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Eric Mupenzi

erimu2022@gmail.com

Mount Kigali University

Jean Damascène Iyamuremye

Mount Kigali University

Fisseha Berehe Aberha

Mount Kigali University

Gashongore Kevis

Mount Kigali University

Mojeed Akorede Gbadamosi

University of Rwanda

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Prevalence and social ecological factors associated with mental health issues among teenage mothers in Rwamagana district of Rwanda: a community based cross sectional study

Authors: Eric Mupenzi[1]*; Jean Damascène Iyamuremye[1]; Fisseha Berehe Aberha[1]; Gashongore Kevis[1]; Mojeed Akorede Gbadamosi[2]

Affiliations:

[1]Mount Kigali University, Kigali City, Rwanda.

[2]University of Rwanda, Kigali City, Rwanda.

***Corresponding author:**

Eric Mupenzi

E-mail: erimu2022@gmail.com

ABSTRACT

Background: Teenage motherhood can be accompanied by substantial psychosocial stress, but evidence on psychological symptoms among teenage mothers in rural Rwanda is limited. This study estimated the proportion of teenage mothers in Rwamagana District who met a study-defined threshold for mental health issues and explored associated factors across social-ecological levels.

Methods: A cross-sectional study included 96 teenage mothers aged 18 to 19 years with at least one living child, sampled from three sectors. Structured interviews were conducted in Kinyarwanda. The outcome was defined as at least two of nine symptom domains occurring "frequently" or "almost every day" during the previous two weeks. This study-developed threshold was not validated against a clinical diagnostic interview. Separate Firth penalized logistic regression models were fitted for each social-ecological level.

Results: Twenty-one participants (21.9%; 95% CI: 14.3 – 31.7) met the study-defined threshold. In separate ecological-level models, lack of family support (OR 5.48, 95% CI: 1.90 – 17.10; p =

0.002) and fear of disclosing the partner because of possible legal penalties (OR 5.23, 95% CI: 1.38 – 29.68; p = 0.013) were associated with higher odds of meeting the threshold. Financial support, lack of knowledge about legal services, and financial independence were also associated with the outcome, but estimates were imprecise, and the directions of the two financial associations were unexpected.

Conclusions: Approximately one in five participants met the study-defined threshold for mental health issues. The findings suggest that family support and concerns about partner disclosure warrant further investigation, but the small cross-sectional study and unvalidated symptom threshold do not support diagnostic or causal conclusions. Larger studies using validated measures and longitudinal designs are needed.

Keywords: Teenage Mothers; Mental Health; Social-Ecological perspective

BACKGROUND

Adolescence, defined by the World Health Organization (WHO) as the period between ages 10 and 19, is a critical stage of physical, psychological, and social development (1). Pregnancy and motherhood during this period can introduce additional demands at a time when many young people are still completing their education, developing social relationships, and establishing economic independence. Globally, an estimated 21 million girls aged 15 to 19 years in low and middle-income countries experienced pregnancy annually in 2019. Approximately half of these pregnancies were unintended, resulting in an estimated 12 million births(1). Adolescent pregnancy remains an important public health concern because its consequences extend beyond reproductive

health to include educational opportunities, economic prospects, social relationships, and psychological well-being.

Teenage mothers may experience considerable psychological and social difficulties as they navigate the responsibilities of childcare alongside the demands of adolescence. Research has identified depression, anxiety, social isolation, stigma, and limited access to appropriate support as important concerns for pregnant and parenting adolescents (2,3). Financial hardship, disrupted education, relationship problems, and inadequate family support may compound these difficulties. In Rwanda, qualitative research has documented how teenage mothers experience stigma from family members, peers, communities, and healthcare providers, alongside restricted educational opportunities and social isolation (4). These experiences may contribute to psychological distress, although their effects are likely to vary according to individual circumstances and the support available to each young mother.

Evidence from Rwanda also indicates that mental health concerns among adolescent mothers warrant greater attention. In a cross-sectional study of 120 adolescent mothers, Niyonsenga and Mutabaruka reported that 48% had clinically high levels of depressive symptoms (5,6). Although this finding highlights a potentially substantial burden, it should be interpreted in the context of the study's sample, measurement instrument, and postpartum focus. It does not establish the prevalence of mental health issues among all adolescent mothers in Rwanda. More recently, Mizero and colleagues found that adolescent mothers experienced financial difficulties and sociocultural barriers when accessing healthcare, while their psychological and social needs were not consistently addressed by available services (6). Together, these studies suggest that mental health of teenage mothers should be considered alongside their reproductive and broader social needs.

The circumstances surrounding adolescent motherhood are shaped by factors operating at several interconnected levels. Individual experiences and characteristics may interact with family relationships, community attitudes, access to services, and wider social and economic conditions. Bronfenbrenner's ecological perspective provides a useful theoretical basis for understanding how these different environments influence individual development and well-being(7). Applied to teenage motherhood, a social-ecological approach allows researchers to examine potential correlates of psychological symptoms at the individual, interpersonal, community, and structural levels, rather than treating mental health as solely an individual concern. This perspective is particularly relevant in Rwanda, where research has documented the overlapping effects of stigma, social exclusion, limited economic opportunities, and gaps in support for teen mothers (4,6,8).

Despite growing evidence on adolescent pregnancy in Rwanda, much of the available research has focused on its prevalence, determinants, reproductive health, and access to healthcare (6,9). Although existing studies have described the psychosocial challenges faced by teenage mothers, evidence on the factors associated with their psychological symptoms remains limited, particularly in specific local settings such as Rwamagana District. In addition, the relationships among family support, financial circumstances, concerns about partner disclosure, knowledge of legal services, and psychological well-being require further investigation. Understanding these relationships may help identify areas for future research and inform the development of contextually appropriate services. However, the evidence must be interpreted carefully because associations observed in cross-sectional studies cannot establish causal relationships.

This study, therefore, aimed to estimate the proportion of teenage mothers in Rwamagana District who met the study-defined threshold for mental health issues and to explore factors associated with this outcome, organized within the social-ecological framework. By examining individual,

interpersonal, and broader contextual factors, the study seeks to contribute locally relevant evidence to the limited literature on the mental well-being of adolescent mothers in Rwanda.

METHODS

Study design

This was a descriptive cross-sectional study using a quantitative approach. The study design and reporting follow the Strengthening Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies (10) (Supplementary File S1).

Study setting

The study was conducted in Rwamagana District, located in the Eastern Province of Rwanda. According to the fifth Rwandan Population and Housing Census, the district has a total population of 484,953 residents distributed over an area of 681.8 km. The majority of the population is young, with approximately 56.05 per cent under 25 years of age and 22.21 per cent aged 10 to 19 years. The female population aged 10 to 19 years is 54,101. The district has 14 sectors with a population density of 711.3 per km. Data collection was conducted between November and December 2025.

Participants

The target population comprised teenage mothers aged 18 to 19 years who were permanent residents of Rwamagana District during the study period and who had at least one living child. Participants were included if they were aged 18 to 19 years, had been residents of Muyumbu, Fumbwe, or Kigabiro sectors for at least one year, had at least one living child, had delivered at a health facility in one of the three sectors, and provided written informed consent. Teenage mothers who were unable to communicate or who were unwilling to participate were excluded.

Variables

The primary outcome was a study-defined indicator of mental health issues, termed "study-defined outcome" in the original study protocol. It was defined as reporting at least two of nine symptom domains at a frequency of "frequently" or "almost every day" during the preceding two weeks. This threshold was not validated against a clinical diagnostic interview; the outcome should therefore not be interpreted as a confirmed diagnosis or as equivalent to a validated screening instrument. The elements assessed were persistent feelings of sadness or worry, feeling overwhelmed or unable to cope with stress, difficulty enjoying things, concentration difficulties, sleep alterations, appetite changes, negative thinking patterns, functional impairment in daily responsibilities, and negatively affected relationships.

Exposure variables were organized according to the Social Ecological Model. Individual-level variables included unplanned pregnancy, body image distortion, feeling overwhelmed by parenting responsibilities, lack of information on positive parenting, alcohol or drug use to cope with stress, and previous mental health antecedents. Interpersonal-level variables included physical abuse, emotional abuse, perpetrator type, lack of family or partner financial support, lack of emotional support, discomfort disclosing the partner due to fear of legal penalties, partner refusal to register the child in civil registration, family support, having someone who listens, and friend support. Community-level variables included religious exclusion, peer group participation, religious group participation, school reintegration, knowledge of mental health services, and knowledge of legal services. Structural-level variables included financial independence, financial barriers to healthcare, school dropout, access to quality and affordable healthcare, and training on positive parenting.

Potential confounders considered in the analysis were participant age, education level, marital status, living arrangement, occupation, and sector of residence.

Data sources and measurement

Data were collected using a structured interview questionnaire administered face-to-face in Kinyarwanda. The questionnaire was developed for this study from the study objectives and relevant literature. The nine symptom items were described as adapted from core domains of depression and anxiety. The questionnaire was translated into Kinyarwanda and back-translated. The supplied manuscript does not report formal psychometric validation, cognitive interviewing, internal consistency, or criterion validation against a diagnostic interview; if these were conducted, they should be reported; otherwise, their absence should be acknowledged. Data were collected by seven trained data collectors from November to December 2025 at participants' households in collaboration with local leaders. Interviews were conducted respectfully and empathetically using clear, nonjudgmental language to minimize discomfort. Participants' privacy, dignity, cultural beliefs, and values were respected throughout the interviews.

Bias

Several steps were taken to minimize potential sources of bias. Data collectors were trained to use neutral prompting and to avoid leading questions. Interviews were conducted in private settings to reduce social desirability bias. The questionnaire was translated and back-translated to ensure linguistic equivalence. All participants were assured of confidentiality and anonymity to encourage honest responses. Despite these measures, self-reported data are subject to recall and social desirability biases, which are acknowledged as limitations.

Study size

The sample size was calculated using Cochran formula, the single-population-proportion formula with a 95% confidence level, p = 0.06 (the Eastern Province estimate), and a 5-percentage-point margin of error.

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{d^2}$$

$$n = \frac{(1.96)^2(0.06)(1-0.06)}{(0.05)^2} \approx 86.68$$

The calculated sample was approximately 87; adding 10% for anticipated nonresponse yielded a target of 96. This planning value was not an estimate of the prevalence of the study-defined mental-health outcome. Therefore, the sample size calculation does not establish adequate precision for the outcome prevalence or sufficient power for association analyses. The final sample included 96 participants and 21 outcome events, so association estimates are exploratory.

Sampling strategy

The sampling frame was constructed using delivery registers and Health Management Information System (HMIS) data covering January 2024 to October 2025. A total of 135 teenage mothers aged 18 to 19 years who met the initial age- and facility-based identification criteria were identified. The sampling frame included their names, dates of birth, ages at childbirth, residential addresses, and contact details. Of the 135 eligible individuals identified, 83 were recorded at Muyumbu Health Centre and Murehe Health Post, a health facility extension serving Muyumbu Health Centre catchment area; 30 were recorded at Nyagasambu Health Centre in Fumbwe Sector; and 22 were recorded at Rwamagana Health Centre in Kigabiro Sector (See Figure 1).

Proportionate stratified random sampling was used to allocate the total sample of 96 participants across the three strata according to the number of eligible teenage mothers identified in each stratum. The required sample size for each stratum was calculated using the formula: **ni** = Ni**n*/N where (ni) is the sample size allocated to stratum (i), (Ni) is the number of eligible teenage mothers in stratum (i), (N) is the total number of eligible teenage mothers in the sampling frame, and (n) is the overall sample size.

Based on this formula, 59 participants were allocated to Muyumbu Sector (83/135 x 96 = 59), 21 to Fumbwe Sector (30/135 x 96 = 21), and 16 to Kigabiro Sector (22/135 x 96 = 16). These allocations summed to the required sample of 96 participants.

Within each stratum, simple random sampling was performed using computer-generated random numbers in Microsoft Excel to select the required number of participants from the sampling frame. Selected participants were contacted and visited at their households by trained data collectors to assess their eligibility and invite them to participate in the study.

The sampling frame was restricted to teenage mothers identified through the delivery registers and HMIS records of the specified health facilities. So, teenage mothers who had delivered outside these facilities and were not captured in the available records were not represented in the sampling frame. The findings should therefore be interpreted in relation to the population covered by these facility-based records and may not be generalizable to all teenage mothers in the study area.

Quantitative variables

Participant age was analyzed as a categorical variable (18 years versus 19 years). Age at first childbirth was also analyzed as a categorical variable. All symptom items were ordinal with four frequency categories (never, occasionally, frequently, almost every day). For the outcome definition, each symptom item was dichotomized as 0 for never or occasionally and 1 for

frequently or almost every day. The dichotomized items were summed to create a symptom count ranging from 0 to 9. A threshold of at least two frequent symptoms was used to classify the study-defined outcome. The threshold was selected with reference to the observed symptom-count distribution and the small sample, rather than being validated against a clinical reference standard. This data-dependent threshold may affect the estimated prevalence and associations.

Statistical methods

Data were analyzed using SPSS version 27 for recoding and descriptive statistics, and R version 4.5.3 for regression modelling. The haven package was used to import the SPSS data file, and the logistic package was used to fit Firth penalized logistic regression models. Firth penalization was chosen because of the small sample size and the relatively low number of outcome events (21 cases), which makes standard maximum likelihood estimation prone to small-sample bias and separation problems.

Bivariate Firth logistic regression was used to screen candidate predictors. Variables with $p < 0.20$ in bivariate analyses and those considered theoretically important were included in multivariable modelling. Estimates from the full bivariate screen are presented in Supplementary Table S1. Given the small number of outcome events, this data-driven screening approach may produce unstable estimates and should be regarded as exploratory. The models were specified separately by the Social Ecological Model level; they were not a single model that simultaneously controlled for all potential confounders. Therefore, estimates should not be described as fully adjusted for confounding across ecological levels. Four separate multivariable Firth models were fitted, one for each level of the Social Ecological Model. Each model was limited to two or three predictors to avoid overfitting, given the 21 outcome events. The interpersonal model contained family support,

fear of partner disclosure, and financial support. The individual model contained feeling overwhelmed by parenting responsibilities, education (collapsed to binary: primary or less versus secondary), and unplanned pregnancy. The community model contained knowledge of legal services. The structural model contained financial independence.

Penalized profile likelihood confidence intervals and penalized likelihood ratio test p-values were reported. For each ecological-level model, the penalized likelihood ratio test was reported. Because the models included different numbers and types of predictors and were not designed as competing models, their p-values should not be compared to rank ecological levels or to conclude that one level was "strongest." Statistical significance was defined as a two-sided p-value below 0.05. Missing data were minimal for the variables included in the models. Conditional variables with structural missingness (e.g., where to go for mental health help and known legal services used) were reported descriptively only and not imputed (Supplementary Table S2). Multiple imputation was considered but not used because the missingness in the analysis variables was low and the conditional variables were excluded from modelling.

Ethical considerations

Ethical approval was obtained from the Mount Kigali University Ethical Review Committee (MKUR04/ERC/0580). Permission to conduct the study was obtained from Rwamagana District Authority (approval reference No. 3743/07.05.01). Written informed consent was obtained from all participants before data collection. Participants were fully informed about the purpose of the study, their voluntary participation, and their right to withdraw at any time without penalty. Only teenage mothers aged 18 to 19 years were included; no participants under 18 years of age were

enrolled. Confidentiality and anonymity were strictly maintained throughout the study. Data were stored securely, and access was restricted to the research team.

RESULTS

Sociodemographic characteristics of participants

A total of 96 teenage mothers aged 18 to 19 years participated in the study. Table 1 presents their sociodemographic characteristics. The majority were 19 years old (74.0%), and most were from Muyumbu sector (61.5%), followed by Fumbwe (21.9%) and Kigabiro (16.6%). Half of the participants (50.0%) reported their first childbirth at age 19, while 42.8 per cent gave birth for the first time at age 18. Most had completed primary education (77.1%), and 21.9 per cent had secondary education. The majority were single (85.4%), while 14.6 per cent were cohabiting. Christianity was the dominant religion (92.7%). Most participants had one living child (93.8%), and three-quarters were living with their parents (75.0%). Farming was the most common occupation (75.0%), while 14.6 per cent reported no occupation.

Table 1. Sociodemographic characteristics of teenage mothers in Rwamagana District, Rwanda (n = 96)

Characteristic	Category	n	%
Age (years)	18	25	26.0
	19	71	74.0
Sector	Muyumbu	59	61.5
	Fumbwe	21	21.9
	Kigabiro	16	16.6
Age at first childbirth	15	1	1.0
	16	1	1.0
	17	5	5.2
	18	41	42.8
	19	48	50.0
Education level	No formal education	1	1.0
	Primary	74	77.1

	Secondary	21	21.9
Marital status	Single	82	85.4
	Cohabiting	14	14.6
Religion	Christian	89	92.7
	Muslim	1	1.0
	No religion	6	6.3
Number of living children	One	90	93.8
	Two	6	6.2
Living arrangement	Parents	72	75.0
	Partner	20	20.9
	Alone	3	3.1
	Grandmother	1	1.0
Occupation	Farming	72	75.0
	Private servant	9	9.4
	Trader	1	1.0
	No occupation	14	14.6

Prevalence of mental health issues among teenage mothers

Of the 96 teenage mothers, 21 (21.9%; 95% CI: 14.3–31.7) met the study-defined threshold of mental health issues with at least two symptom domains occurring frequently or almost every day during the preceding two weeks. Seventy-five participants (78.1%) did not meet this threshold. This is an operational symptom indicator and should not be interpreted as a confirmed diagnosis. The distribution of symptom counts ranged from zero to four. Table 2 presents the distribution.

Table 2. Distribution of frequent symptom counts among teenage mothers (n = 96)

Number of frequent symptoms	**n**	**%**
0	51	53.1
1	24	25.0
2	15	15.7
3	5	5.2
4	1	1.0
Mental health issues (2 or more)	21	21.9

Factors associated with mental health issues among teenage mothers

Table 3 presents the results of the Firth penalized logistic regression models across the four levels of the Social Ecological Model. The interpersonal-level model had a penalized likelihood ratio test p-value below 0.001; the community- and structural-level models each had p = 0.027 and p = 0.029, respectively, and the individual-level model had p = 0.191. Because the models contained different predictors and were fitted separately, these tests do not establish that one ecological level is more important than another.

Table 3. Firth penalized logistic regression of factors associated with study-defined symptom outcome among teenage mothers, by ecological level (n=96)

Ecological level and variable	Comparison	OR	95% CI	p-value
Individual level				
Overwhelmed by parenting	No vs Yes	0.41	0.15–1.06	0.066
Education	Secondary vs Primary or less	1.71	0.55–5.04	0.342
Unplanned pregnancy	No vs Yes	1.58	0.42–5.33	0.480
Model likelihood ratio test				0.191
Interpersonal level				
Family support	No vs Yes	5.48	1.90–17.10	**0.002**
Fear of partner disclosure	Yes vs No	5.23	1.38–29.68	**0.013**
Financial support	Yes vs No	3.48	1.20–10.91	**0.022**
Model likelihood ratio test				**<0.001**
Community level				
Knowledge of legal services	No vs Yes	3.03	1.13–8.94	**0.027**
Model likelihood ratio test				**0.027**
Structural level				
Financial independence	Yes vs No	3.05	1.13–8.33	**0.029**
Model likelihood ratio test				**0.029**

Abbreviation: CI = profile likelihood confidence interval; OR = penalized odds ratio.

Note: Reference categories are shown in the comparison column. For fear of partner disclosure, the odds ratio and confidence interval have been inverted to express the risk associated with fear of disclosure relative to comfort with disclosure.
Bold represent significant p-value

In the interpersonal-level model, three variables were associated with the study-defined symptom outcome. Mothers who lacked family support had about 5 times higher odds compared with those who received family support (OR 5.48, 95% CI 1.90 – 17.10, p = 0.002). Mothers who were uncomfortable disclosing their partner due to fear of legal penalties had about 5 times higher odds compared with those who were comfortable (OR 5.23, 95% CI 1.38 to 29.68, p = 0.013). Mothers who reported having financial support had nearly 3 times higher odds compared with those who did not (OR 3.48, 95% CI 1.20 – 10.91, p = 0.022). The direction of the financial support association was unexpected; the cross-sectional data do not establish an explanation.

In the community-level model, participants who did not know where to access legal services related to teenage motherhood had higher odds of meeting the study-defined threshold of mental health issues than those who did (OR 3.03, 95 per cent CI 1.13 – 8.94, p = 0.027).

In the structural-level model, participants who reported lack of financial independence had higher odds of meeting the study-defined symptom threshold for mental health issues than those who did not (OR 3.05, 95 percent CI 1.13 – 8.33, p = 0.029). This association was also unexpected and should be interpreted cautiously.

At the individual level, no predictor reached conventional significance. Feeling overwhelmed by parenting responsibilities showed a borderline association (OR 0.41, 95 percent CI 0.15 – 1.06, p = 0.066), but the model as a whole did not significantly predict the outcome. This finding does not establish the absence of associations between individual characteristics and the outcome. Full

coefficient and standard error estimates for the individual-level model are presented in Supplementary Table S3.

Sensitivity analysis

When the threshold was raised to three or more frequent symptoms, six participants (6.3%) met the outcome definition. Because only six participants met this threshold, formal multivariable modelling was not feasible. The crude direction of association for family support was consistent with the primary analysis: a higher proportion of mothers met the outcome among those who lacked family support (5 of 30, 16.7%) than among those who received family support (1 of 66, 1.5%). The direction of association for fear of partner disclosure and financial support was weakly consistent with the primary analysis. The direction regarding knowledge of legal services and financial independence was inconsistent with the primary analysis. The small number of events under the alternative threshold precludes firm conclusions, and the sensitivity analysis should be interpreted as exploratory (Supplementary Table S4).

DISCUSSION

Principal findings

In this cross-sectional study of 96 adolescent mothers aged 18 to 19 years in Rwamagana district of Rwanda, 21 participants (21.9%; 95% CI: 14.3 – 31.7) met the study-defined threshold for mental health issues. In separate models organized according to the social-ecological framework, lack of family support, fear of disclosing the child's father's identity due to possible legal penalties, and lack of knowledge about legal services were associated with higher odds of meeting this threshold. Unexpected positive associations were also observed for reported financial support and financial independence. These findings suggest that psychological well-being among adolescent

mothers may be related to a combination of family relationships, concerns about legal consequences, access to information, and economic circumstances.

The findings should be interpreted as exploratory rather than definitive. The outcome was based on a study-developed threshold rather than a validated diagnostic instrument, and only 21 participants met that threshold. The small number of outcome events, wide confidence intervals, and separate modelling of ecological levels limit the precision of the estimates and the extent to which they account for confounding. Still, the results identify several potentially important areas for further research among teenage mothers in Rwanda.

Comparison with existing literature

The proportion of participants meeting the study-defined threshold for mental health issues was 21.9%. This is numerically close to the 22.7% prevalence of depression or anxiety reported among adolescent and young adult mothers in a multicentre Brazilian study published in 2025 (11). However, the two estimates should not be interpreted as evidence of comparable mental health burdens. The Brazilian study assessed depression and anxiety using the Depression Anxiety Stress Scales 21, whereas the present study used nine symptom domains and a study defined threshold of at least two frequent symptoms. Differences in measurement, sampling, population characteristics, and outcome definitions may explain similarities or differences between the estimates.

Evidence from Rwanda also demonstrates the importance of examining mental health among adolescent mothers. Niyonsenga and Mutabaruka reported clinically high levels of depressive symptoms in 48% of a convenience sample of 120 adolescent mothers aged 15 to 19 years (5,12). That estimate was higher than the proportion observed in the present study, but the difference

should be interpreted cautiously. Their study assessed postpartum depressive symptoms using the Edinburgh Postnatal Depression Scale, while the present study used a broader, study-specific symptom threshold. The samples may also have differed in assessment timing and other characteristics. The estimates, therefore, do not establish whether psychological symptoms are more or less common in either population.

Qualitative and mixed methods research in Rwanda provides further context for the present findings. Coast and colleagues described how adolescent pregnancy and motherhood can be accompanied by stigma, social isolation, restricted educational opportunities, and economic disadvantage (4). These experiences offer a plausible social context for the associations observed in our study, particularly the association between lack of family support and mental health issues. However, the present study did not directly assess all these experiences, and their role in explaining the observed associations remains uncertain.

Taken together, these studies support the relevance of teenage mothers' mental health as a public health concern in Rwanda. However, differences in study populations and measurement approaches make direct comparisons of prevalence difficult. The present estimate should be understood as the proportion of participants meeting the study-defined threshold, not as the prevalence of clinically diagnosed depression, anxiety, or common mental disorders.

Family support and mental health issues among teenage mothers

Lack of family support was associated with higher odds of meeting the symptom threshold (OR 5.48, 95% CI: 1.90 – 17.10). This finding is consistent with research suggesting that social support is relevant to maternal mental health. In a systematic review and meta-analysis of 67 studies involving 64,449 pregnant women, Bedaso and colleagues found that low social support was

associated with antenatal depression and anxiety (13). Similarly, a systematic review examining risk factors for postpartum depression among adolescent mothers identified a lack of familial social support among the factors associated with increased risk (14).

Research in Brazil has also identified insufficient family caregiving support as a factor associated with depression among teenage mothers (11). Although these studies differ in setting, population, and outcome measurement, their findings are broadly consistent with the association observed in the present study.

Family support may be particularly relevant during teenage motherhood because young mothers may need assistance with childcare, household responsibilities, emotional difficulties, and decisions about education or employment. In Rwanda, where adolescent motherhood may be accompanied by stigma and social exclusion, the availability of supportive family relationships may also influence how young mothers manage these demands (4). These are plausible explanations rather than mechanisms demonstrated by our data.

The magnitude of the observed association warrants caution. The confidence interval is wide, reflecting substantial uncertainty about the strength of the association. In addition, the cross-sectional design does not establish whether the lack of family support preceded mental health issues. Psychological distress could affect family relationships or perceptions of available support, and other factors could influence both. Larger studies using validated measures of social support and mental health are needed to examine this relationship more reliably.

Fear of partner disclosure and knowledge of legal services

Fear of disclosing the identity of the child's father because of possible legal penalties was also associated with higher odds of mental health issues threshold. This finding highlights a potentially

important issue at the intersection of teenage motherhood, legal concerns, confidentiality, and psychological well-being.

Research in Rwanda has documented the stigma experienced by teenage mothers and the social and institutional challenges they may face during pregnancy and motherhood (4). These findings provide relevant context for understanding why concerns about disclosure might coexist with psychological distress. However, the current study cannot establish whether fear of legal consequences reflects actual legal exposure, perceived threats, concerns about confidentiality, relationship difficulties, or other circumstances. It would therefore be inappropriate to attribute the association to a specific legal process or assume that all participants experienced the same concerns.

Participants who lacked knowledge of where to obtain legal services also had higher odds of meeting the symptom threshold. One possible interpretation is that uncertainty about where to seek assistance may accompany broader experiences of vulnerability or limited access to reliable information. However, this interpretation remains tentative because the study did not establish whether participants needed legal assistance, had attempted to obtain it, or experienced barriers when seeking services.

These findings suggest that future research should examine the circumstances surrounding partner disclosure, perceived legal risks, confidentiality, and access to legal information. Where appropriate, adolescent-friendly services could consider how confidential counselling and clear information about available support are communicated to young mothers. Such recommendations should be understood as potential service considerations, not as interventions proven effective by this study. The findings do not establish that improved access to legal information would reduce psychological symptoms.

Interpreting the financial associations

Participants reporting lack of financial support and those reporting lack of financial independence had higher odds of meeting mental health issues threshold. Research on adolescent motherhood in Rwanda has documented economic disadvantage alongside psychosocial difficulties, including stigma, social isolation, and restricted opportunities (4). Niyonsenga and Mutabaruka also identified an association between economic income and postpartum depressive symptoms among adolescent mothers in Rwanda, although their study used a different outcome and a different set of explanatory variables (5). These studies provide a reason to investigate economic circumstances further, but they do not establish a consistent direction of association between financial resources and mental health.

Several explanations for our findings are possible. Participants experiencing psychological distress may have been more likely to receive financial assistance, meaning that support followed rather than preceded the symptoms. Financial independence may also have coincided with employment demands, childcare responsibilities, or limited practical assistance from family members. Alternatively, the observed associations may reflect differences in household circumstances, partner involvement, or other unmeasured factors. The wording and interpretation of the financial variables may also have affected the results.

The study cannot distinguish among these explanations because financial circumstances and psychological symptoms were assessed simultaneously. It would therefore be misleading to conclude that financial support or independence adversely affects mental health. Future studies should distinguish between income, financial transfers, perceived financial security, employment, control over money, and the practical support available for childcare. Longitudinal data would help establish whether changes in these circumstances precede changes in psychological symptoms.

Individual-level findings and the social ecological framework

The individual-level model did not show a statistically significant overall association (penalized likelihood ratio test, $p = 0.191$), and none of its included predictors reached the conventional 0.05 significance threshold. This finding should not be interpreted as evidence that individual characteristics are unimportant to psychological well-being among teenage mothers.

With only 21 participants meeting the outcome threshold, the analysis provided limited information for precise estimates of association. Wide confidence intervals may reflect this uncertainty, and potentially relevant associations may not have been detected. Also, the separate models were organized by ecological level rather than jointly adjusting for all candidate confounders.

The social-ecological framework was useful for organizing potential correlates across individual, interpersonal, and broader contextual domains. However, fitting separate models for these domains does not demonstrate that the observed associations are independent of one another. Family support, financial circumstances, concerns about disclosure, and access to legal information may overlap or be related to underlying social conditions. Future studies with larger samples could examine these relationships jointly, using a prespecified analytical framework that distinguishes potential confounders from variables that may lie on the same causal pathway.

Strengths and limitations

This study addresses a locally relevant public health issue in a population that may experience substantial social and practical challenges. Its use of a social ecological framework provides a structured way to consider potential correlates beyond individual characteristics alone. Conducting interviews in Kinyarwanda may also have supported communication with participants in their preferred language. In addition, Firth penalized logistic regression was used to reduce small-

sample estimation bias and address problems associated with separation. These are methodological strengths, although they do not eliminate the limitations associated with the small sample.

Several limitations warrant attention. First, the outcome was derived from nine symptom domains developed or adapted for this study, with participants classified as meeting the threshold if they reported at least two frequent symptoms. The threshold was not validated against a clinical diagnostic interview, and formal psychometric and criterion validation were not reported. Its selection, with reference to the observed symptom count distribution, may also have introduced data-dependent classification. Therefore, the reported 21.9% should not be interpreted as the prevalence of a diagnosed mental disorder. If the data permit, sensitivity analyses using alternative clinically or substantively defensible thresholds would help establish whether the main findings are sensitive to the outcome definition.

Second, the sample included 96 participants, of whom 21 met the outcome threshold. The sample size calculation used a 6% planning value that was not an estimate of the mental health outcome examined here. It therefore does not establish that the study had adequate precision to estimate the outcome proportion or to detect associations. Although Firth penalization can improve estimation under certain small sample conditions, it cannot compensate for limited information. The wide confidence intervals should be considered when interpreting the magnitude and reliability of the observed associations.

Third, candidate predictors were selected in part based on bivariate p-values, and models were fitted separately for different ecological levels. This approach may have resulted in unstable variable selection, residual confounding, and chance findings arising from multiple comparisons. The associations should therefore be treated as exploratory, particularly where their direction was unexpected. Future analyses should prioritize a prespecified conceptual model and justify

adjustment variables on substantive grounds rather than relying mainly on statistical significance in preliminary analyses.

Fourth, the cross-sectional design does not establish temporal order or support causal conclusions. Psychological symptoms may influence participants' relationships and financial circumstances, just as those circumstances may be related to psychological well-being. Fifth, both the outcome and explanatory variables were self-reported during the same interview. Recall errors, social desirability bias, and differences in how participants understood sensitive questions may have affected the responses.

Finaly, eligibility was restricted to mothers aged 18 to 19 years who had at least one living child, had lived in one of three sectors for at least one year, and had delivered at a health facility in those sectors. The results may not be generalized to younger adolescents, teenage mothers who delivered outside health facilities, mothers whose children had died, recent residents, or adolescent mothers in other parts of Rwanda. The sampling frame, recruitment procedures, number of eligible individuals approached, participation rate, and reasons for nonparticipation should be reported in sufficient detail to allow readers to assess possible selection and nonresponse bias.

Implications for research and public health practice

The findings identify lack of family support, concerns about partner disclosure and potential legal consequences, and knowledge of legal services as areas warranting further investigation among teenage mothers in Rwanda. They also suggest that financial circumstances should be examined in greater detail rather than treated as straightforward indicators of psychological protection or risk.

For practice, these findings may encourage health and social service providers to consider how teenage mothers are asked about family support, confidentiality concerns, and access to

information. However, this study did not evaluate a service intervention and cannot establish that addressing any particular factor would improve mental health outcomes. Any service response should be informed by additional evidence and designed to protect participants' privacy and safety. Future research should use culturally appropriate mental health instruments with evidence of validity in the intended population, recruit larger and more representative samples, and document participant selection and nonresponse. Longitudinal studies would help clarify the temporal relationships between psychological symptoms, family support, financial circumstances, and concerns about disclosure. Qualitative research could also help explain how adolescent mothers understand these experiences and what forms of support they consider acceptable and useful.

Conclusion

In this sample of teenage mothers in Rwamagana district of Rwanda, approximately one in five participants met the study-defined threshold for mental health issues. Lack of family support, fear of partner disclosure due to potential legal penalties, lack of knowledge about legal services, and unexpected positive associations with financial support and financial independence were observed in exploratory analyses. These findings should be interpreted with caution because of the small sample size, the unvalidated outcome threshold, potential residual confounding, and the cross-sectional design. They provide a basis for further investigation of the social and economic circumstances associated with psychological well-being among teenage mothers, but do not establish causal relationships or the effectiveness of specific interventions.

Declarations

Ethical approval and accordance: Ethical approval for this study was obtained from Mount Kigali University Ethical Review Committee (MKUR04/ERC/0580), in accordance with the

ethical standards of Mount Kigali University Ethical Review Committee and the principles of the 1964 declaration of Helsinki and its subsequent amendments. Administrative authorization to conduct the study was obtained from Rwamagana district officials, with approval reference number (No. 3743/07.05.01).

Consent to participate: Written informed consent was obtained from all participants before data collection. Only teenage mothers aged 18–19 years were included in the study; therefore, no participants under 18 years of age were enrolled.

Consent for publication: Not applicable. This manuscript does not contain any individual's identifiable information requiring consent for publication.

Availability of data and materials: All materials used for data analysis in this study are not publicly available due to the confidentiality of participants' information. They are only available from the corresponding author on any rational request.

Competing interests: The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Authors' contributions: EM: Conceptualization, Writing original draft. IJD and BFA: Supervision. MAG: Formal analysis, Validation, Writing review and editing. GK: Writing review and editing. All authors read and approved the final manuscript.

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Figures

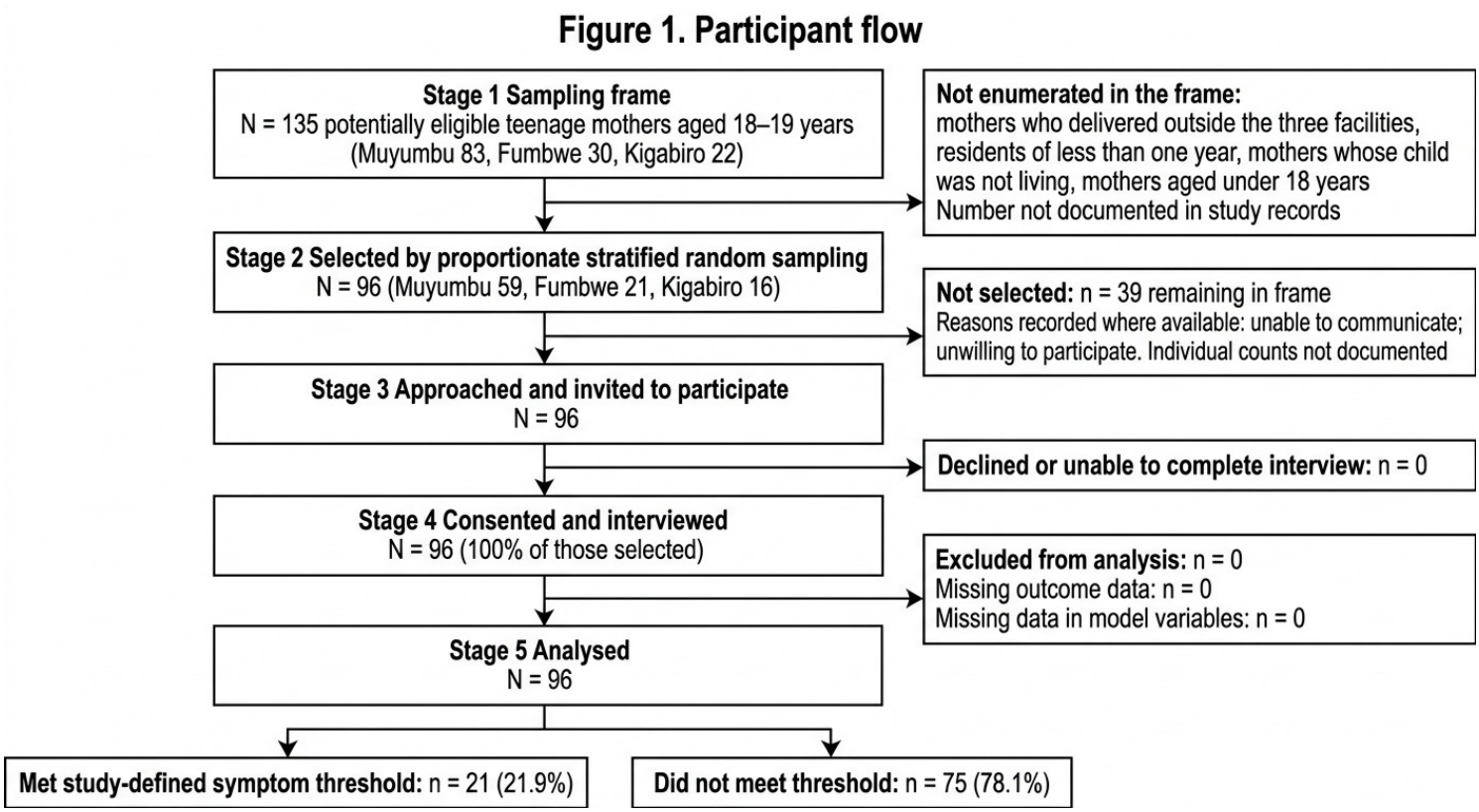


Figure 1

Legend not included with this version

Supplementary Files

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