

BMJ Open Impact of maternal morbidities on the longitudinal health-related quality of life trajectories among women who gave childbirth in four hospitals of Northwest Ethiopia: a group-based trajectory modelling study

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ABSTRACT

Objectives To identify distinct trajectories of health-related quality of life and its predictors among postpartum women in Northwest Ethiopia.

Design Health facility-linked community-based prospective follow-up study.

Setting South Gondar zone, Northwest Ethiopia.

Participants We recruited 775 mothers (252 exposed and 523 non-exposed) after childbirth and before discharge. Exposed and non-exposed mothers were identified based on the criteria published by the WHO Maternal Morbidity Working Group.

Outcome measures The primary outcome measure of this study was trajectories of health-related quality of life. The Stata Traj package was used to determine the trajectories using a group-based trajectory modelling. Multinomial logistic regression model was used to identify predictors of trajectory membership.

Results Four distinct trajectories for physical and psychological and five trajectories for the social relationships and environmental health-related quality of life were identified. Direct and indirect maternal morbidities, lower educational status, poor social support, being government employed and merchant/student in occupation, vaginal delivery, lower monthly expenditure, stress, fear of childbirth and anxiety were found to be predictors of lower health-related quality of life trajectory group membership.

Conclusions Health professionals should target maternal morbidities and mental health problems when developing health intervention strategies to improve maternal health-related quality of life in the postpartum period. Developing encouraging strategies for social support and providing health education or counselling for women with less or no education are essential to avert the decrease in health-related quality of life trajectories of postpartum women.

INTRODUCTION

The sustained focus on maternal health in recent years has resulted in significant progress in improving maternal health, particularly with

Strengths and limitations of this study

- This is the first study to identify different trajectories and predictors of health-related quality of life domains among postpartum women in Ethiopia.
- Recall bias might have been introduced since the questionnaire was completed at 6th, 12th and 18th week after childbirth.
- Only mothers who came to the study hospitals for childbirth were recruited for this study, therefore, precludes generalisation to postpartum women who gave birth at home.

the reduction of maternal deaths worldwide.¹ The global maternal mortality ratio has declined by 44% between 1990 and 2015, but well short of the targeted 75% reduction.²⁻³ However, increased rates of survival imply that the prevalence of long-term impact of maternal morbidity on the health-related quality of life (HRQOL) of women would be increasing.⁴ The issue is not concluded when the patient is released from hospital since women who survive severe complications have poor quality of life (QOL), impaired functional status, poor sexual function, anxiety disorders and depression when evaluated in the postpartum period.⁴⁻⁷ Therefore, the survival of an increasing number of patients following events of maternal morbidity draws attention to the long-term consequences of maternal morbidity events on the HRQOL of women.^{4,8}

Individual women can progress from maternal morbidity to full recovery, potentially life-threatening morbidities, maternal near miss (women who nearly died) or maternal deaths in the continuum of immediate outcomes of maternal conditions.^{6,7} Except for maternal death, each of these maternal morbidity

conditions can have a negative impact on the HRQOL of women.^{4,6,7} Moreover, the postpartum period is a vulnerable and critical time as women undergo physical, emotional and social changes,^{9,10} and a series of comorbidities and complications can arise.¹¹ Since the postpartum women have to cope with all these changes and morbidities, their HRQOL could be impaired.⁴ It has been reported that the experience of pain and fatigue could negatively affect HRQOL after childbirth.^{12,13} HRQOL is an important patient-reported health outcome which has been used in sectors of public health to measure the effectiveness of interventions or to allocate resources.¹⁴ QOL and the more specific notion of HRQOL are widely used to understand how diseases or the absence of disease influences the lives of individuals. According to the WHO, QOL has been defined as ‘the individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns’.^{15,16} As good health is not only the absence of disease or infirmity but also a state of complete physical, mental and social well-being, the notion of HRQOL comprises aspects of QOL which can affect health or be affected by health conditions and it is an optimum level of mental, physical and social well-being.^{5,17}

Maternal healthcare outcomes usually focus on mortality and morbidity, with a traditional pathology focused aim of preventing, detecting and managing maternal health problems.^{6,12,18} While these are still very relevant today, efforts need to go beyond survival, with a view to consider HRQOL as an additional outcome that can maximise the health and well-being of women throughout their lives.^{12,18,19} However, most of the existing studies of maternal health focus on mortality and morbidity, and there is limited research that aims to assess women’s HRQOL as a primary outcome.^{5–7} In addition, most study designs were cross-sectional, providing limited insights into HRQOL trajectories during postpartum period.²⁰ There might be different subgroups of postpartum women sharing a common, underlying pattern of HRQOL change over time. Improving the postnatal QOL of women could be facilitated by having more knowledge about the most important factors associated with HRQOL trajectories.¹⁸ Since the group-based trajectory modelling enables us to identify the distinct trajectories of HRQOL and their predictors, interventions can be targeted at more specific risk factors of the poor HRQOL trajectory. This could have a benefit to health professionals, postpartum women and policymakers. Therefore, the objective of this study was to identify the distinct trajectories of HRQOL and its predictors among postpartum women in Northwest Ethiopia.

METHODS

Study design and study area

Health facility-linked community-based prospective follow-up study was conducted in four hospitals of South Gondar zone, Northwest Ethiopia from 1 October 2020 to 30 March 2021. South Gondar zone is located at 650 km northwest from Addis Ababa, the capital city of Ethiopia.

Study population and inclusion criteria

Postpartum women whose age was 15 years and above were the study population. The direct and indirect maternal morbidities published by the WHO Maternal Morbidity Working Group (MMWG)²¹ were used as an inclusion criterion of women in the exposed group. The direct maternal morbidities included in this study were gestational hypertension, pre-eclampsia, eclampsia, placenta previa, placental abruption, postpartum haemorrhage, mastitis, puerperal sepsis, urinary tract infection, perineal tear, episiotomy wound infection, vaginal wall/perineal laceration and caesarean section wound infection. The indirect maternal morbidities included in this study were asthma, tuberculosis, influenza, pneumonia, malaria, HIV/AIDS, candidiasis, hepatitis, hypertension, anaemia and diabetes mellitus. Women without the direct or indirect maternal morbidities were included in the non-exposed group. Women who are unable to communicate (having hearing problem and cannot communicate with sign language) were excluded from the study.

Sample size determination

The PS Power and Sample Size software²² was used for sample size calculation for comparing the means of two groups. The calculated sample size was 768 (256 exposed and 512 non-exposed) by taking 0.05 alpha (α), power of 90%, 15.7 SD of physical QOL score of mothers with moderate fear of childbirth, 3.9 detectable difference in the means of physical QOL score of mothers with and without fear of childbirth, 1:2 ratio of exposed to non-exposed. These parameters used for the sample size calculation were taken from a study in Malawi.²³

Sampling procedure

Because of the difficulty in identifying women with direct obstetric complications in the community when they do not seek medical help, identification of exposed and non-exposed mothers was done in four hospitals of South Gondar zone, Northwest Ethiopia. All women who presented to delivery service in four hospitals with and without maternal morbidity were eligible for recruitment. Based on the inclusion criteria for exposed group, all women diagnosed with at least one direct or indirect maternal morbidity were included in the study. Non-exposed women were selected by using simple random sampling technique with 1:2 ratio of exposed to non-exposed women. This recruitment procedure continued prospectively until the required sample size was fulfilled. After child delivery and before discharge, women were asked for consent to participate in the study. For those women who agreed to participate in the study, their full address was taken and appointment was made at their home to collect the data for the follow-up study.

Patient and public involvement

Patients or members of the public were not involved in the design, or conduct, or reporting, or dissemination plans of the research since it was not appropriate.

Outcome and independent variables

HRQOL was considered as the outcome or dependent variable, while direct maternal morbidities (obstetric haemorrhage, hypertensive disorders, obstructed labour, puerperal sepsis, gestational diabetes mellitus, perineal tear), indirect maternal morbidities (anaemia, malaria, hypertension, asthma, tuberculosis, HIV), sociodemographic variables (age, educational status, marital status, religion, ethnicity, occupation, monthly expenditure), residence, obstetric variables (parity, mode of delivery, gestational age at birth, birth weight, birth interval, fetal death, unwanted pregnancies, antenatal care visit, history of abortion), and psychosocial factors (social support, fear of childbirth, depression and anxiety) were considered as independent variables.

Definition for the exposure variables

Women with maternal morbidity were identified on the basis of maternal morbidity matrix developed by the WHO MMWG, specifically by the direct or indirect maternal morbidities listed in the inclusion criteria. The WHO MMWG defined maternal morbidities as: 'Any health condition attributed to and/or complicating pregnancy and childbirth that has a negative impact on the woman's wellbeing and/or functioning'.²⁴ To operationalise this definition, the WHO MMWG has developed three dimensions of maternal morbidity matrix. The first dimension, which includes the direct and indirect maternal morbidity, is composed of 121 conditions, 58 symptoms, 29 signs, 44 investigations and 35 management strategies.²⁴ The second dimension of the matrix measures functional impact and disability related to pregnancy, as defined in the International Classification of Functioning, Disability and Health, and is measured using the WHO Disability Assessment Schedule 2.0.^{25 26} The third dimension measures maternal history focusing on social and health-related characteristics which include socioeconomic status, pre-existing health conditions and careseeking during pregnancy, which might help to identify the maternal morbidity as well as influence the risk and severity of the morbidity.²⁴

Measurement tools for the variables

Health-related quality of life

The QOL was measured by the Amharic version of the WHO Quality of Life (WHOQOL-BREF) instrument.²⁷ It consists of 24 items to measure perception of QOL in four domains, including physical health, psychological, social relationships and environment, and two items on overall QOL and general health. The domain scores were transformed into a linear scale between 0 and 100 following the scoring guidelines.²⁷ A higher score indicated a better QOL. The WHOQOL-BREF has been previously validated and used in Ethiopia.²⁸

Depression, anxiety and stress

Depression, anxiety and stress were measured by using the short version of Depression, Anxiety and Stress Scale-21

questionnaire. It is a validated and reliable instrument with 21 items in three domains. Each domain comprises seven items assessing symptoms of depression, anxiety and stress. In this study, a score of ≥ 10 was considered for a mother to have a symptom of depression. A cut-off score of ≥ 8 was considered to have symptoms of anxiety for this study. A score of ≥ 15 was considered to have symptoms of stress for this study. This instrument has been used previously in Ethiopia.^{29 30}

Fear of childbirth

The Wijma Delivery Expectation/Experience Questionnaire (W-DEQ) was used to measure fear of childbirth. The W-DEQ has been designed especially to measure fear of childbirth operationalised by the cognitive appraisal of the delivery. The internal consistency and split-half reliability of the W-DEQ was checked in previous studies in Ethiopia with the Cronbach's alpha score of 0.932.^{31 32} A score of ≥ 85 was considered to have fear of childbirth for this study.^{31 32}

Social support

Social support was measured using the Oslo three-item Social Support Scale with scores ranging from 3 to 14. The social support scores were categorised into poor or no social support for scores less than 9. The scores from 9 to 14 were considered moderate to strong support and merged together as 'yes' for social support. The Oslo three-item Social Support Scale was validated and previously used in Ethiopia.³³⁻³⁵

Supportive attitude towards wife beating

The variable 'supportive attitude towards wife beating' is a direct indicator of women empowerment and came from the question 'Sometimes a husband is annoyed or angered by things that his wife does. In your opinion, is a husband justified in hitting or beating his wife in the following situations: (1) if she goes out of home without telling him, (2) if she neglects the children, (3) if she argues with him, (4) if she refuses to have sex with him and (5) if she burns the food?' Responses were coded as: '1' for yes response and '0' for no. Then a single composite variable 'supportive attitude towards wife beating' was constructed by grouping women into two categories: women who agreed to at least one reason for wife beating, indicating a lower level of empowerment and women who did not agree with all reasons of wife beating, indicating a higher level of women autonomy.^{36 37}

Data collection and quality control

Recruitment of the study participants was done after childbirth and before the time of discharge. The exposure variables (direct or indirect maternal morbidities) and baseline data were collected by health professionals working in the gynaecology and obstetrics ward of the study hospitals after childbirth and before discharging the mother. The direct and indirect maternal morbidity conditions were diagnosed prospectively every day by the health professionals. The data were collected with a

questionnaire consisted of patient interview and record review. The interview was on socioeconomic status, medical and obstetric history and clinical symptoms. In addition, physical examination has been done by a healthcare professional in order to evaluate clinical signs. The record review was intended to extract information on selected laboratory tests and results for haemoglobin, HIV, malaria (rapid diagnostic test or smear) and glucometer (random blood sugar).

The follow-up data on the 26-item WHOQOL-BREF were collected by community health workers (health extension workers in Ethiopian context). The follow-up data collection was done at the 6th, 12th and 18th week of postpartum period based on the home visit appointment which was made at the time of discharge. Training was given for health professionals working in the gynaecology and obstetrics ward of the study hospitals and community health workers who were data collectors. As part of the training process in each study area, data collectors carefully reviewed each question and conducted pretest in the study area before the study commences since women who gave birth before the study period were not eligible to be included in the actual data collection. The questionnaire was revised for word corrections based on the pretest findings. Supervision was done by the principal investigator.

Data processing and analysis

Trajectories of HRQOL were determined by group-based trajectory modelling using the Traj package of Stata. The group-based trajectory modelling was used to identify distinct homogeneous clusters of postpartum women with similar progressions of HRQOL during the follow-up period.³⁸ The identification process of appropriate group trajectories was based on the selection and reporting procedures outlined by Nagin and Odgers.³⁹ The trajectory model specifications were tested by determining whether the polynomial functional forms (shapes) of HRQOL trajectories were linear, quadratic or cubic according to the Bayesian information criterion (BIC). The closer the negative BIC value is to zero, the better is the fit of the model. A difference in the BIC value of at least 10 points between two models indicates that the model with the lower BIC value has a better model fit.³⁹ The posterior probabilities of 0.70 or higher and entropy of >0.80 were also used for fit indices of distinct trajectory classification.⁴⁰ Additionally, we required at least 10% of the sample to be present in a particular group and all trajectories were distinct from one another by visual assessment of trajectory figures looking for non-overlapping CIs. Norm scores were used to indicate and label each trajectory (eg, physical health; poor: 45.7, fair: 61.5, good: 73.8, very good: 82.6, excellent: 91.4).⁴¹

Finally, the multinomial logistic regression model was used to identify factors associated with probability of trajectory group membership. First, unadjusted bivariable associations between each predictor and trajectory group membership were tested in order to identify predictors having a *p* value of ≤ 0.2 to enter into the multivariable

multinomial logistic regression. Next, keeping the rule of one predictor per 10 cases, multivariable multinomial logistic regression model was fitted to determine the factors associated with HRQOL trajectory group membership. We report the OR of group membership with 95% CI and a *p* value of < 0.05 was considered for statistical significance. In order to investigate the potential effect of multicollinearity, we have checked the collinearity statistics considering correlation coefficient of well below 0.80, variance inflation factor (VIF) of < 5 and tolerance of > 0.2 as indicators of no multicollinearity.^{42,43} Stata V.16 and IBM SPSS Statistics V.26.0 were used for the statistical analyses.

RESULTS

Even though the calculated sample size was 768, hoping that adding additional study participants would improve estimates of the study and minimise the effects of loss to follow-up, a total of 779 postpartum women were included at baseline. Out of these women, 775 (99.5%) participated at the first, second and third follow-up of the study (6th, 12th and 18th week of postpartum period). The reason for loss to follow-up of the four mothers was changing the place of living and going out of the study area. A total of 775 mothers who completed all the three measurements with HRQOL data were included in the analyses. Table 1 shows the sociodemographic characteristics of mothers included in the study. The mean age of the study participants was 26.3 years (± 4.36). Nearly all (771 or 99.5%) of the participants were from urban areas. Almost all of them, 774 (99.9%), were Amhara by ethnicity and 742 (95.7%) were followers of Orthodox Christianity followed by Muslim, 30 (3.9%).

Identifying HRQOL trajectories

The group-based trajectory analysis of the longitudinal data on 775 mothers indicates that four trajectory classes best fitted the data for physical and psychological QOL. Five trajectories best fitted the data for social and environmental QOL (see table 2). To explore the extent to which individuals were appropriately classified to a given trajectory, we report the mean posterior probabilities of placement into each group along with other fit statistics in table 2. For example, the mean probability for participants assigned to group 4 for the physical QOL was 0.965, while other fit statistics (BIC=-7876.91, entropy=0.851, polynomial function order of quadratic, quadratic, linear, linear and proportion of $\geq 10\%$ in each trajectory) confirmed that the four trajectory groups were optimal for physical QOL.

Trajectories for physical HRQOL

As indicated in table 2, the four-trajectory model best fitted the data for physical HRQOL. The trajectories were labelled as: poor, fair, very good and excellent physical QOL. Specifically, 21.0%, 38.3% and 22.5% of mothers had poor, fair and very good trajectories of physical QOL

Table 1 Sociodemographic characteristics of postpartum women in Northwest Ethiopia, 2021

Variables	Direct maternal morbidity		Total, n (%)
	Yes, n (%)	No, n (%)	
Age (mean (±SD)=26.33 (±4.355))			
Residence			
Urban	251 (99.6)	520 (99.4)	771 (99.5)
Rural	1 (0.4)	3 (0.6)	4 (0.5)
Ethnicity			
Amhara	252 (100)	522 (99.8)	774 (99.9)
Tigre	0 (0.0)	1 (0.2)	1 (0.1)
Religion			
Orthodox	241 (95.6)	501 (95.8)	742 (95.7)
Muslim	10 (4.0)	20 (3.8)	30 (3.9)
Protestant	1 (0.4)	2 (0.4)	3 (0.4)
Education status			
Illiterate/read and write	31 (12.3)	34 (6.5)	65 (8.4)
Grade 1–8	48 (19.0)	88 (16.8)	136 (17.5)
Grade 9–12	74 (29.4)	145 (27.7)	219 (28.3)
Certificate/diploma	63 (25.0)	154 (29.5)	217 (28.0)
Degree and higher	36 (14.3)	102 (19.5)	138 (17.8)
Occupation			
Government employed	61 (24.2)	169 (32.3)	230 (29.7)
Merchant/student	39 (15.5)	106 (20.3)	145 (18.7)
Housewife	141 (56.0)	226 (43.2)	367 (47.4)
Farmer/daily labourer	11 (4.3)	22 (4.2)	33 (4.3)
Marital status			
Married	246 (97.6)	516 (98.7)	762 (98.3)
Single/widowed/divorced	6 (2.4)	7 (1.3)	13 (1.7)
Monthly expenditure			
≤3000 Ethiopian currency	48 (19.0)	158 (30.2)	206 (26.6)
3001–4000 Ethiopian currency	76 (30.2)	116 (22.2)	192 (24.8)
≥4001 Ethiopian currency	128 (50.8)	249 (47.6)	377 (48.6)

with increasing patterns (ie, recovery) throughout the follow-up period (see [figure 1](#)). The fourth trajectory labelled as excellent trajectory of physical QOL consisted of 18.2% of mothers with increasing patterns between 6th and 12th week (ie, recovery) and stable between 12th and 18th week of postpartum period.

Trajectories for psychological HRQOL

The four trajectories of psychological QOL were labelled as poor, fair, very good and excellent psychological QOL (see [table 2](#) and [figure 2](#)). The first trajectory labelled as poor psychological QOL consisted of 16.1% of mothers with increasing patterns (ie, recovery) throughout the follow-up period. The second and third trajectories

labelled as fair and very good psychological QOL consisted of 31.0% and 28.1% of mothers. These trajectories exhibited slightly increasing patterns (ie, slow recovery) throughout the follow-up period. The fourth trajectory labelled as excellent psychological QOL consisted of 24.8% of mothers with stable patterns throughout the follow-up period.

Trajectories for social HRQOL

The five-class trajectories best fitted the data for social QOL. The five trajectories were labelled as very poor, poor, good, very good and excellent social QOL (see [table 2](#) and [figure 3](#)). The first, second, third and fourth trajectories labelled as very poor, poor, good and very good social QOL consisted of 29.8%, 17.7%, 16.4% and 15.5% of mothers, respectively. These trajectories exhibited relatively increasing patterns (ie, recovery) between 12th and 18th week of the follow-up period. The fifth trajectory, labelled as excellent social QOL with 20.6% of the total cohort, exhibited consistently high QOL patterns throughout the follow-up period.

Trajectories for environmental HRQOL

As indicated in [table 2](#), the five-trajectory model best fitted the data for the environmental QOL. The five trajectories were labelled as very poor, poor, fair, very good and excellent environmental QOL. The very poor, poor, fair and very good trajectories with 28.3%, 22.0%, 17.5% and 15.5% of the total cohort, respectively, exhibited slightly increasing patterns (ie, recovery) between the 12th and 18th week of the follow-up period. The excellent trajectory (the fifth group) with 16.7% of the total cohort exhibited relatively stable patterns throughout the follow-up period ([figure 4](#)).

In conclusion, the lower trajectories of physical and psychological QOL showed improved patterns throughout the follow-up period. The excellent trajectories of physical and psychological QOL were relatively stable in their patterns, which is true that since the level of these trajectories was excellent, no change (recovery) was expected. With regard to the social and environmental QOL, lower trajectories showed improvement after 12 weeks of postpartum period. Similar with the physical and psychological QOL trajectories, the excellent trajectories of the social and environmental QOL were relatively stable throughout the study period.

Predictors for the trajectories of HRQOL domains

The statistically significant predictors of trajectory group membership for each of the HRQOL domains were presented in [tables 3–6](#).

Predictors of physical HRQOL

Women with direct maternal morbidity were 6.7 times more likely to belong to the poor trajectory (poor: OR (95% CI)=6.66 (1.01 to 43.98)) and 10.1 times (OR (95% CI)=10.08 (2.50 to 40.69)) more likely to belong to the fair HRQOL trajectory relative to the excellent physical HRQOL trajectory. Mothers with indirect maternal

Table 2 Fit indices for group-based trajectory models of the four domains of WHOQOL-BREF among postpartum women in Northwest Ethiopia, 2021

Number of trajectories	Polynomial function order	BIC	Posterior probability	Entropy	Proportions in each trajectory					
					1	2	3	4	5	
Physical HRQOL										
1	2	-8887.86	1.0	NA	100					
2	1, 2	-8245.47	0.999	0.879	59.5	40.5				
3	1, 2, 2	-7959.62	0.996	0.885	23.6	41.9	34.5			
4	2, 2, 1, 1	-7876.91	0.965	0.866	21.0	38.3	22.5	18.2		
5	2, 2, 2, 1, 1	-7834.78	0.965	0.934	20.0	34.3	16.2	20.0	9.4	
Psychological HRQOL										
1	2	-8553.45	1.0	NA	100					
2	2, 1	-7680.01	0.999	0.937	58.7	41.3				
3	2, 1, 1	-7333.05	0.999	0.914	22.2	39.3	38.6			
4	2, 1, 1, 1	-7094.01	0.999	0.972	16.1	31.0	28.1	24.8		
5	2, 2, 1, 1, 1	-6925.92	0.998	0.612	15.6	26.6	18.1	15.3	24.3	
Social HRQOL										
1	2	-8711.44	1.0	NA	100					
2	2, 1	-7898.24	0.999	0.930	62.4	37.6				
3	2, 2, 1	-7407.51	0.999	0.958	30.8	34.9	34.3			
4	2, 2, 1, 1	-7187.09	0.997	0.941	30.5	32.0	15.7	21.8		
5	2, 2, 2, 1, 0	-7154.54	0.996	0.961	29.8	17.7	16.4	15.5	20.6	
6	2, 2, 2, 1, 1, 0	-7122.65	0.997	0.947	29.5	12.7	6.3	15.2	15.7	20.6
Environmental HRQOL										
1	2	-9738.67	1.0	NA	100					
2	2, 1	-8743.93	1.0	0.938	59.5	40.5				
3	2, 2, 2	-8246.78	1.0	0.944	38.4	33.2	28.4			
4	1, 1, 1, 1	-8043.64	0.999	0.865	34.3	23.9	16.3	25.4		
5	1, 1, 1, 1, 1	-7935.60	0.999	0.904	28.3	22.0	17.5	15.5	16.7	
6	1, 1, 1, 1, 1, 1	-7691.49	0.999	0.052	9.6	27.9	21.2	14.7	19.4	7.2

BIC, Bayesian information criterion; HRQOL, health-related quality of life; NA, not applicable; WHOQOL-BREF, WHO Quality of Life.

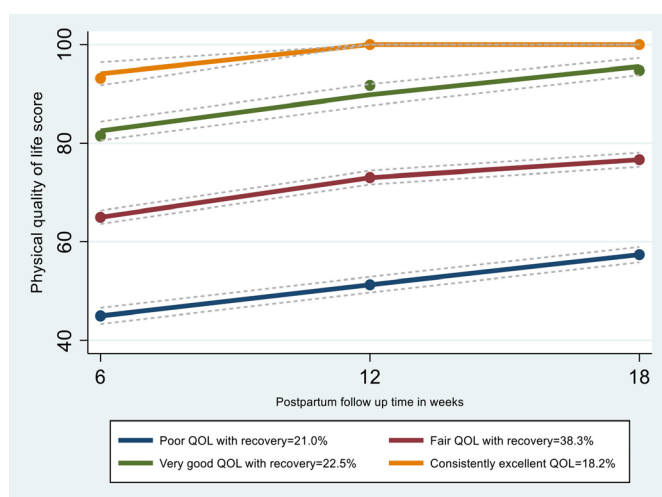


Figure 1 Trajectories of physical health-related quality of life (QOL) in postpartum women, Northwest Ethiopia, 2021.

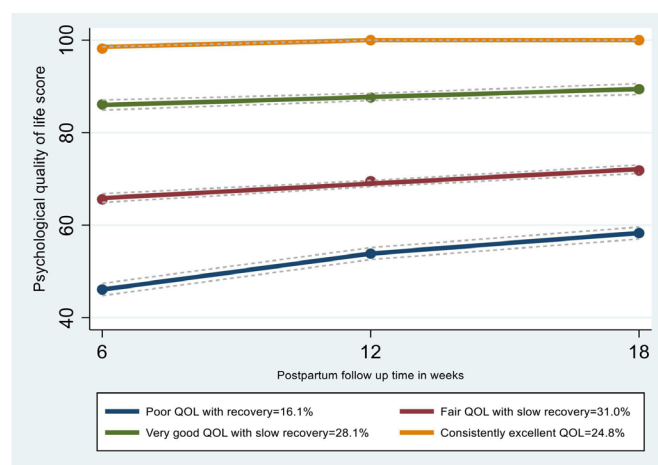


Figure 2 Trajectories of psychological health-related quality of life (QOL) in postpartum women, Northwest Ethiopia, 2021.

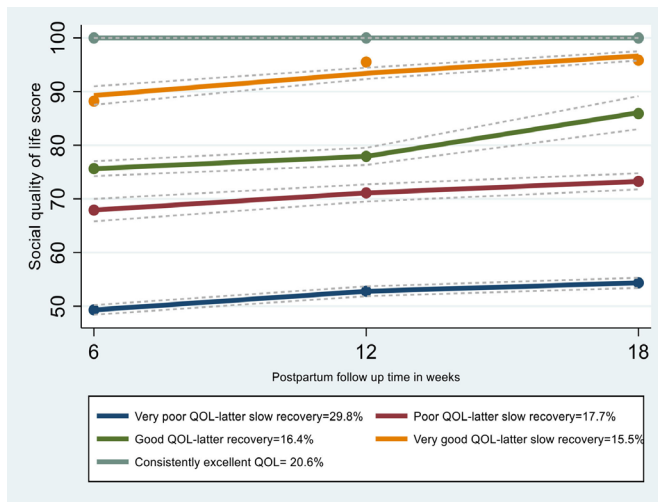


Figure 3 Trajectories of social health-related quality of life (QOL) in postpartum women, Northwest Ethiopia, 2021.

morbidity were also 5.8 times (OR (95% CI)=5.76 (1.79 to 18.51)) more likely to belong to the fair HRQOL trajectory relative to the excellent physical HRQOL trajectory. Participants with a higher anxiety score (OR (95% CI)=1.54 (1.02 to 2.32)) and participants with poor social support (OR (95% CI)=2.63 (1.21 to 5.69)) were more likely to belong to the poor trajectory compared with participants in the excellent HRQOL trajectory. In addition, participants with spontaneous vaginal/instrumental delivery (OR (95% CI)=2.16 (1.10 to 4.23)) were more likely to belong to the fair trajectory relative to the excellent physical HRQOL trajectory. The details are given in [table 3](#).

Predictors of psychological HRQOL

As indicated in [table 4](#), mothers with direct maternal morbidity were 7.5 and 8.1 times more likely to belong to the poor and fair HRQOL trajectory groups, respectively (poor: OR (95% CI)=7.54 (1.03 to 55.31); fair: OR (95% CI)=8.12 (1.90 to 34.70)) relative to the excellent

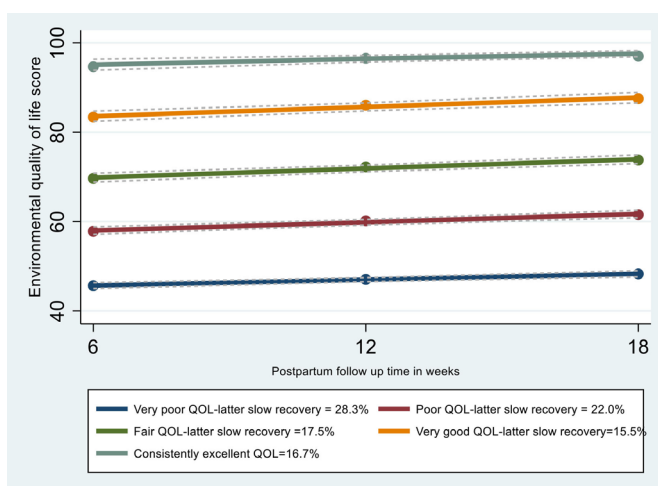


Figure 4 Trajectories of environmental health-related quality of life (QOL) in postpartum women, Northwest Ethiopia, 2021.

psychological HRQOL trajectory. Women with poor social support were 3.1 and 3.9 times more likely to belong to the poor and fair HRQOL trajectories, respectively (poor: OR (95% CI)=3.10 (1.45 to 6.61); fair: OR (95% CI)=3.86 (2.04 to 7.31)) relative to the excellent trajectory. Mothers with indirect maternal morbidity were also 5.8 times more likely to belong to the fair trajectory (fair: OR (95% CI)=5.76 (1.75 to 18.96)) relative to the excellent trajectory (see [table 4](#)).

Predictors of social HRQOL

For the social HRQOL trajectories, while not supportive of wife beating is protective of poor social HRQOL trajectory group membership, government employed and merchant/student in occupation were risk factors to belong to this group, relative to the excellent social HRQOL trajectory ([table 5](#)). Women with indirect maternal morbidity were 4.4 and 6.9 times more likely to belong to the very poor and poor social HRQOL trajectories, respectively (very poor: OR (95% CI)=4.42 (1.17 to 16.61); poor: OR (95% CI)=6.91 (1.72 to 27.66)) relative to the excellent social HRQOL trajectory. Similarly, women with vaginal delivery were 2.7 and 1.9 times more likely to belong to the very poor and poor social HRQOL trajectories, respectively (very poor: OR (95% CI)=2.67 (1.37 to 5.20); poor: OR (95% CI)=1.93 (1.02 to 3.64)) relative to the excellent social HRQOL trajectory (see [table 5](#)).

Predictors of environmental HRQOL

Participants with direct maternal morbidity were 15.0 and 9.0 times more likely to belong to the very poor and poor environmental HRQOL trajectories, respectively (very poor: OR (95% CI)=15.01 (2.68 to 84.16); poor: OR (95% CI)=9.12 (1.81 to 45.87)) compared with participants in the excellent environmental HRQOL trajectory. Mothers with indirect maternal morbidity were also 4.5 and 5.4 times more likely to belong to the very poor and poor environmental HRQOL trajectories, respectively (very poor: OR (95% CI)=4.54 (1.14 to 18.08); poor: OR (95% CI)=5.41 (1.37 to 21.35)) relative to the excellent environmental HRQOL trajectory (see [table 6](#)).

DISCUSSION

This study investigates heterogeneity in HRQOL trajectories of women during the first 18 weeks of postpartum period partitioned into three phases, each consisting of 6 weeks. Four distinct trajectories were identified for both physical and psychological HRQOL. We have also identified five distinct trajectories for the social relationships and environmental HRQOL in this study.

The lower trajectories of physical and psychological QOL exhibited slightly increasing patterns throughout the follow-up period. Similarly, the lower trajectories of social and environmental QOL also showed a slight improvement after 12 weeks of postpartum period. This indicates that maternal morbidity conditions adversely

Table 3 Significant predictors of the trajectories of physical HRQOL in postpartum women, Northwest Ethiopia, 2021

Physical HRQOL trajectories	Poor vs excellent*		Fair vs excellent*		Very good vs excellent*	
	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value
Stress score	1.48 (1.02 to 2.17)	0.041	1.47 (1.01 to 2.15)	0.044	1.50 (1.023 to 2.20)	0.035
Fear of childbirth score	1.03 (1.01 to 1.04)	<0.001	1.03 (1.02 to 1.04)	<0.001	1.02 (1.003 to 1.03)	0.016
Direct maternal morbidity						
Yes	6.66 (1.01 to 43.98)	0.049	10.08 (2.50 to 40.69)	0.001		
No	1.00		1.00			
Anxiety score	1.54 (1.02 to 2.32)	0.041				
Type of fuel						
Electric/kerosene	0.47 (0.22 to 0.99)	0.049				
Charcoal/firewood/dung	1.00					
Education status						
Illiterate/read and write	8.42 (1.52 to 46.80)	0.015				
Grade 1–8	6.67 (1.66 to 26.88)	0.008				
Grade 9–12	6.16 (1.77 to 21.47)	0.004				
Certificate/diploma	3.56 (1.26 to 10.00)	0.016				
Degree and higher	1.00					
Social support						
Poor social support	2.63 (1.21 to 5.69)	0.014				
Strong social support	1.00					
Occupation						
Government employed			7.14 (1.49 to 34.09)	0.014		
Merchant/student			6.36 (1.41 to 28.75)	0.016		
Housewife			3.07 (0.76 to 12.32)	0.114		
Farmer/daily labourer			1.00			
Indirect maternal morbidity						
Yes			5.76 (1.79 to 18.51)	0.003		
No			1.00			
Mode of delivery						
SVD/instrumental delivery			2.16 (1.10 to 4.23)	0.025		
Elective/emergency C/S			1.00			
Monthly expenditure						
≤3000 Ethiopian currency			0.91 (0.45 to 1.81)	0.783		
3001–4000 Ethiopian currency			2.02 (1.03 to 3.95)	0.040		
≥4001 Ethiopian currency			1.00			

*Variables included in the model were: anxiety score, stress score, PTSD score, fear of childbirth score, supportive of wife-beating attitude, direct maternal morbidity, indirect maternal morbidity, mode of delivery, type of fuel for cooking, educational status of mothers, husband educational status, occupation of mothers, husband occupation, social support, monthly expenditure, birth weight and psychological violence.

AOR, adjusted OR; C/S, caesarean section; HRQOL, health-related quality of life; PTSD, post-traumatic stress disorder; SVD, spontaneous vaginal delivery.

affected multiple domains of HRQOL until 12 weeks post partum. The gradual resumption of QOL reflects the normal adjustments of mothers.⁴⁴ In addition to the effect of maternal morbidity conditions, the slow improvement in QOL during the study period might be due to the tight restrictions on how the woman should behave during the postnatal period in Ethiopian culture.⁴⁵ For example, the postnatal woman's food and sleeping area

would be separated from the rest of the family in the postpartum period, with no gaps where draughts of air or sunlight might penetrate through.⁴⁶ For the duration of the postnatal period, the woman would be restricted from crossing the perimeter of her compound or participating in usual social obligations.⁴⁶ Therefore, this might have also contributed to the slow improvement of QOL of women, especially for the social and environmental

Table 4 Significant predictors of the trajectories of psychological HRQOL in postpartum women, Northwest Ethiopia, 2021

Psychological HRQOL trajectories	Poor vs excellent*		Fair vs excellent*		Very good vs excellent*	
	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value
Explanatory variables						
Baseline anxiety score	1.81 (1.24 to 2.65)	0.002	1.71 (1.17 to 2.49)	0.006	1.55 (1.06 to 2.27)	0.023
Direct maternal morbidity						
Yes	7.54 (1.03 to 55.31)	0.047	8.12 (1.90 to 34.70)	0.005	4.75 (1.18 to 19.16)	0.028
No	1.00		1.00		1.00	
Social support						
Poor social support	3.10 (1.45 to 6.61)	0.003	3.86 (2.04 to 7.31)	<0.001		
Strong social support	1.00		1.00			
Fear of childbirth						
Yes	2.86 (1.33 to 6.16)	0.007				
No	1.00					
Education status						
Illiterate/read and write	5.21 (1.26 to 21.65)	0.023				
Grade 1–8	1.52 (0.53 to 4.42)	0.438				
Grade 9–12	1.87 (0.72 to 4.86)	0.198				
Certificate/diploma	2.67 (1.19 to 5.98)	0.017				
Degree and higher	1.00					
Stress score	1.33 (1.02 to 1.73)	0.033			1.30 (1.001 to 1.68)	0.049
Body mass index			1.25 (1.11 to 1.41)	<0.001	1.12 (1.01 to 1.24)	0.036
Indirect maternal morbidity						
Yes			5.76 (1.75 to 18.96)	0.004	3.65 (1.13 to 11.73)	0.03
No			1.00		1.00	
Mode of delivery						
SVD/instrumental delivery			2.31 (1.14 to 4.66)	0.019	1.75 (1.003 to 3.06)	0.049
Elective/emergency C/S			1.00		1.00	
Birth weight			1.94 (1.01 to 3.70)	0.046		
Support wife beating						
No					0.61 (0.39 to 0.96)	0.034
Yes					1.00	
Monthly expenditure						
≤3000 Ethiopian currency					1.50 (0.81 to 2.80)	0.198
3001–4000 Ethiopian currency					1.95 (1.06 to 3.58)	0.031
≥4001 Ethiopian currency					1.00	

*Variables included in the model were: anxiety score, stress score, fear of childbirth score, supportive of wife-beating attitude, direct maternal morbidity, indirect maternal morbidity, mode of delivery, past mode of delivery, educational status of mothers, occupation of mothers, marital status, social support, monthly expenditure, age of the mother, body mass index, parity, gestational age and birth weight.

AOR, adjusted OR; C/S, caesarean section; HRQOL, health-related quality of life; SVD, spontaneous vaginal delivery.

domains. This study has also identified predictors of the HRQOL trajectory group membership for each domain separately.

Sociodemographic factors

Lower education level was consistently associated with poor trajectory group membership for the physical, psychological and social QOL relative to the excellent QOL trajectory. This finding is similar with previous studies which have reported that lower education level

was associated with poor QOL.^{47–49} This might be due to the fact that women with lower education may not have adequate information on enabling factors for QOL which could hinder resilience and significantly decrease the likelihood of recovery.⁵⁰ This finding may be useful when targeting interventions and follow-ups, as women with less or no education may need training packages to convey information to promote their awareness about enabling factors of QOL, so as to improve their QOL in

Table 5 Significant predictors of the trajectories of social HRQOL in postpartum women, Northwest Ethiopia, 2021

Social HRQOL trajectories	Very poor vs excellent*		Poor vs excellent*		Good vs excellent*		Very good vs excellent*	
	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value
Explanatory variables								
Indirect morbidity								
Yes	4.42 (1.17 to 16.61)	0.028	6.91 (1.72 to 27.66)	0.006	6.83 (1.79 to 26.12)	0.005	4.00 (1.02 to 15.72)	0.047
No	1.00		1.00		1.00		1.00	
Mode of delivery								
SVD/instrumental delivery	2.67 (1.37 to 5.20)	0.004	1.93 (1.02 to 3.64)	0.043	3.90 (1.78 to 8.53)	0.001	2.19 (1.12 to 4.29)	0.023
Elective/emergency C/S	1.00		1.00		1.00		1.00	
Fear of childbirth								
Yes	11.96 (4.66 to 30.67)	<0.001	6.26 (2.39 to 16.40)	<0.001			8.25 (3.15 to 21.64)	<0.001
No	1.00		1.00				1.00	
Body mass index	1.17 (1.03 to 1.33)	0.013	1.16 (1.02 to 1.31)	0.021	1.20 (1.05 to 1.37)	0.007		
Social support								
Poor social support	3.53 (1.78 to 7.01)	<0.001	2.07 (1.02 to 4.20)	0.045	3.27 (1.52 to 7.03)	0.002		
Strong social support	1.00		1.00		1.00			
Education status								
Illiterate/read and write	6.72 (1.47 to 30.70)	0.014						
Grade 1–8	3.23 (1.06 to 9.83)	0.039						
Grade 9–12	2.88 (1.08 to 7.70)	0.035						
Certificate/diploma	2.05 (0.91 to 4.61)	0.084						
Degree and higher	1.00							
Anxiety score	1.21 (1.01 to 1.45)	0.037						
Support wife beating								
No			0.49 (0.28 to 0.86)	0.014				
Yes			1.00					
Occupation								
Government employed			5.99 (1.05 to 34.26)	0.044				
Merchant/student			6.04 (1.13 to 32.26)	0.035				
Housewife			2.69 (0.56 to 12.97)	0.218				
Farmer/daily labourer			1.00					

*Variables included in the model were: anxiety score, stress score, fear of childbirth score, supportive of wife-beating attitude, direct maternal morbidity, indirect maternal morbidity, mode of delivery, type of fuel for cooking, educational status of mothers, husband educational status, occupation of mothers, husband occupation, social support, monthly expenditure, age of the mother, body mass index and parity. AOR, adjusted OR; C/S, caesarean section; HRQOL, health-related quality of life; SVD, spontaneous vaginal delivery.

the postpartum period. However, other studies reported that higher education level was associated with poor QOL, indicating that the association between education and QOL is complex.^{23 51} These conflicting findings suggest the need for more research work which may include the undertaking of meta-analysis.

We found that being government employed and merchant/student were associated with fair trajectory group membership for the physical and poor trajectory group membership for the social QOL relative to the excellent trajectory. Additionally, being merchant/student was

associated with poor trajectory group membership for the environmental QOL relative to the excellent trajectory. A previous study reported higher QOL of postnatal women before they return to work but lower QOL when they resumed work outside their home, which is in congruent with our study finding.⁵² Women who return to work may find their job more challenging with additional task of baby care, especially for those women without social support for domestic tasks. Higher responsibility and workload would most likely affect the HRQOL trajectories negatively due to work-related stress.^{50 53} Hence,

Table 6 Significant predictors of the environmental HRQOL trajectory membership in postpartum women, Northwest Ethiopia, 2021

Environmental HRQOL trajectories	Very poor vs excellent*		Poor vs excellent*		Good vs excellent*		Very good vs excellent*	
	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value
Social support								
Poor social support	8.03 (3.71 to 17.39)	<0.001	3.88 (1.78 to 8.46)	0.001	4.00 (1.77 to 9.04)	0.001	2.89 (1.31 to 6.39)	0.009
Strong social support	1.00		1.00		1.00		1.00	
Anxiety score	1.50 (1.11 to 2.03)	0.008	1.45 (1.07 to 1.97)	0.015	1.64 (1.20 to 2.23)	0.002		
Direct morbidity								
Yes	15.01 (2.68 to 84.16)	0.002	9.12 (1.81 to 45.87)	0.007	14.07 (2.49 to 79.43)	0.003		
No	1.00		1.00		1.00			
Indirect morbidity								
Yes	4.54 (1.14 to 18.08)	0.032	5.41 (1.37 to 21.35)	0.016	4.76 (1.16 to 19.55)	0.03		
No	1.00		1.00		1.00			
Stress score	1.27 (1.03 to 1.58)	0.025	1.32 (1.07 to 1.63)	0.011				
Support wife beating								
No	0.48 (0.25 to 0.90)	0.022						
Yes	1.00							
Parity			2.19 (1.18 to 4.04)	0.013				
Mode of delivery								
SVD/instrumental delivery			3.71 (1.73 to 7.95)	0.001				
Elective/emergency C/S			1.00					
Occupation								
Government employed			3.24 (0.65 to 16.26)	0.153				
Merchant/student			4.73 (1.02 to 22.06)	0.048				
Housewife			2.42 (0.59 to 9.87)	0.219				
Farmer/daily labourer			1.00					
Gestational age					1.24 (1.05 to 1.46)	0.012		
Maternal age							1.09 (1.01 to 1.19)	0.031

*Variables included in the model were: anxiety score, stress score, depression score, fear of childbirth score, supportive of wife-beating attitude, direct maternal morbidity, indirect maternal morbidity, stressful life event of health risk, mode of delivery, educational status of mothers, husband educational status, occupation of mothers, husband occupation, social support, monthly expenditure, age of the mother, body mass index, parity, gravidity, gestational age and birth weight.

AOR, adjusted OR; C/S, caesarean section; HRQOL, health-related quality of life; SVD, spontaneous vaginal delivery.

higher social support, longer period of maternity leave and reduced workload particularly for employed women may contribute to the improvement of QOL of women in the postpartum period. On the contrary, other studies have reported that women who were employed had better psychological and environmental HRQOL after childbirth.^{23 47} However, another study reported that there is no significant association between occupational status and HRQOL in postpartum women.⁴⁸ With regard to the relationship between employment and women's health status, there are two major approaches within the framework of theoretical models of 'role'.⁵³ The first approach is role strain, which argues that multiple roles might have negative effects on the well-being of women.⁵³ The findings of our study are in line with this approach. The second approach is role enhancement which argues

that engaging in multiple roles enhances well-being of women.⁵³

Women with a lower monthly expenditure were found to be more likely to belong to the fair physical HRQOL trajectory relative to the excellent trajectory. Similar findings were reported by previous researches in which women with a low income were likely to have a low HRQOL.^{23 54 55} Having a low income may predispose women to feel that they are not insured and it may also increase the risk of stress and various health problems because of lack of financial support after childbirth.²³ Hence, proper post-natal care and counselling should be given for women with low income after delivery, as they are likely to suffer from stress and other health problems. However, other studies found no relationship between women's HRQOL and their monthly income.^{47 48} Therefore, further studies

should be done to examine the relationship of women's HRQOL and their monthly income.

It was also found that women with increased maternal age were more likely to belong to the very good trajectory of environmental HRQOL as compared with the excellent trajectory. Similar finding was reported by previous studies that women with increased age were more likely to have a lower QOL.^{49 52 55 56} This might be due to the fact that older women were likely to have a higher parity. Multiparity with other social and cultural factors might have increased the responsibilities, the demand for physical energy and social involvements thereby affecting their QOL negatively. On the contrary, another study identified that the mother's younger age at childbirth was associated with lower HRQOL,⁵⁷ and other studies also reported that there is no association between maternal age and HRQOL.^{56 58} Additionally, our study indicated that higher body mass index is a risk factor for women to belong to the poor trajectories of psychological and social QOL. In a previous longitudinal study among pregnant women, obesity was found to be associated with decreased level of HRQOL which is in congruent with our study finding.⁵⁹ Therefore, interventions and counselling services should be designed targeting postpartum women with higher age and body mass index so as to improve their QOL.

Obstetrics and morbidity-related factors

Direct and indirect maternal morbidities were found to be independent risk factors for women to belong to the lower HRQOL trajectories in the physical, psychological and environmental HRQOL domains relative to the highest trajectories. The indirect maternal morbidities were also found to be independent risk factors for women who belong to the lower social HRQOL trajectories relative to the highest trajectory. This finding is similar to the findings reported by previous studies.^{49 58 60} The authors of these studies reported that complications during delivery were significantly associated with poor perception in general satisfaction with health, social and environmental domains of HRQOL. Some of these complications the authors reported were hypertensive disorders and postpartum haemorrhages. It has been also reported by other studies that intercurrent illness and gestational hypertension lead to lower HRQOL in postpartum women.^{61 62}

Among the direct maternal morbidities, gestation hypertension was found to be related to poor physical HRQOL in a study from the Netherlands.⁶³ The physical HRQOL was on average 1.5 points lower in women with gestational hypertension.⁶³ Women with hypertension may experience acute complications like placental abruption, pulmonary oedema or stroke,⁶⁴ which could have an impact on HRQOL.⁶³ There is also an increased risk of a medically indicated preterm birth among women with hypertension and as a result women may experience the need to deal with the consequences of premature birth.^{63 64} In one study, mothers of preterm babies were reported to have higher levels of fatigue in the morning at 6 weeks post partum because of higher physical demands

for caring for preterm babies and having fragmented sleep.⁶⁵ A prospective cohort study in Burkina Faso also showed that women with severe obstetric complications (anaemia, hypertension, haemorrhage, dystocia and infection) generally reported feeling worse than women with uncomplicated deliveries.⁶⁶ It was suggested that the different patterns of health problems may affect women at different times following severe obstetric complications.⁶⁶ Hence, preventive strategies along with prompt diagnosis and treatment of maternal morbidities would contribute to improve the QOL of postpartum women.

The finding of our study also showed that women who had vaginal delivery were more likely to belong to the lower HRQOL trajectories in all HRQOL domains relative to the highest trajectories. This is in line with the study finding in Tanzania which reported that women who had caesarean delivery were more likely to have better physical HRQOL scores than their counterparts.⁶² Another study in Asia also reported that women who had planned caesarean sections have higher scores in all the domains of HRQOL than mothers who had spontaneous delivery or instrument-assisted delivery.⁶⁷ The possible reason might be that women who had caesarean delivery may have received more family support because of their surgery than those women with vaginal delivery. Another justification might be the fear of childbirth is linked to vaginal birth⁶⁸; women who had vaginal birth might have experienced high levels of fear of childbirth, which reduces their level of self-confidence, and in turn decreases their HRQOL.⁶⁹ Therefore, social support should be strengthened for women who gave birth with vaginal delivery, as given for women with caesarean section. In addition, providing adequate information about birth procedures and response to mothers' needs during childbirth and training of healthcare providers to be mindful of factors that contribute to fear of childbirth are essential so as to improve QOL in the postpartum period. Our study, however, is in contrast with other studies which reported that caesarean delivery was associated with a lower overall HRQOL score in postpartum women.^{49 55 56 70} A study from China has also reported no significant differences between women with normal vaginal delivery and caesarean section in all domains of HRQOL during the postpartum period.¹³ Higher gestational age was also identified as a risk factor for a woman to belong to the lower environmental HRQOL trajectory compared with the highest trajectory, which is in line with other studies that reported gestational age as a risk factor for poor HRQOL score.^{56 71 72} Thus, counselling interventions should be designed targeting women who would likely give birth during the post-term gestational age so that their QOL could be improved.

Psychosocial factors

With regard to the psychosocial factors, social support was found to be associated with all domains of HRQOL in which women with poor social support were more likely to belong to the lower HRQOL trajectories relative to

the highest trajectories. Inversely, this means that relative to women with poor social support, women with strong social support were more likely to belong to the highest HRQOL trajectories. A study conducted in Tanzania agreed with the finding of our study, in which women with higher levels of social support were more likely to have higher HRQOL.⁶² This might be because positive social environment and support in the form of provision of resources and assurance can act as a stress-buffering mechanism, protecting the mental health and QOL of individuals.

We also found that women with fear of childbirth were more likely to belong to the lower psychological and social HRQOL trajectories compared with the highest trajectories. This is in congruent with other studies that reported women with a higher fear of childbirth were more likely to have lower HRQOL.^{23 73} This might be due to the fact that women with fear of childbirth may experience high levels of anxiety during the postpartum period, which reduces their level of self-confidence, and in turn decreases their HRQOL.⁶⁹ Hence, encouraging mothers to express their fears/concerns after childbirth and have continuous check-ups and counselling might be beneficial to improve the QOL of postpartum women.

Women having higher stress and anxiety symptom scores were also at risk of belonging to the lower HRQOL trajectories in all domains relative to the highest trajectory. The exception is that stress was not associated with the social HRQOL trajectory. Our finding is consistent with previous studies.^{55 74 75} These studies have reported that having psychopathological symptoms was significantly associated with lower HRQOL^{55 74} and a significant decrease in HRQOL was found in women with anxiety symptoms in the postpartum period.⁷⁵ Therefore, prompt diagnosis and treatment of mental health problems in the postpartum period might help to avert the decrease in HRQOL of postpartum women.

Strength and limitation

A key strength of this study is the use of a group-based trajectory analysis to identify subgroups of longitudinal HRQOL trajectories based on multiple HRQOL domains. Group-based trajectory modelling enables the identification of the distinct underlying trajectories of HRQOL and their predictors. Understanding these distinct trajectory subgroups and the risk factors associated with each subgroup can help to provide mothers with personalised prognostic information and to inform the design of targeted risk factors prevention for women in the postpartum period.

However, this study is not without limitations. Recall bias might have been introduced since the postnatal questionnaire was completed by women around 6th, 12th and 18th week after childbirth. The study included only mothers who came to the study hospitals for childbirth. As a result, since the hospitals are located in urban areas, women in the rural areas and those who did not attend hospitals for child delivery were not included in

the study. Women's QOL vulnerability may differ between women in the urban and rural areas and between those who attend their child delivery in hospitals and in health centres or at home. Hence, the sample of our study may not be representative of the wider postpartum women, which precludes generalisation to the wider source population. In addition, most variables were self-report and it is possible that women might not be comfortable in disclosing information about their own levels of stress, anxiety, depression and post-traumatic stress disorder (PTSD) because of concerns about social desirability. Finally, even if we have used a well-established and validated self-report instruments, there might be symptom overlaps between stress, anxiety, depression and PTSD questionnaires leading to some overestimation. However, no multicollinearity was found between the independent variables included in the regression model as measured by VIF of <5 and tolerance of >0.2. Therefore, the parameter estimates of the variables in the model were not affected.

Conclusion and recommendation

While four distinct trajectories were found for the physical and psychological HRQOL, five trajectories of QOL were identified for the social and environmental domains of the 26-item WHOQOL-BREF. Direct and indirect maternal morbidities were found to be predictors of lower HRQOL trajectories of all domains except the direct maternal morbidity is not for the social HRQOL trajectory. Therefore, management of these morbidities is necessary to prevent the decrease in HRQOL trajectories of HRQOL.

In addition, stress, fear of childbirth and anxiety were predictors of lower HRQOL trajectory membership among the identified latent trajectory groups. Therefore, prompt identification of women with common perinatal mental problems and psychological interventions should be made through integration of healthcare services which would help mothers toward achieving a better HRQOL trajectory after childbirth.

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Contributors MTM was the primary investigator involved in proposal writing, designing, and recruitment and training of supervisors and data collectors; and analysis and writing and in all stages of the project implementation. He did most of the analysis and writing of the paper. MTM accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish. GDA and TA contributed to the designing of the methodology, leading the primary investigator, and were involved in designing the project proposal, design of questionnaires and supervision, and involved in giving comments on the progress of the project and final approval of the paper. All authors read and approved the final manuscript.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Obtained.

Ethics approval This study has been approved by the Institutional Review Board of Bahir Dar University (reference number: 00225/2020). Written informed consent was obtained from each participant before participating in the study. In addition to informed consent from their caregivers, assent was also obtained from teenage mothers whose age is less than 18 years, to participate in the study. Using codes and passwords, and limiting access to the data only for the investigators were the measures taken to ensure the confidentiality of the data. Data collectors read out and assisted participants to fill out the consent form if participants were unable to read and write.

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Data availability statement Data are available upon reasonable request. Extra data are available from the corresponding author upon reasonable request.

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