, monthly household income, and the spouse's age, (2) socio-psychological factors, such as current employment status, medical insurance coverage, living arrangements, exposure to negative life events in the past year, quality of marital relationship, level of social support, and self-rated health status, (3) health behavior data, covering sleep duration and quality, weekly exercise frequency, and adverse lifestyle behaviors, and (4) maternal and obstetric history, including the number of prenatal check-ups, gestational age, occurrence of multiple pregnancies, unplanned pregnancies, history of infertility, total number of pregnancies, and number of deliveries.

Statistical Analysis

Data analysis was performed utilizing Stata 15.1 software. The HUVs of pregnant and postpartum women were statistically described using the mean and standard deviation ($\bar{x} \pm s$). Although HUVs exhibited a skewed distribution, the potential for ceiling effects[36] limited the discriminatory power of median and interquartile range descriptions. Therefore, the mean and standard deviation were employed to provide a more effective statistical characterization.[37] Independent samples *t*-test was employed to compare HUVs between women with and without depressive symptoms at different stages of childbirth. One-way analysis of variance (ANOVA) was used to compare HUVs among women with varying levels of depression at each stage of childbirth. Additionally, a Tobit regression model was utilized to examine factors influencing HUVs in pregnant and postpartum women. All statistical tests were considered significant at $P < 0.05$.

Results

Basic Characteristics of Survey Participants

A total of 1,217 questionnaires were distributed, of which 1,177 valid responses were included in the analysis, resulting in an effective response rate of 96.73%. The prevalence of depressive symptoms among pregnant and postpartum women in Yunnan was 22.85% (269 out of 1,177). The average age of the survey participants was 26.62 years (*SD* = 5.62), ranging from 14 to 45 years, with the majority (82.50%) aged between 20 and 34 years. In terms of marital status, 87.26% were in their first marriage. Ethnic minorities accounted for 59.98% of the sample, while 59.30% resided in rural areas. Educational attainment was relatively low, with 51.23% having completed junior high school or below. Regarding employment status, 40.10% of participants were unemployed. More than half (54.04%) reported a monthly household income of at least 5,000 RMB, and 62.45% lived with their husband and in-laws.

With respect to pregnancy status, a higher proportion of participants were pregnant (61.51%, n=724) compared those in the postpartum period (38.49%, n=453). When categorized by the six stages of pregnancy and postpartum—from the first trimester to 6–12 months after delivery—the distribution was as follows: the largest number of women were in their first trimester (23.70%, n=279), followed by the third trimester (18.95%, n=223), the second trimester (18.86%, n=222), 6–12 months after delivery (18.27%, n=215), the first 42 days after delivery (12.06%, n=142), and 7 weeks to 3 months after delivery (8.16%, n=96).

HUVs of Pregnant and Postpartum Women with Different Levels of Depressive Symptoms

The HUVs of pregnant and postpartum women in Yunnan ranged from 0.0569 to 1, with an average utility value of 0.9547 (*SD* = 0.1020). Across the entire maternal population, as well as within the subgroups of pregnant or postpartum women, those without depressive symptoms were consistently exhibited higher HUVs than those with depressive symptoms. Moreover, HUVs were significantly lower with increasing severity of depression ($P< 0.05$). Similarly, when analyzed across the six stages of pregnancy and postpartum—from the first trimester to 6–12 months after delivery—statistically significant differences in HUVs were observed based on the presence and severity of depressive symptoms ($P< 0.05$). Further details are provided in Table 1.

Influencing Factors on HUVs in Pregnant and Postpartum Women

A Tobit regression model was employed to conduct univariate analysis of the factors factors associated with HUVs of pregnant and postpartum women, followed by multivariate analysis incorporating statistically significant factors identified in the univariate analysis. The results indicated that, after controlling for other covariates, depressive symptoms and low social support remained significantly associated with lower HUVs across the overall maternal population [depressive symptoms: −0.1300 (−0.1638 to −0.0961), low social support: −0.0993 (−0.1492 to −0.0494)], in pregnant women [depressive symptoms: −0.1087 (−0.1423 to −0.0751), low social support: −0.0819 (−0.1356 to −0.0264)], and in postpartum women [depressive symptoms: −0.1519 (−0.2237 to −0.0800), low social support: −0.1197 (−0.2055 to −0.0338)]. Notably, these associations appeared stronger among postpartum women compared to those during pregnancy.

In the overall maternal population, several factors were negatively associated with HUVs, including multiple awakenings [−0.0526 (−0.0891 to −0.0162)], difficulty falling asleep [−0.0578 (−0.1011 to −0.0146)], having only one main meal per day [−0.2209 (−0.3669 to −0.0748)], exercising for less than 30 minutes daily [−0.0364 (−0.0654 to −0.0075)], a spouse's age of ≤ 29 years [−0.0477 (−0.0831 to −0.0123)], and young maternal age (<20 years) [−0.0650 (−0.1147 to −0.0154)] all decrease HUVs.

For pregnant women, factors associated with lower HUVs include multiple awakenings [−0.0419 (−0.0807 to −0.0031)], having only one main meal per day [−0.1595 (−0.3032 to −0.0157)], unemployment [−0.1996 (−0.3659 to −0.0333)], living with husband and in-laws [−0.0461 (−0.0809 to −0.0113)], and experiencing moderate or severe pregnancy symptoms [−0.0837 (−0.1285 to −0.0389)].

For postpartum women, the following factors were negatively associated with HUVs: exercising for less than 30 minutes daily [−0.0861 (−0.1654 to −0.0069)], young maternal age (<20 years) [−0.0880 (−0.1740 to −0.0021)], advanced maternal ages (≥ 35 years) [−0.0919 (−0.1835 to −0.0004)], experiencing domestic violence [−0.5078 (−0.8419 to −0.1736)], inability to lactate and breastfeed normally after childbirth [−0.0741 (−0.1447 to −0.0501)], poor postpartum recovery [−0.1410 (−0.2319 to −0.0501)], and the husband and mother caring for the infant [−0.0914 (−0.1767 to −0.0062)]. Additionally, a longer time since childbirth was positively associated with higher HUVs, postpartum women's HUVs improve [0.0007 (0.0004 to 0.0010)]. Further details are available in Table 2.

Factors Associated with Women's HUVs Across Six Stages

An analysis of factors associated with HUVs across six stages of the reproductive cycle—ranging from the first trimester to 6–12 months postpartum—revealed that depressive symptoms were consistently associated with lower HUVs across all stages. Moderate to severe pregnancy reactions were negatively associated with HUVs during the first trimester [−0.2034 (−0.2989 to −0.1078)] and the second trimester [−0.1609 (−0.2551 to −0.0668)], with a more pronounced impact observed in the first trimester. Additionally, younger maternal age (<20 years) was negatively associated with HUVs during the period from 7 weeks to 3 months postpartum months postpartum [−0.1698 (−0.3110 to −0.0286)] and from 6–12 months postpartum [−0.1809 (−0.2676 to −0.0942)], though it has no significant effect on HUVs at other stages of the reproductive cycle.

For women in the first trimester, several factors were negatively associated with HUVs, including being unemployed [−0.0954 (−0.1603 to −0.0306)], sleeping less than 7 hours per night [−0.1105 (−0.2178 to −0.0031)], sleeping 7 to

Table 1 HUVs of Pregnant and Postpartum Women with Different Degrees of Depressive Symptoms in Rural Yunnan ($\bar{x} \pm s$)

Depressive Symptoms	Overall (n=1177)	Pregnancy				Postpartum			
		Total (n=724)	First Trimester (n=279)	Second Trimester (n=222)	Third Trimester (n=223)	Total (n=453)	First 42 Days After Delivery (n=142)	7 Weeks to 3 Months After Delivery (n=96)	6–12 Months After Delivery (n=215)
Total Sample	0.9547±0.1020	0.9542±0.0939	0.9587±0.0912	0.9694±0.0717	0.9333±0.1118	0.9556±0.1137	0.9072±0.1631	0.9698±0.0999	0.9813±0.0552
No Depressive Symptoms	0.9715±0.0784	0.9732±0.0626	0.9741±0.0777	0.9842±0.0415	0.9602±0.0591	0.9689±0.0969	0.9220±0.1557	0.9830±0.0501	0.9940±0.0018
Depressive Symptoms	0.8982±0.0088	0.8994±0.0101	0.9216±0.0121	0.9112±0.0180	0.8603±0.0224	0.8953±0.0174	0.8411±0.0356	0.8558±0.0809	0.9346±0.0145
Mild depression	0.9148±0.1255	0.9118±0.1244	0.9193±0.1162	0.9299±0.1058	0.8884±0.1452	0.9217±0.1285	0.8670±0.1712	0.9516±0.0508	0.9471±0.0999
Moderate/severe depression	0.8459±0.1813	0.8459±0.1813	0.9272±0.0928	0.8243±0.1537	0.7587±0.2297	0.8602±0.1685	0.7547±0.2043	0.7122±0.3823	0.8899±0.0805
t(*P*)*	10.86(<0.001)	9.85(<0.001)	4.54(<0.001)	6.67(<0.001)	6.43(<0.001)	5.47(<0.001)	2.32(0.022)	4.12(<0.001)	7.20(<0.001)
F(*P*)**	72.79(<0.001)	55.16(<0.001)	10.32(<0.001)	33.22(<0.001)	30.92(<0.001)	22.88(<0.001)	3.85(0.024)	19.76(<0.001)	32.57(<0.001)

Notes: * indicates comparisons between groups with and without depressive symptoms; ** indicates comparisons among groups without depression, with mild depression, and with moderate/severe depression.

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Table 2 Analysis of Factors Influencing HUVs of Pregnant and Postpartum Women in Rural Yunnan [*Coef* (95% CI)]

Variable (Reference Group)	All Samples	Pregnancy	Postpartum
Depressive Symptoms (No Depressive Symptoms)	−0.1300 (−0.1638 ~ −0.0961)	−0.1087 (−0.1423 ~ −0.0751)	−0.1519 (−0.2237 ~ −0.0800)
Low Social Support (Medium/High Social Support)	−0.0993 (−0.1492 ~ −0.0494)	−0.0810 (−0.1356 ~ −0.0264)	−0.1197 (−0.2055 ~ −0.0338)
Multiple Awakenings (No)	−0.052 (−0.0891 ~ −0.0162)	−0.0419 (−0.0807 ~ −0.0031)	
Having only One Main Meal Per Day (2~3 Times)	−0.2209 (−0.3669 ~ −0.0748)	−0.1595 (−0.3032 ~ −0.0157)	
Daily Exercise Duration <30 Minutes (>30 Minutes)	−0.0364 (−0.0654 ~ −0.0075)		−0.0861 (−0.1654 ~ −0.0069)
Spouse Age ≤29 Years (≥30 Years)	−0.0477 (−0.0831 ~ −0.0123)		
Difficulty Falling Asleep (No)	−0.0578 (−0.1011 ~ −0.0146)		
Young Maternal Age: < 20 years (Adequate Maternal Age)	−0.0650 (−0.1147 ~ −0.0154)		−0.0880 (−0.1740 ~ −0.0021)
Advanced Maternal Age: ≥ 35 years (Adequate Maternal Age)			−0.0919 (−0.1835 ~ −0.0004)
Domestic Violence (No)			−0.5078 (−0.8419 ~ −0.1736)
Unemployment (No)		−0.1996 (−0.3659 ~ −0.0333)	
Living with Husband and In-laws (Living with Husband)		−0.0461 (−0.0809 ~ −0.0113)	
Medium/Severe Pregnancy Symptoms (Mild)		−0.0837 (−0.1285 ~ −0.0389)	
Inability to Lactate and Breastfeed Normally After Childbirth (Able)			−0.0741 (−0.1447 ~ −0.0501)
Poor Postpartum Recovery (Better Recovery)			−0.1410 (−0.2319 ~ −0.0501)
Infant's Age			0.0007 (0.0004 ~ 0.0010)
Both Husband and Mother Caring for the Infant (No)			−0.0914 (−0.1767 ~ −0.0062)

Notes: Only variables that significantly influence HUVs at different stages of childbearing are listed in the table.

9 hours per night [−0.0586 (−0.1162 to −0.0009)], and experiencing multiple awakenings [−0.0683 (−0.1311 to −0.0055)]. For women in the third trimester, factors associated with lower HUVs include being divorced or unmarried [−0.2713 (−0.4459 to −0.0967)], experiencing financial difficulties [−0.0883 (−0.1594 to −0.0172)], having only one main meal per day [−0.3716 (−0.6618 to −0.0814)], and increasing gestational age[−0.0069 (−0.0127 to −0.0010)]. During the first 42 days postpartum, factors negatively associated with HUVs include exercising for less than 30 minutes daily [−0.1341 (−0.2608 to −0.0075)] and both the husband and mother caring for infant [−0.1492 (−0.2763 to −0.0221)]. Conversely, a greater infant age was positively associated with higher HUVs [0.0059 (0.0034 to 0.0084)]. Poor postpartum recovery [−0.1845 (−0.3234 to −0.0456)] was negatively associated with HUVs among women from seven weeks to three months postpartum. For women 6–12 months postpartum, factors associated with lower HUVs included young maternal age (<20 years) [−0.0809 (−0.2676 to −0.0942)], advanced maternal age (≥ 35 years) [−0.0812 (−0.1526 to −0.0110)], lack of health insurance [−0.2467 (−0.4301 to −0.0633)], history of low mood [−0.0809 (−0.1597 to −0.0021)], and feeling mentally and physically exhausted from infant care [−0.0537 (−0.1059 to −0.0015)]. Further details are available in Table 3.

Discussion

The HUVs of pregnant and postpartum women in Yunnan ranged from 0.057 to 1.000, with a mean of 0.955 (SD= 0.102). Compared with the mean HUVs of Chinese adults under 40 (0.962),[38] this finding indicates a modest but meaningful reduction in health-related quality of life during pregnancy and postpartum. Understanding the factors underlying this reduction is crucial, and our study highlights a significant association between depressive symptoms and HUVs in this population. The findings indicate that women without depressive symptoms consistently reported higher HUVs compared to those with depressive symptoms, a trend observed throughout both the pregnant and postpartum periods. Additionally, a significant negative correlation was observed between the severity of depressive symptoms and HUVs, which is consistent with previous research.[39] Depressive symptoms are recognized as sentinel indicators of psychological health and may serve as prodromal signs of major depressive disorder.[40] If left unaddressed, these symptoms may progress, adversely affecting women's quality of life. These findings underscore the critical need for early identification and intervention for perinatal depression, which are essential to mitigate its adverse effects on maternal health and well-being and prevent potential consequences on child development.

Further analysis reveals that depressive symptoms and low social support were significantly associated with lower HUVs during both the pregnancy and postpartum periods. These results are consistent with existing research,[41,42]

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Table 3 Analysis of Factors Influencing HUVs of Women from First Trimester to Six to 12 Months After Delivery in Rural Yunnan [Coef (95% CI)]

Variable (Reference Group)	First Trimester	Second Trimester	Third Trimester	First 42 Days After Delivery	7 Weeks to 3 Months After Delivery	6–12 Months After Delivery
Depressive Symptoms (Non-depressed)	−0.0928 (−0.1549 ~ −0.0306)	−0.0785 (−0.1394 ~ −0.0177)	−0.0985 (−0.1442 ~ −0.0529)	−0.1641 (−0.2713 ~ −0.0568)	−0.1837 (−0.3328 ~ −0.0346)	−0.1076 (−0.1680 ~ −0.0471)
Unemployed (Farmer/Worker/Self-employed/Individual)	−0.0954 (−0.1603 ~ −0.0306)					
Sleep <7h (≥9h)	−0.1105 (−0.2178 ~ −0.0031)					
Sleep 7~9h (≥9h)	−0.0586 (−0.1162 ~ −0.0009)					
Multiple Awakenings (No)	−0.0683 (−0.1311 ~ −0.0055)					
Divorced/Unmarried (First Marriage)			−0.2713 (−0.4459 ~ −0.0967)			
Financial Difficulties (No)			−0.0883 (−0.1594 ~ −0.0172)			
Having only One Main Meal Per Day (2~3 Times)			−0.3716 (−0.6618 ~ −0.0814)			
Daily Exercise Duration <30 Minutes (>30 Minutes)				−0.1341 (−0.2608 ~ −0.0075)		
Young Maternal Age: < 20 years (Adequate Maternal Age)					−0.1698 (−0.3110 ~ −0.0286)	−0.1809 (−0.2676 ~ −0.0942)
Advanced Maternal Age: ≥ 35 years (Adequate Maternal Age)						−0.0812 (−0.1526 ~ −0.0110)
Lack of Health Insurance (Yes)						−0.2467 (−0.4301 ~ −0.0633)
History of Low Mood (No)						−0.0809 (−0.1597 ~ −0.0021)
Medium/Severe Pregnancy Symptoms (Mild)	−0.2034 (−0.2989 ~ −0.1078)	−0.1609 (−0.2551 ~ −0.0668)				
Gestational Age			−0.0069 (−0.0127 ~ −0.0010)			
Infant's Age				0.0059 (0.0034 ~ 0.0084)		
Husband and Mother Caring for Infant (No)				−0.1492 (−0.2763 ~ −0.0221)		
Poor Postpartum Recovery (Good)					−0.1845 (−0.3234 ~ 0.0456)	
Exhausted from Infant Care (No)						−0.0537 (−0.1059 ~ −0.0015)

Notes: Only variables that significantly influence HUVs at different stages of childbearing are listed in the table.

reinforcing that psychosocial factors are strongly correlated with the well-being of women during these stages. Specifically, depressive symptoms during pregnant and postpartum have been identified as key correlates of lower HUVs.[43] The biological, psychological, and social changes associated with pregnancy and childbirth can exacerbate depressive mood, which may be related to reduced HUVs.[44,45] Moreover, this study found that low social support was also associated with lower HUVs across all subgroups within the pregnant and postpartum period. Insufficient social support can result in unmet emotional and material needs, leaving women feeling isolated and unsupported when facing the pressures of pregnancy, childbirth, and neonatal care, which may in turn correspond with lower HUVs.[46,47] Notably, both depressive symptoms and low social support were more strongly associated with lower HUVs among postpartum women, who are particularly susceptible to these factors due to hormonal changes and the stress of adjusting motherhood. The rapid decline in hormones post-childbirth can contribute to mood instability,[48] while inadequate support can make the new responsibilities of childcare overwhelming, leading to increased stress and a lower perceived quality of life.

In the context of pregnancy, multiple factors were associated with variation in HUVs, including sleep disturbances, daily meal consumption patterns, employment status, living arrangements, and the severity of pregnancy symptoms. Specifically, frequent awakenings can lead to poor sleep quality, which was correlated with decreased daytime functioning and mood — both critical components of HUVs.[49] Having only one main meal per day can result in nutritional deficiencies, which may be linked to poorer maternal and fetal health and lower HUVs.[50] Unemployment not only increases economic pressure but also psychological stress, both of which are associated with decreased HUVs.[51] Family dynamics, such as living with a husband and in-laws, may introduce additional stress and conflict, negatively correlating with mental health and HUVs. Furthermore, moderate to severe pregnancy symptoms can limit daily activities, increase physical discomfort, and cause emotional distress, thereby relating to lower quality of life and HUVs.[52]

The factors associated with HUVs vary across different stages of pregnancy. In the first trimester, unemployment, sleep disturbance, and moderate to severe pregnancy symptoms were associated with lower HUVs. In the second trimester, moderate to severe pregnancy symptoms remained correlated with lower HUVs. In the third trimester, additional risk factors include divorced or unmarried status, financial difficulties, daily meal consumption patterns, and advancing gestational age. These factors highlight the importance of targeted interventions during different stages of pregnancy. Comprehensive prenatal care, including improving sleep quality, providing nutritional support, offering economic assistance, addressing family relationship dynamics and effectively managing pregnancy symptoms, is pivotal to support the well-being of pregnant women.

Among postpartum women, HUVs were associated with a variety of factors that differ from those during pregnancy. Key factors include insufficient daily exercise, young and advanced maternal age, domestic violence, laceration difficulties, poor postpartum recovery, and shared caregiving responsibilities between the husband and mother. Regular exercise plays a crucial role in maintaining postpartum recovery, mental health, and cardiovascular well-being. Insufficient exercise was associated with poorer recovery and lower HUVs.[53] Young and advanced maternal ages present distinct physiological and psychological adaptation challenges: young mothers might struggle with role adjustment due to limited life experience,[54] while mother with advanced maternal ages may face higher risks of complications, both of which were related to lower HUVs.[55] Additionally, external factors such as domestic violence were correlated with poorer mental and physical health, increasing the likelihood of anxiety and depression, which corresponded to lower HUVs.[56] Issues related to lactation, postpartum recovery, and infant health were associated with the mother's ability to care for her infant, forming a complex network that relates to maternal well-being and infant health, resulting in lower HUVs.[57]

The factors associated with HUVs vary across different postpartum periods. For women within the first 42 days postpartum, relevant correlates include insufficient exercise and shared caregiving responsibilities. Between seven weeks and three months postpartum, young maternal age and poor postpartum recovery were associated with lower HUVs. For women 6–12 months postpartum, young and advanced maternal age, lack of health insurance, history of low mood, and exhaustion from infant care were all correlated with lower HUVs. These associations factors exhibit distinct characteristics at various recovery stages, underscoring the need for tailored interventions based on the specific challenges faced at each phase. Personalized exercise regimens, psychological counseling, social support systems, and economic assistance are indispensable for supporting better HUVs and enhancing overall maternal health.

Enhancing the quality of life for pregnant and postpartum women is of paramount importance. While studies have primarily focused on improving life quality for women with depressive symptoms, most interventions have achieved some success.[10,58] Effective interventions are often characterized by adaptability, community-based approaches, and active engagement. However, the cost-effectiveness of these interventions remains underexplored, particularly in regions with limited medical resources.[59] It is imperative to identify interventions that are both effective and economically viable to ensure their sustainability and scalability. This study provides foundational data for future healthcare resource allocation by quantifying the burden of illness through HUVs, a measure that reflects associations between health status and perceived quality of life. This is essential for economic evaluations and policy decisions aimed at improving maternal and child health outcomes globally.[60]

Limitations

This study is subject to several limitations. First, the data were collected from a single rural county in Yunnan Province, and therefore the findings are not necessarily representative of the broader Chinese or global population. Future research should expand the study scope to include multiple counties or provinces to enhance the representativeness of the sample. Second, the study did not specifically measure HUVs across different ethnic groups. Given the rich ethnic diversity in Yunnan Province, HUVs may vary significantly among ethnicities due to cultural, socioeconomic, and genetic factors. Future studies should incorporate ethnic stratification to better inform targeted public health interventions. Third, as a cross-sectional study, this research can only identify associations rather than establish causal relationships, and some potentially important variables—such as ethnicity, access to formal healthcare services, and local cultural influences—were not included, although they are likely to affect HUVs. Future longitudinal studies incorporating these factors are warranted to better capture temporal dynamics and provide a more comprehensive understanding of HUVs among women across reproductive stages. Finally, the study was conducted within a limited timeframe and thus provides only a cross-sectional snapshot of women's health status across different reproductive stages. Longitudinal studies with extended follow-up periods are warranted to capture meaningful changes over time and better elucidate causal relationships.

Conclusion

This study provides a comprehensive analysis of HUVs among pregnant and postpartum women in rural Yunnan, China, highlighting the significant associations between perinatal depressive symptoms and HUVs across all perinatal stages. Key factors associated with variations in HUVs include social support, lifestyle and behavior, breastfeeding challenges, postpartum recovery, and infant health. These findings suggest the potential need for targeted strategies to support maternal well-being and infant care, particularly through improved social and psychological support systems. In resource-limited rural settings, community-based maternal health programs may benefit from integrating perinatal depression screening, counseling, and education on healthy behaviors and breastfeeding. While causality cannot be inferred from this cross-sectional study, these associations highlight areas for future longitudinal and interventional research. Importantly, this study contributes valuable evidence from an underrepresented population to the literature on maternal health and HUVs in low-resource contexts. The findings may help inform future research and regional health initiatives aimed at promoting maternal and child health equity.

Ethics Approval and Informed Consent

This study received ethical approval from the Institutional Review Board of Kunming Medical University (approval number: KMMU2020MEC91). At the beginning of the research, the researchers explained the project to the respondents. The information included the aims of the study, potential advantages and disadvantages of participation, the expected benefits of carrying out the research, principles of privacy and confidentiality, and a declaration of voluntary participation. Respondents were also informed that they could withdraw from the study at any time. The study was conducted in accordance with the Declaration of Helsinki, and all respondents signed informed consent forms. In addition, participants who showed symptoms of depression during the screening process were provided with group psychological counseling. Our research team had previously developed a Perinatal Mental Health Group Counseling Operation Manual and a User

Manual to guide primary health care staff and to support pregnant and postpartum women. These manuals were used to ensure that respondents received appropriate psychological care and referrals when necessary.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Consent to Publish

The datasets generated and analyzed during the current study are not publicly available due to privacy considerations. Participants were informed at the time of data collection that their data would not be made publicly available to ensure confidentiality. However, the data are available from the corresponding author upon reasonable request, subject to compliance with applicable privacy regulations and consent agreements.

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Disclosure

The authors report no conflicts of interest in this work.

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