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# Socioeconomic Status as a Longitudinal Predictor of Negative Automatic Thoughts and Depression

Clara Turturescu, Violeta Rotarescu - University of Bucharest

Cristian Opariuc-Dan - Ovidius University, Constanta

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University of Bucharest, Department of Psychology, 90 Panduri Av, Bucharest, RO.
Tel.: +40 (0) 31-425.34.45
*E-mail address:*
clara.turturescu@drd.unibuc.ro

ABSTRACT

The aim of the present study is to examine socio-economic status (SES) as a longitudinal predictor of negative automatic thoughts (NAT) and depression. We collected data across three waves and tested a mediation model in which SES predicted NAT, which in turn predicted depression. SES was operationalized through multiple indicators, including education, material deprivation, income per person (monthly), and perceived economic status. NAT was measured using the Automatic Thoughts Questionnaire (ATQ-15), and depression was assessed with the Beck Depression Inventory (BDI). A linear mixed model (LMM) was employed to account for repeated measures and individual variability over time. Results indicated that NAT was a strong predictor of depression across waves, while some SES indicators (income per person and perceived economic status) were associated with NAT and depressive symptoms. Limitations included high attrition rates across waves and model warnings indicating potential instability in parameter estimates. These findings underscore the mediating role of cognitive patterns in the SES–depression relationship and highlight the need for early cognitive interventions in socioeconomically disadvantaged populations.

**Keywords**: socioeconomic status, negative automatic thoughts, depression, longitudinal study, mediation, mixed model

## 1. INTRODUCTION

The relationship between socio-economic status and mental health is becoming an increasingly studied topic due to its implications in modern society. Studies show that the more deprived a person's social environment is, the more likely they are to suffer from health problems (Chai et al., 2024). Depression is a disorder linked to lower socioeconomic status (Hao & Farah, 2023). Cognitive models suggest that cognitions are organized hierarchically, so that underlying schemata influence behavior through more automatic, superficial cognitive processes (Calvete et al., 2013). Early maladaptive schemas and depressions symptoms are linked (Tariq et al., 2021). The heterogeneity aspect of depression includes the negative automatic thoughts (Chahar Mahali et al., 2020). Beck (1960) conducted numerous studies on clinical depression. According to Beck's theories dysfunctional attitudes, depressive schemas, maladaptive beliefs or assumptions, and negative automatic thoughts (Dozois & Beck, 2008) predispose individuals to process information negatively, distorted (Flynn & Rudolph, 2011).

Several studies have been conducted in the past to reveal the importance of low socioeconomic status in association with depression, but from our knowledge none of them addressed this issue from the perspective of how negative automatic thoughts mediates the relationship between them. The relationship between depressive symptoms and negative automatic thoughts about self it is a positively and strongly correlation (Chahar Mahali et al., 2020). Negative automatic thoughts (NAT) are defined as “spontaneous, involuntary, and often distorted thoughts that arise in the mind, impacting our emotions, behaviors, and overall well-being” (“Negative Automatic Thoughts,” n.d.).

Romania has made significant progress in terms of the economy (România - Prezentare generală, n.d.), but the poverty rate has not decreased considerably, as expected, so Romania remains one of the countries in the European Union where 1 in 5 Romanians will be affected by poverty in 2023 (Adam, 2023). Several studies have shown that income inequality is associated with a higher risk of depression (Patel et al., 2018) and that there are comorbidities (physical illness and mental disorders) among poor population (Patel & Kleinman, 2003). People with low income are “typically 1.5 to 3 times more likely than the rich to experience depression and anxiety” (Ridley et al., 2020). Socioeconomic status has significant mediating effect between childhood environment and adulthood health (Chai et al., 2024). The mental health is influenced by social, environment and economic factors in which people are born, grow, work and age (Knifton & Inglis, n.d.). The risk of mental health problems should therefore be addressed through social and health policies. Poverty affects education as well. Persons born in low SES households are about twice as likely as those from high – SES households to develop learning – related behaviors problems (Morgan, 2009).

Income, education, social class or wealth (Freeman et al., 2016) are indicators for socio-economic status (SES). Socioeconomic status is a significant predictor of quality of life (Nutakor et al., 2023). Living in poverty and in hostile environments could lead to poor academic success (Sheridan & McLaughlin, 2016).

In different cultures and countries, poverty and low socio-economic status have a specific language and meaning (Gweshengwe & and Hassan, 2020). Automatic thoughts are elements of language, so they are the ones that shape our perception of life, i.e. lead us to healthy or unhealthy behaviors. Through thinking, humans have a general idea of the world which surrounds them (Kosheleva, 2021). Automatic thoughts lead to cognitive distortions or bias. The term “cognitive bias ” was introduced in the early 1970s by Amos Tversky and Daniel Kahneman to define poor judgment and irrational thinking (Cognitive Bias - an Overview | ScienceDirect Topics, n.d.). Cognitive bias affects a person’s life due to the fact they become the cause of incorrect or inaccurate decision (Kosheleva, 2021). They could lead to see the world in a negative light, which could conduct to develop anxiety, depression and other mental health problems (Friedman Hershey H., 2025).

Chronic poverty produce chronic stress (Johnson, 2019) which affect human functioning in everyday life, it is a domino effect (Johnson, 2019). Studies suggest that combined psychoeducation, physical exercise and some cognitive behaviour therapy exercises could be an option for some disadvantaged groups for preventing depressions (van der Waerden et al., 2013).

Interventions who include culture’s characteristics are effective in reducing depressive symptoms in low socioeconomic status populations (Rojas-García et al., 2015).

To this end, the present study’s objectives was to examine the socioeconomic status is a longitudinal predictor for automatic negative automatic thoughts and depression.

We believed if we found a strong relationship between low socioeconomic status, negative automatic thoughts and depression, we can address these issues through psychoeducation intervention.

## 2. MATERIALS AND METHODS

We used CHERRIES checklist (Eysenbach, 2004) aimed to assess the quality of Web Surveys to enhance the methodology.

### Design

Data was collected between March 2023 and March 2024 using an online form (www.questionpro.com). The questionnaire was distributed via social media, and a printed version distributed in urban and rural areas where access was possible. Informed consent was obtained from all patients for being included in the study. A convenience sample was used. The analysis of the model was carried out using a longitudinal design with three waves of data collection. A total of 163 participants were initially recruited, with participation dropout across waves. The time points were equally spaced, allowing for within-subject variation across time.

We conducted a linear mixed-effects model (LMM) using SPSS Statistics for Windows, version 25 to examine the influence of socioeconomic status and negative automatic thoughts on depressive symptoms over time. The model included fixed effects for education level, material deprivation, individual income, perceived economic status, and automatic negative thoughts (ATQ scores). A random intercept for participant code was included to account for individual differences. Time (Wave) was modeled as a repeated measure with a diagonal covariance structure to handle unequal variances across waves. Maximum likelihood (ML) estimation was used to accommodate missing data and enable model comparison.

### Informed consent process

The informed consent form indicated that participation was voluntary, and the participants could withdraw from the study at any time. The time required to answer the questions was approximately 25 - 30 minutes. Data were initially stored securely on QuestionPro Forms and then exported into Excel format. After export, the files were deleted from the QuestionPro Forms. We stored the participants' responses at 2 instruments (Beck Depression Scale and Automatic Thoughts Questionnaire), as well as some social and demographic data (gender, age, education, income etc.). The first and second authors investigated the participants, and data will be archived and stored 5 years after publication. No other personal information was collected, and the data collection process was anonymous.

Development and pre-testing. All the materials used for data collection were first translated from English to Romanian and then back from Romanian to English by two separate teams of two professional translators. Agreements across items were discussed to preserve the content validity of the original instruments. A small group of 25 participants from Bucharest University, Romania, was used to pretest the questionnaires, and some items were modified. The final versions were tested again before data collection.

### Recruitment process

An online survey was distributed, and the potential participants were informed that their data would remain confidential and anonymous, and all their responses would be used solely for research. Advertising was conducted on social media sites (Facebook and Instagram) and online and physical groups.

### Survey administration

Questionnaires were designed using QuestionPro Forms, the link was distributed on social media sites, participation was not mandatory, and no incentives were given. Data collected in three different waves, approximately 3.5 months apart. Data collection was carried out over approximately 1 year (from March 2023 – March 2024). No adaptive or random item procedures were implemented. Participants were allowed to review their steps, and no completeness check method was used.

### Response rates

We did not check the response rate statistics.

### Preventing multiple entries

To prevent multiple entries, we asked for participants to write a code formed from their name initial and birth date (date and month). No multiple entries were observed.

### Analysis

We discarded questionnaires with incomplete data and no statistical corrections were applied.

### Participants

We collected data in three waves. In the first wave, 163 Romanian people completed the questionnaire, aged between 18-24 years (17.80%) and over 64 years (4.90%), 68.10% females, participated in the study. In terms of education, most had some form of higher or long education (58.90%), followed by those who graduated only from high school (33.10%) and those who had primary and secondary education (8.00%). Participants who had no income and less than or equal to the minimum wage (reported at 2022) – 25.80% and those who had individual income higher than average wage in Romania -

50.40%. 46 participants people completed second wave age between 18-24 years (32.60%) and over 64 years (4.3%), 69.9% females, participated in the study. In terms of education, most had some form of higher or long education (58.80%), followed by those who graduated only from high school (39.20%) and those who had primary and secondary education (2.20%). Participants who had no income and less than or equal to the minimum wage (reported at 2022) – 10.80% and those who had individual income higher than average wage in Romania - 52.40%. 26 participants people completed second wave age between 18-24 years (11.50%) and over 64 years (7.70), 69.20% females, participated in the study. In terms of education, most had some form of higher or long education (80.80%), followed by those who graduated only from high school (19.20%). Participants who had no income and less than or equal to the minimum wage (reported at 2022) – 15.30% and those who had individual income higher than average wage in Romania - 61.50%.

**Measures**

*Depression*. To assess depression, the Beck Depression Inventory (Beck, 1961) was used, an instrument with 21 items such as: "I feel like I have nothing to look forward for the future" or "I feel like I have failed more than others". Answers were given on a 4 - point scale, with high values indicating high levels of depression. The internal consistency of the scale was excellent (Cronbach's α=.90, 95% CI [.88, .92]).

*Negative automatic thoughts*. Many researchers have intended to assess automatic thoughts in the past, and in 1980, Hollon and Kendall developed the Automatic Thoughts Questionnaire (ATQ) (Gökdağ & Kaçar-Başaran, 2014). The scale contains a number of 15 items (items like "I'm no good" or "I feel so helpless") that received answers on an ordinal scale from 1 (not at all) and 5 (all the time), with high scores indicating a high level of negative thoughts, and the internal consistency of the scale being very good Cronbach's α=.97, 95% CI [.97, .99]) (Netemeyer & Williamson, 2024).

*Socio-economic status*. Socioeconomic status (SES) is a key indicator of an individual's or household's living conditions and overall quality of life. It significantly influences development, health, well-being, and cognitive functioning (Chakrabartty, 2024). In this study, SES was assessed using demographic and economic indicators informed by public policy documents and official statistics from the Romanian National Institute of Statistics (Institutul National de Statistica, 2016) & (Institutul National de Statistica, 2023), Eurostat (Kotzeva, 2022) and the World Bank (World Bank Group, 2015).

To capture SES, we included four measures: years of formal education (Educational Level: from early childhood education – to highly educated) (Hanandita & Tampubolon, 2014) a severe material and social deprivation (Income 1 – Material deprivation) (Kotzeva, 2022), monthly individual income (Income 3 – income per person), and subjective economic self-perception (Income 6 – Perceived economic status). The indicators were selected for their relevance and accuracy in reflecting socioeconomic conditions, especially within the Romanian context. For instance, severe material deprivation was operationalized based on the inability—due to economic constraints rather than choice—to afford at least four of nine essential items: the ability to face unexpected expenses; afford an annual one-week holiday away from home; consume meat or a protein equivalent every other day; maintain adequate home heating; and ownership of basic durable goods such as a colour television, washing machine, car, and telephone; as well as the ability to pay rent, mortgage, or utility bills (Kotzeva, 2022).

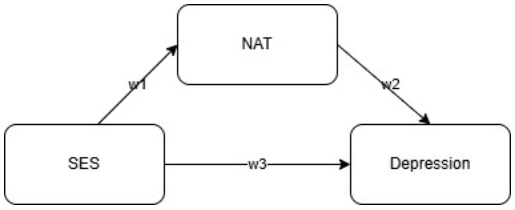
## 3. RESULTS

**Overview of the Statistical Analyses**

We used SPSS (Version 25) to conduct multiple regression analyses and multicollinearity diagnostics (see Table 3), as well as linear mixed models to test the longitudinal effects of socioeconomic status (SES), negative automatic thoughts (NAT), and depression (see Figure 1).

**Figure 1**

*Conceptual model*




**Preliminary descriptive analysis**

Standardized residuals ranged from -3.37 to 3.83 (M = .00, SD = .99), and studentized residuals ranged from -3.42 to 3.89 (M = -.001, SD = 1.00), indicating a small number of potential outliers. However, Cook's distance values (M = .005, Max = .070) and centered leverage values (M = .021, Max = .108) were well below thresholds indicating influential observations. The Mahalanobis distance ranged from .27 to 25.25 (M = 4.98, SD = 4.11), suggesting a few cases may be multivariate outliers, but no extreme influence was observed.

Descriptive statistics for the study variables are presented in Table 1. Participants reported an average score of M = 10.77 (SD = 9.53) on the Beck Depression Inventory (BDI), with scores ranging from 0 to 38. The distribution of BDI scores was moderately skewed (skewness = .95, kurtosis = .18), indicating a slight positive skew but generally acceptable normality for analysis. The mean score on the Automatic Thoughts Questionnaire (ATQ) was M = 29.68 (SD = 14.82), with a range from 15 to 75, also showing moderate positive skewness (skewness = .92).

Regarding socioeconomic status (SES) indicators, participants had an average education level (EDI) of 6.67 (SD = 2.29) on a 10-point scale (from early childhood education – to highly educated – PhD or equivalent), with a slightly negatively skewed distribution (skewness = –.46). The material deprivation variable (Income 1) had a low mean of .09 (SD = .28) and showed strong positive skewness (skewness = 2.99) and leptokurtosis (kurtosis = 7.02), indicating that most participants reported no deprivation. Income per person (Income 3) had a mean of 4.26 (SD = 2.46), and perceived economic status (Income 6) had a mean of 3.48 (SD = 1.61), both displaying moderate negative skewness and acceptable kurtosis values. Overall, the data show acceptable distributional properties for further inferential analyses, although material deprivation may warrant caution or transformation due to its non-normal distribution.

**Table 1**

*Descriptive statistics and univariate normality assessment*

| Variables | N | Mean | SD | Min | Max | Skew (SE) | Kurt (SE) |
|---|---|---|---|---|---|---|---|
| Depression | 235 | 10.77 | 9.53 | 0 | 38 | .95 | .18 |
| NAT | 235 | 29.68 | 14.82 | 15 | 75 | .92 | -.11 |

**Model analysis**

A multiple regression analysis was conducted to examine whether socioeconomic status (SES) indicators and negative automatic thoughts predict levels of depression. The regression model was significant, $F(5, 229) = 75.59$, $p < .001$, accounting for variance in depression scores ($R^2 = .623$). Among the predictors, NAT emerged as a strong positive predictor of depression, while two SES variables—income per person and perceived economic status —also contributed significantly. Education level and material deprivation were not significant predictors.

**Table 2**

*ANOVA Summary for the Multiple Regression Model Predicting Depression*

| Source | SS | df | MS | F | p |
|---|---|---|---|---|---|
| Regression | 13,229.57 | 5 | 2,645.92 | 75.59 | <.001 |
| Residual | 8,015.47 | 229 | 35.00 | | |
| Total | 21,245.05 | 234 | | | |

*Note.* Predictors: Education, Material Deprivation, Income per person, Perceived Economic Status, and Negative automatic thoughts. Dependent variable: Depression.

Collinearity diagnostics indicated no multicollinearity among the predictors. All variance inflation factor (VIF) values were below 2, and tolerance values were above .60, suggesting acceptable independence of predictors in the regression model (see Tabel 3).

**Table 3**
*Collinearity diagnostic*

| | VIF | Tolerance |
|---|---|---|
| (1) Education level (EDl) | 1.49 | .67 |
| (2) Income 1 (Material deprivation) | 1.08 | .92 |
| (3) Income 3 (Person) | 1.50 | .65 |
| (4) Income 6 (Perceived economic status) | 1.10 | .89 |
| (5) NAT (Negative automatic thoughts) | 1.16 | .85 |

*Note.* Tolerance values above .10 and VIF values below 5 indicate that multicollinearity is not a concern (Multivariate Data Analysis, n.d.)

Our model included fixed effects for socioeconomic status (EDI, Income 1, Income 3, Income 6) and NAT, and random effects for subjects (Participant_code) and repeated measures (Wave). The model assumes an identity covariance structure for the random intercept and a diagonal covariance structure for the repeated measures. A total of 163 subjects were included in the analysis.

The analysis of fixed effects revealed that education level (EDl) ($F(8, 184.439) = 2.32$, $p = .021$), income per person ($F(7, 199.270) = 2.75$, $p = .009$), perceived economic status ($F(5, 185.117) = 2.76$, $p = .020$), and negative automatic thoughts ($F(1, 177.716) = 312.92$, $p < .001$) were significant predictors of depression. However, material deprivation was not a significant predictor ($F(1, 228.988) = .029$, $p = .866$), and the intercept was not significant ($F(1, 198.995) = 1.37$, $p = .243$) (see Tabel 4).

**Table 4**
*Type III Tests of Fixed Effects for Predicting Depression*

| Source | Numerator df | Denominator df | F | Sig. |
|---|---|---|---|---|
| Intercept | 1 | 198.995 | 1.369 | .243 |
| Education Level (ED1) | 8 | 184.439 | 2.320 | .021 |
| Material Deprivation (Income 1) | 1 | 228.988 | .029 | .866 |
| Income per Person (Income 3) | 7 | 199.270 | 2.754 | .009 |
| Perceived Economic Status (Income 6) | 5 | 185.117 | 2.759 | .020 |
| Negative Automatic Thoughts (NAT) | 1 | 177.716 | 312.915 | .000 |

*Note.* Type III tests were used to assess the fixed effects. Significant results ($p < .05$) are highlighted.

The estimates of fixed effects indicate that negative automatic thoughts (NAT) ($b = .447$, $SE = .025$, $t = 17.689$, $p < .001$) is a strong predictor for depression, with a positive relationship. The education level (EDl) and material deprivation (Income 1) were not significant predictors for all levels of education ($b = -7.857$ to $-3.438$, p values ranging from .055 to .798) and material deprivation ($b = .231$, $p = .866$). Income per person (Income 3) at levels 1 ($b = 6.783$, $p < .001$) was significant, indicating that a lower income per person was associated with higher depression scores. Similarly, perceived economic status (Income 6) levels 2 and 3 ($b = 5.555$ and $b = -1.087$, respectively) did not yield significant results, as indicated by p values exceeding .05 (see Table 5).

**Table 5**

*Estimates of Fixed Effects for Predicting Depression*

| Parameter | Estimate | Std. Error | df | t | Sig. | 95%CI |
|---|---|---|---|---|---|---|
| Intercept | 1.959 | 7.637 | 164.898 | .257 | .798 | [-13.120, 17.038] |
| Education Level (EDl=2) | -7.857 | 5.033 | 166.521 | -1.561 | .120 | [-17.795, 2.080] |
| Education Level (EDl=3) | -8.136 | 4.735 | 177.347 | -1.718 | .087 | [-17.480, 1.208] |
| Education Level (EDl=4) | -5.419 | 4.253 | 165.838 | -1.274 | .204 | [-13.816, 2.979] |
| Education Level (EDl=5) | -4.348 | 4.781 | 173.279 | -.909 | .364 | [-13.785, 5.090] |
| Education Level (EDl=6) | -7.475 | 5.443 | 163.326 | -1.373 | .172 | [-18.223, 3.273] |
| Education Level (EDl=7) | -8.947 | 4.630 | 169.794 | -1.933 | .055 | [-18.087, 0.192] |
| Education Level (EDl=8) | -3.438 | 4.200 | 161.913 | -.819 | .414 | [-11.733, 4.856] |
| Education Level (EDl=9) | -6.218 | 4.195 | 162.401 | -1.482 | .140 | [-14.501, 2.066] |
| Education Level (EDl=10) | 0 [b] | 0 | . | . | . | . |
| Material Deprivation (Income 1=0) | .231 | 1.367 | 228.988 | .169 | .866 | [-2.463, 2.926] |
| Material Deprivation (Income 1=1) | 0 [b] | 0 | . | . | . | . |
| Income per Person (Income 3=0) | 1.625 | 1.388 | 157.404 | 1.171 | .244 | [-1.117, 4.366] |
| Income per Person (Income 3=1) | 6.783 | 1.628 | 232.370 | 4.167 | .000 | [3.576, 9.991] |
| Income per Person (Income 3=2) | .429 | 2.171 | 223.787 | .197 | .844 | [-3.850, 4.707] |
| Income per Person (Income 3=3) | 2.074 | 1.275 | 181.461 | 1.626 | .106 | [-0.443, 4.590] |
| Income per Person (Income 3=4) | 1.556 | 1.245 | 163.233 | 1.250 | .213 | [-0.903, 4.015] |
| Income per Person (Income 3=5) | .920 | 1.104 | 143.530 | .834 | .406 | [-1.262, 3.102] |
| Income per Person (Income 3=6) | .542 | 1.467 | 200.496 | .369 | .712 | [-2.350, 3.434] |
| Income per Person (Income 3=7) | 0 [b] | 0 | . | . | . | . |
| Perceived Economic Status (Income 6=1) | -.274 | 6.347 | 166.846 | -.043 | .966 | [-12.806, 12.257] |
| Perceived Economic Status (Income 6=2) | 5.555 | 6.552 | 166.544 | .848 | .398 | [-7.382, 18.491] |
| Perceived Economic Status (Income 6=3) | -1.088 | 6.495 | 174.965 | -.167 | .867 | [-13.906, 11.731] |
| Perceived Economic Status (Income 6=4) | -1.551 | 6.294 | 164.276 | -.246 | .806 | [-13.979, 10.878] |
| Perceived Economic Status (Income 6=5) | -2.154 | 6.283 | 164.458 | -.343 | .732 | [-14.560, 10.252] |
| Perceived Economic Status (Income 6=7) | 0 [b] | 0 | . | . | . | . |
| Negative Automatic Thoughts (NAT) | .447 | .025 | 177.716 | 17.689 | .000 | [0.397, 0.497] |

All three variance estimates for the repeated measures (Wave 1, Wave 2, and Wave 3) are statistically significant ($p < .001$), suggesting that there is significant variation in depression scores across the different time points (see Tabel 6).

The intercept variance is reported as zero, indicating that there is no variability in the intercept across participants for the model's random effect. This suggests that all subjects share the same initial level of depression (i.e., no individual differences in the baseline depression score).

**Table 6**
Estimates of Covariance Parameters

| Parameter | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|---|---|---|---|---|---|
| **Repeated Measures** | | | | | |
| Var: [Wave=1] | 33.53 | 3.85 | 8.71 | .000 | 26.77, 42.00 |
| Var: [Wave=2] | 22.98 | 5.20 | 4.42 | .000 | 14.74, 35.81 |
| Var: [Wave=3] | 13.64 | 4.26 | 3.20 | .001 | 7.40, 25.17 |
| **Intercept** | 0.00 | 0.00 | - | - | - |

## 4. DISCUSSIONS

This study aimed to explore the relationships between socioeconomic status (SES), negative automatic thoughts, and depression over time. The results suggest that both SES and NAT are significant predictors of depression, with notable differences in how each dimension of SES (education, material deprivation, income, perceived economic status) interacts with NAT to influence depression scores. Our findings indicate that NAT has a strong positive relationship with depression, as expected (Chai et al., 2024). The significant positive coefficient for NAT ($\beta = .456$, $p < .001$) shows that as automatic negative thoughts increase, depression scores also rise. This supports previous research that suggests automatic thoughts play a key role in the development and maintenance of depression (Dozois & Beck, 2008). The educational levels and material deprivation variables were not significant predictors across different categories. Conversely, income measures (e.g., Income 3, Income 6) were more influential, with perceived economic status (Income 6) showing a significant inverse relationship with depression ($\beta = -.757$, $p = .003$), which suggests that better perceived economic circumstances can reduce depression levels.

These results highlight the importance of addressing negative automatic thoughts (Chahar Mahali et al., 2020) in therapeutic settings, such as cognitive-behavioral therapy (CBT), as a means of mitigating depression. The influence of perceived economic status underscores the need for mental health practitioners to consider clients' subjective financial perceptions in treatment planning.

Given that perceived economic status appears to be a stronger predictor of depression than objective measures like income, future research might focus on understanding the psychological mechanisms through which economic perception affects mental health.

### Limitations and Future Directions

Despite the valuable insights gained from this study, several limitations must be acknowledged. First, the longitudinal data suffered from high attrition, with a notable drop in the number of participants from Wave 1 (N = 163) to Wave 2 (N = 46) and Wave 3 (N = 26). This substantial reduction in sample size over time may have limited the power of the analysis and affected the stability of parameter estimates.

Second, SPSS issued two warnings during the mixed model analysis that further highlight potential limitations in model reliability. The first warning noted that "the covariance structure for the random effect with only one level was changed to Identity," suggesting that the model treated the random intercept as fixed due to insufficient variability at that level. This adjustment likely reflects limited between-subject variability in the intercept, which can occur when participant data are sparse across waves.

The second warning indicated that "the final Hessian matrix is not positive definite although all convergence criteria are satisfied." This warning often points to instability or overfitting in the parameter estimates, which may again be related to the small number of participants in later waves. Although the model did converge, this issue suggests that results—particularly those involving random effects or interactions—should be interpreted with caution.

Despite these warnings, diagnostic checks for multicollinearity among the predictors revealed no concerning results. Variance inflation factors (VIFs) were all below 2, and tolerance values were above 0.6, indicating acceptable levels of collinearity among the fixed effect predictors (see Table 3).
Together, these methodological challenges emphasize the need for future research to use larger and more consistently retained samples in longitudinal designs to strengthen the generalizability and stability of findings.

### Practical Implications

The results have implications for developing countries' society in terms of mental health policies. We believe that by increasing access to psychoeducation and CBT approach, individuals would develop more functional thinking mechanisms that would help them to break the cycle of poverty or increase their socioeconomic status, thus the risk of developing a mental health problem would decrease. We believe that our research could contribute to the development of public policies aimed at combating poverty.

### Conclusions

In conclusion, this study supports the importance of addressing automatic negative thoughts in the treatment of depression and highlights the potential role of perceived economic status as a key determinant of mental health. While education and material deprivation had mixed effects, our findings contribute to the growing body of research exploring the intersection between SES and mental health. Future research should continue to investigate these relationships, particularly the role of subjective financial perceptions in the development of depressive symptoms.

**Declarations**

**Ethics approval**. The research was conducted following the Helsinki Declaration guidelines and the ethical requirements of the Ethical Committee of the University of Bucharest to which the authors are affiliated (document No. 101/19.12.2021).

**Consent to participate**

Informed consent was obtained from all individual participants included in the study.

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