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RESEARCH

# Development and validation of the eco-reproductive concern scale

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## Abstract

**Purpose** Climate change has emerged as a growing psychosocial stressor that shapes individuals' perceptions of the future, including decisions related to childbearing. However, the lack of standardized measurement tools limits the systematic assessment of eco-reproductive concerns within public health and nursing research. This study aims to develop a measurement tool that assesses individuals' reproductive concerns and intentions in the context of climate change and environmental crises.

**Method** This cross-sectional methodological study was conducted with 617 adults aged 18–45 years between September and December 2025. Data were collected using the Personal Information Form and the Eco-Reproductive Concern Scale (ERCS). Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed on independent samples. Reliability was assessed using Cronbach's alpha, McDonald's omega, and split-half methods. Convergent, discriminant, and construct validity, as well as measurement invariance across gender, were evaluated. Data analyses were conducted using SPSS Statistics 29 and AMOS.

**Results** Participants' mean age was 26.37 ± 8.28 years in the EFA phase (74.3% women, 25.7% men) and 26.97 ± 8.65 years in the CFA phase (72.1% women, 27.9% men). EFA yielded a 28-item, four-factor structure, accounting for 70.12% of the total variance. CFA confirmed the factor structure, demonstrating acceptable model fit ($\chi^2/df = 2.35$, CFI = 0.909, TLI = 0.900, RMSEA = 0.074, SRMR = 0.064). Convergent and discriminant validity were supported by AVE, CR, and Fornell–Larcker criteria. The scale's internal consistency was excellent (Cronbach's $\alpha = 0.946$). Measurement invariance across women and men was established at configural, metric, and scalar levels.

**Conclusions** The study found that the ERCS is a valid and reliable instrument for assessing reproductive concerns associated with climate change. The ERCS can be used across a broad range of health research and clinical settings, including public health, nursing, medicine, psychology, and other behavioral and allied health disciplines, to better understand how environmental crises influence reproductive attitudes and intentions.

**Keywords** Climate change · Eco-reproductive · Climate change concern · Eco-anxiety · Reproductive intentions · Scale development

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## Introduction

Climate is a fundamental determinant of human health, and the risks associated with climate change adversely affect multiple physical health outcomes (Maibach et al., 2021). Climate change-related factors such as poor air quality, rising global temperatures, the spread of waterborne diseases, malnutrition, and the increasing frequency of extreme weather events are projected to cause substantial premature mortality and morbidity (CDC, 2024; Lee et al., 2023). Beyond these physical effects, climate change is also associated with significant mental health consequences, including heightened stress, anxiety, depression, sleep disturbances, and more severe outcomes such as post-traumatic stress disorder and suicidal ideation (Brophy et al. 2023; Ojala et al. 2021; Usher et al. 2019). Consequently, concern about the environmental impacts of climate change and the future of current and subsequent generations constitutes an important source of psychological stress (Pihkala, 2020).

Climate change has a particularly strong impact on young people, many of whom report functional difficulties and pessimistic expectations about the future (Hickman et al. 2021). These concerns reflect fears of an uncertain and threatening future, diminished life opportunities, environmental loss, and hesitation about parenthood, rooted in the perception that humanity has failed to adequately address climate-related risks (Hickman et al. 2021; Peters et al. 2025; Traylor & Chae, 2025). Accordingly, recent demographic research has increasingly examined whether climate-related anxiety plays a meaningful role in shaping reproductive intentions and behaviors (Innocenti et al. 2024; Peters et al. 2025; Traylor & Chae, 2025).

The discourse connecting climate change concerns with fertility intentions generally centers on two main arguments. The first emphasizes the ecological burden of additional human life: individuals may believe that each new child contributes to worsening environmental quality and ecological conditions (Bastianelli 2025; Jylhä et al. 2025). The second argument focuses on moral and emotional concerns, as some people fear that children born today will suffer in a world where environmental degradation is already severe and expected to intensify. Consequently, individuals may choose to forgo parenthood for the sake of their hypothetical future children. Such concerns appear particularly salient among younger generations, as many adolescents and young adults express profound anxiety about environmental conditions and their expectations regarding parenthood amid climate change (Bastianelli 2025; Hickman et al., 2021; Schneider-Mayerson & Leong, 2020).

Recent research has underscored potential associations between climate change concerns and variations in fertility preferences and reproductive motivations (Jylhä et al., 2025; Meynell et al. 2024). Survey data from a climate activist network indicated that nearly 60% of respondents expressed being “very” or “extremely” worried about the potential carbon footprint associated with having future children (Schneider-Mayerson & Leong, 2020). A number of studies have identified a negative association between climate change concern or eco-anxiety and fertility intentions (Bastianelli 2025; Powdthavee et al. 2024). Smith et al. (2023), in interviews with young people, found that climate change played an important dampening role in their fertility intentions. Ivanova and Balbo (2024) showed that individuals who perceive the future of the next generation as deteriorating are less likely to become parents, suggesting that perceptions of the future may be as influential as perceptions of present circumstances in shaping fertility behavior.

However, it remains uncertain whether these mechanisms genuinely influence fertility desires and intentions at the population level (Bastianelli et al. 2025). Two recent exceptions are the studies by Powdthavee et al. (2024) and Golovina and Jokela (2024). The former reported that individuals in the United Kingdom who were less concerned about environmental issues were more likely to become parents within the following six years. Similarly, drawing on data from the German Socio-Economic Panel, Golovina and Jokela (2024) found a negative association between feelings of uncertainty and the likelihood of having children. However, this study does not examine environmental concerns in isolation; instead, it combines them with other forms of social anxiety using exploratory factor analysis. (Golovina & Jokela, 2024). Furthermore, existing research often relies on small samples from specific groups, such as students or individuals with exceptionally high levels of environmental concern (Arnocky et al., 2012; Jylhä et al., 2025). Overall, these limitations highlight the need for more comprehensive investigations into the associations between climate change anxiety and reproductive intentions.

Recent research has begun to explore how climate change–related anxiety influences reproductive attitudes and decisions. For example, Innocenti et al. (2024) developed the Climate Change-related Reproductive Concerns Scale, a unidimensional measure focusing primarily on anti- and pro-reproductive attitudes associated with climate change anxiety and eco-paralysis. While this work represents an important step in understanding climate-related reproductive attitudes, it conceptualizes reproductive concerns largely as a single attitudinal construct and primarily within a psychological distress framework. Consequently, a more comprehensive understanding of eco-reproductive concerns may require consideration of a broader range of psychosocial and value-based factors. In this context, reproductive intentions may be shaped not only by climate-related

anxiety but also by individuals' values, beliefs, sense of responsibility toward future generations, and anticipated behavioral responses to environmental uncertainty. Given these considerations, the present study aims to develop and validate the Eco-Reproductive Concern Scale, designed to assess individuals' eco-reproductive concerns and intentions regarding childbearing in the context of climate change and environmental crises.

## Materials and methods

### Setting and participants

This cross-sectional and methodological study consisted of adults between 18 and 45. Data were collected between September and December 2025 via an online questionnaire administered via Google Forms. A voluntary convenience sampling method was used, and exclusion criteria: (1) those who had ongoing pregnancies, (2) those who had diagnosed infertility, and (3) other cognitive or psychological disorders serious enough to prevent them from completing the survey.

Guidelines for scale development recommend that exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) be conducted on independent samples, with a minimum sample size of at least 300 participants for factor analytic procedures (Gökdemir & Yılmaz, 2023). Accordingly, data for the present study were collected in two separate phases. In the first phase, data obtained from 370 participants were used to perform EFA and reliability analyses. In the second phase, data collected from an independent sample of 247 participants were utilized to conduct CFA and measurement invariance testing.

### Measurements

Data were collected through the Personal Information Form and Eco-Reproductive Concern Scale. The Personal Information Form was constructed by the research team following a review of prior studies on climate change perceptions and reproductive decision-making. It included 12 items assessing participants' sociodemographic background, reproductive status and intentions, and prior exposure to climate change-related education and events.

## Tool development process and procedure

### Development of items

A deductive approach was employed to generate the initial item pool for the Eco-Reproductive Concern Scale. First, a comprehensive review of the relevant literature was conducted to identify theoretical frameworks and empirical studies addressing the relationship between ecological concerns and reproductive attitudes and intentions. Based on this review, key conceptual domains associated with eco-reproductive concern were identified.

The item generation process was guided by four core dimensions derived from the literature: (1) Ecological Concerns, reflecting worries about environmental degradation and climate change; (2) Attitudes and Beliefs, capturing individuals' cognitive and emotional evaluations regarding reproduction in the context of environmental issues; (3) Behavioral Intentions, referring to intentions and considerations related to reproductive decision-making influenced by ecological factors; and (4) Values and Sense of Responsibility, encompassing moral values, ethical considerations, and perceived responsibility toward future generations and the environment. Items were formulated to reflect each dimension by adapting concepts, expressions, and themes frequently reported in prior studies, while ensuring clarity, cultural appropriateness, and relevance to the target population. This process resulted in an initial item pool designed to comprehensively represent the theoretical construct of eco-reproductive concern.

### Analysis of the item content validity

The draft items were evaluated by a panel of 10 academic experts from relevant disciplines, including obstetrics and gynecology ($n=2$), women's health and diseases nursing ($n=2$), psychiatric and mental health nursing ($n=2$), psychiatry ($n=2$), and Turkish language and linguistics ($n=2$). The content validity index (CVI) was calculated using the Davis technique. The experts rated each item for relevance and comprehensibility with a content validity index (1 point = not suitable, 4 points = very appropriate). A CVI > 0.80 refers to adequate content validity (Davis, 1992). Content validity analysis was conducted for the initial pool of 40 items. Three items had CVI values below the acceptable threshold of 0.80, whereas the remaining items exceeded it. Accordingly, these three items were excluded, and 37 items were retained and deemed suitable for pilot testing.

### Pilot study with the draft version scale

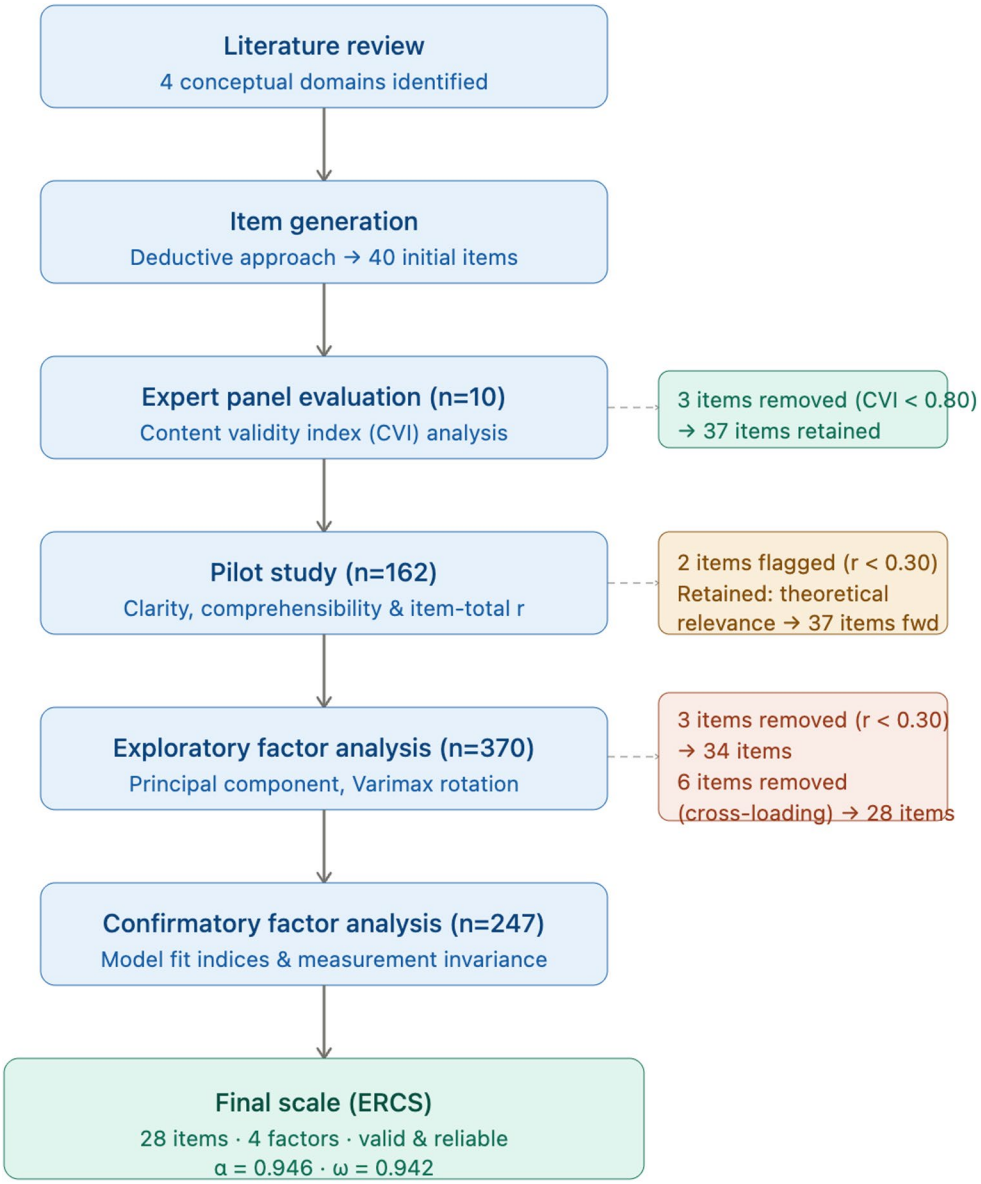
Following the initial pilot assessment, the 37-item final draft was administered to a larger pilot sample of 162 participants. recruited using the same inclusion and exclusion criteria applied in the main study. The mean age of the pilot sample was 30.20 ± 9.24 years, with women comprising 75.3% of the sample. The majority (65.4%) had no children,

and 49.4% reported having been affected by climate change-related disasters. Participants were asked to carefully read each item and evaluate the clarity and comprehensibility of the statements. In addition, the time required to complete the scale was recorded to estimate the average completion duration. Participants involved in this preliminary pilot testing were not included in subsequent stages of the study. Item–total correlation analyses indicated that three items (Item 1 = −0.57, Item 11 = −0.379, Item 30 = −0.95) had item-total correlation coefficients below the commonly accepted threshold of 0.30. Nevertheless, the internal consistency of the overall scale was high, with a Cronbach's alpha of 0.945. Despite their relatively low item–total correlations, these items were retained at this stage because they were considered theoretically relevant to the construct being measured and contributed to content validity. Furthermore, given the pilot study's small sample size, it was decided to retain these items for evaluation in the main study. The overall scale development process is summarized in Fig. 1.

## Data analysis

Data analyses were conducted using the Statistical Package for the Social Sciences (SPSS) and AMOS software. Descriptive statistics were used to summarize participants' characteristics, with frequencies and percentages reported for categorical variables. Normality assumptions were assessed using skewness and kurtosis; values between −1

**Fig.1** The confirmatory factor analysis diagram of the scale and fit index. CMIN/DF=2.348, $x^2p$=0.001, CFI=0.909, RMSEA=0.074, RMR=0.074, SRMR=0.0640, TLI=0.900, IFI=0.910, PGFI=0.677, PNFI=0.772




2. Flowchart of the scale development process

and + 1 indicate a normal distribution. EFA was performed to examine the scale's underlying factor structure. Prior to EFA, the suitability of the data for factor analysis was evaluated using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (≥0.60) and Bartlett's test of sphericity ($p$ <.05). Within the EFA framework, factor loadings, communalities, and factor structure were examined to determine whether the scale demonstrated a factor distribution consistent with the theoretical construct. To confirm the factor structure obtained from EFA, CFA was conducted in the second phase of the analysis. CFA examined item loadings on their respective latent factors, inter-factor correlations, and overall model fit indices. Convergent validity was assessed by evaluating factor loadings, average variance extracted (AVE), and composite reliability (CR) values. Discriminant validity was examined based on the Fornell–Larcker criterion by comparing the square roots of AVE values for each construct with the inter-construct correlation coefficients (Bae, 2017; DeVellis & Thorpe, 2021; Howard, 2016; Kline, 2014; Pallant, 2020).

Reliability analyses included Cronbach's alpha coefficient, McDonald's omega coefficient, and the split-half reliability method. For the split-half analysis, alpha coefficients for each half of the scale, the correlation between halves, and Spearman-Brown and Guttman split-half coefficients were calculated to assess internal consistency. In addition, item analysis was performed by examining item-total correlations and Cronbach's alpha values after deleting items. Relationships among subscales and between subscales and the total scale score were evaluated using Pearson correlation analyses, and these correlations were interpreted as supportive of construct validity. Measurement invariance analysis was conducted to examine whether the scale measured the same construct across women and men. All statistical analyses were performed using a significance level of 0.05 (Bae, 2017; DeVellis & Thorpe, 2021; Howard, 2016; Kline, 2014; Pallant, 2020).

### Ethical consideration

This study was conducted in accordance with ethical principles. Before starting the research, approval was obtained from the XÇukurova University Faculty of Medicine Research Ethics Committee (dated 12.09.2025, numbered 2025/158), and the study was conducted in accordance with the principles of the Declaration of Helsinki. Research data collection began after obtaining ethics committee approval. The manuscript was prepared based on the research conducted in accordance with the checklist for reporting the results of Internet e-surveys (CHERRIES) (Eysenbach, 2004). This web-based survey is accessible only to individuals who received the survey link. The survey was disseminated online via the research team's social media accounts and professional networks. Initial contact with potential participants was made exclusively via online platforms. Before data collection, an Informed Consent Form front page containing information about the study was created for participants' consent. Individuals were provided with detailed information regarding the study's aims, procedures, potential risks and benefits, and their rights as participants, including the right to withdraw at any stage without any consequences. Electronic informed consent was obtained from all participants before they were granted access to the survey. Participants were informed that their participation was entirely voluntary, that their responses would be anonymized, and that no identifying information would be retained. They were also notified that the study findings would be published in an open-access format and that consent was obtained for the use and publication of their anonymized data. The survey included mandatory items, and respondents were not permitted to proceed without completing them. Automated warnings were generated when responses were missing. No alternative response options such as "not applicable" or "prefer not to answer" were provided. Only fully completed questionnaires were included in the analysis. Access to the survey required logging in with a Google account. Duplicate entries were not restricted or identified through IP address tracking, cookies, or log file analysis. Data were stored on password-protected devices accessible only to the research team. View and participation rates could not be calculated due to the survey link's open dissemination and the absence of tracking mechanisms. Although Google Forms is not specifically designed for health data and is not HIPAA compliant, the risk to data security is minimal because no clinical patient data or personal health information was collected in this study. Additionally, no technical data was recorded that could reveal participants' IP addresses or identities. This was considered an additional measure to protect data confidentiality and participant privacy.

## Results

### Characteristics of the participants

Data for the study were collected in two separate phases. The mean age of participants included in the EFA phase was 26.37 ± 8.28 years, and 74.3% of this sample were women. The findings indicated that 77.6% of participants had not received prior education on climate change, 55.9% had not been directly affected by climate change-related disasters, and 77.8% did not have children. Additionally, 48.1% of participants reported planning to have children in the future,

while 40.3% stated that the effects of climate change did not influence their future childbearing decisions (Table 1).

In the CFA phase, the mean age of participants was 26.97 ± 8.65 years, with women comprising 72.1% of the sample. The results showed that 81.0% of participants had not received any education related to climate change, 61.5% had not been affected by climate change–related disasters, and 78.5% did not have children. In addition, 53.0% of participants reported planning to have children in the future, while 40.5% stated that the effects of climate change did not influence their future childbearing decisions (Table 1).

**Table 1** Characteristics of the participants ($n = 617$)

| | | EFA ($n = 370$) | | CFA ($n = 247$) | |
|---|---|---|---|---|---|
| Age | | 26.37 ± 8.28 | | 26.97 ± 8.65 | |
| Characteristics | **Variables** | **n** | **%** | **n** | **%** |
| Gender | Female | 275 | 74.3 | 178 | 72.1 |
| | Male | 95 | 25.7 | 69 | 27.9 |
| Marital Status | Married | 89 | 24.1 | 62 | 25.1 |
| | Single | 274 | 74.1 | 178 | 72.1 |
| | Divorced | 7 | 1.9 | 7 | 2.8 |
| Income Status | 0–10.000 TL | 55 | 14.9 | 40 | 16.2 |
| | 10.000–20.000 TL | 38 | 10.3 | 18 | 7.3 |
| | 20.000–30.000 TL | 43 | 11.6 | 28 | 11.3 |
| | 30.000 TL or more | 160 | 43.2 | 113 | 45.7 |
| | Prefer not to say | 74 | 20.0 | 48 | 19.4 |
| Having Children | 1 Child | 23 | 6.2 | 18 | 7.3 |
| | 2 Children | 41 | 11.1 | 25 | 10.1 |
| | 3 or more Children | 18 | 4.9 | 10 | 4.0 |
| | None | 288 | 77.8 | 194 | 78.5 |
| Plan to have a child in the future | Yes | 178 | 48.1 | 131 | 53.0 |
| | No | 100 | 27.0 | 63 | 25.5 |
| | Undecided | 92 | 24.9 | 53 | 21.5 |
| Receiving any training/education on climate change | Yes | 83 | 22.4 | 47 | 19.0 |
| | No | 287 | 77.6 | 200 | 81.0 |
| Being affected by disasters related to climate change | Yes | 163 | 44.1 | 95 | 38.5 |
| | No | 207 | 55.9 | 152 | 61.5 |
| Situation of climate change affecting the decision to have a child in the future | Yes | 137 | 37.0 | 85 | 34.4 |
| | No | 149 | 40.3 | 100 | 40.5 |
| | Undecided | 84 | 22.7 | 62 | 25.1 |

*n* frequency, % percentage

## Findings about validity and reliability analyses

### EFA

#### Preliminary analyses for factor extraction

EFA: item-level descriptive statistics were examined for the initial pool of 37 items, including item means, standard deviations, item-total correlations, and Cronbach's alpha values after item deletion. The distribution of the 37 items was approximately normal (skewness = −0.229, kurtosis = 0.548). Three items (i1, i11, and i30) demonstrated item–total correlation coefficients below the recommended threshold of 0.30 (Appendix Table 1) and were therefore removed from the item pool.

Subsequently, analyses were repeated for the remaining 34 items. These items also exhibited a normal distribution (skewness = −0.285, kurtosis = 0.744), with item–total correlation coefficients ranging from 0.433 to 0.773 (Appendix Table 2). The overall Cronbach's alpha for the 34-item set was 0.952, indicating excellent internal consistency. Sampling adequacy was confirmed by a Kaiser–Meyer–Olkin (KMO) value of 0.940 and a significant Bartlett's Test of Sphericity ($\chi^2 = 9785.152$, $p < .001$), supporting the suitability of the data for factor analysis. EFA was therefore conducted using the 34-item dataset.

#### Results of exploratory factor analysis and naming of subdimensions

Exploratory factor analysis was performed using principal component analysis with Varimax rotation. Item retention criteria included factor loadings ≥ 0.30 and the absence of cross-loadings exceeding 0.20 across factors. Based on these criteria, six items (i12, i16, i29, i17, i21, and i15) were sequentially removed due to cross-loading. The proportion of explained variance increased following each item removal.

The final EFA was conducted using 28 items, which demonstrated a normal distribution (skewness = −0.196, kurtosis = 0.649). Sampling adequacy remained high (KMO = 0.941), and Bartlett's Test of Sphericity was significant ($\chi^2 = 8254.925$, $p < .001$). Communalities ranged from 0.585 to 0.799, indicating that all items adequately represented the underlying factor structure (Table 2).

Eigenvalues and the scree plot were examined to determine the number of factors. The results supported a four-factor solution (Table 2; Appendix Table 3), and the scree plot is presented in Appendix 1 (Appendix Fig. 1).

The four-factor structure comprised 28 items and accounted for 70.121% of the total variance. The first

**Table 2** Eco-reproductive concern scale' EFA results

| Items | Communalities | Factors | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| i8. I consider parenthood increasingly risky due to the rising frequency of environmental disasters such as floods, storms, and droughts. | 0.785 | 0.817 | | | |
| i2. When I consider having children, I am concerned about the risks that climate change will create in the future. | 0.706 | 0.790 | | | |
| i10. I am concerned about having children because of the potential living conditions the next generation may face related to climate change. | 0.799 | 0.778 | | 0.336 | |
| i9. The prospect of having children frightens me due to ecological threats such as global warming, water and air pollution. | 0.791 | 0.773 | | 0.363 | |
| i4. Environmental destruction (forest fires, depletion of water resources, etc.) causes me to question my decision to have children. | 0.728 | 0.769 | | 0.309 | |
| i7. The rise in extreme weather events (floods, storms, droughts, etc.) influences my decision to have children. | 0.749 | 0.765 | | 0.362 | |
| i5. The thought that my children may not have access to clean drinking water in the future worries me. | 0.699 | 0.747 | | | 0.363 |
| i6. I am concerned that my children may experience psychological difficulties as a consequence of climate change. | 0.665 | 0.738 | | | 0.287 |
| i3. I am concerned that global warming will negatively affect children's health in the future. | 0.652 | 0.712 | | | 0.374 |
| i27. I believe that having children could worsen climate change. | 0.753 | | 0.820 | | |
| i24. I consider that having children is an ethical issue that contributes to climate change. | 0.718 | | 0.807 | | |
| i23. I think that having more children will increase the effects of climate change. | 0.694 | | 0.796 | | |
| i26. I believe having children increases carbon footprint (the total amount of greenhouse gases emitted into the atmosphere as a result of human activities). | 0.679 | | 0.794 | | |
| i25. Not having children helps reduce the effects of climate change. | 0.662 | | 0.771 | | |
| i22. I think that having children increases the burden on the planet's health. | 0.619 | | 0.767 | | |
| i28. I think that having fewer children helps environmental sustainability. | 0.645 | | 0.759 | | |
| i34. Uncertainty regarding the effects of climate change delays my decision to have children. | 0.785 | | | 0.812 | |
| i37. I am considering postponing having children due to environmental risks. | 0.761 | | 0.307 | 0.783 | |
| i35. I may consider not having children if the negative effects of climate change continue. | 0.777 | | 0.320 | 0.770 | |
| i36. I believe that future climate conditions will influence my decision to have children. | 0.757 | 0.344 | | 0.746 | |
| i32. I am forming my decision to have children based on the trajectory of climate change. | 0.644 | | | 0.737 | |
| i31. I may consider giving up on having children due to the effects of climate change. | 0.712 | | 0.311 | 0.737 | |
| i33. I am planning the number of children I intend to have by considering environmental conditions. | 0.585 | | | 0.681 | 0.289 |
| i20. Bringing up children also entails the responsibility of nurturing environmentally conscious individuals. | 0.725 | | | | 0.820 |
| i18. As a parent or prospective parent, I believe it is my responsibility to model environmentally friendly behaviour. | 0.708 | | | | 0.802 |
| i14. Fighting environmental problems for future generations is a parent's duty. | 0.664 | | | | 0.763 |
| i19. Having children causes me to place greater importance on environmental values (protecting nature, living in an environmentally conscious way, etc.). | 0.587 | | | | 0.710 |
| i13. I believe that having children requires responsibility in terms of environmental awareness. | 0.586 | | | | 0.696 |
| Explained variance (Total = 70.121%) | | 41.543 | 14.922 | 8.221 | 5.435 |
| Eigenvalue (Total = 19.634) | | 11.632 | 4.178 | 2.302 | 1.522 |

factor comprised nine items (i2–i10) and explained 41.543% of the variance. As these items reflected concerns about environmental degradation and climate change, this factor was labeled "Ecological Concerns." The second factor comprised seven items (i12, i23–i28) and accounted for 14.922% of the variance; it was labeled "Attitudes and Beliefs". The third factor comprised seven items (i31–i37), accounted for 8.221% of the variance, and was labeled "Behavioral Intentions". The fourth factor included five items (i13, i14, i18–i20), explained 5.435% of the variance, and was labeled "Values and Sense of Responsibility" (Table 2).

## CFA

### Model fit

Confirmatory factor analysis (CFA) was conducted using data from 247 participants. The data demonstrated an approximately normal distribution (skewness = −0.112, kurtosis = 0.466). Sampling adequacy was supported by a KMO value of 0.930 and a significant Bartlett's Test of Sphericity ($\chi^2$ = 5227.038, $p$ <.001). Item-total correlations ranged from 0.328 to 0.770, and the Cronbach's alpha coefficient for the 28-item scale in the CFA sample was 0.945, indicating excellent reliability.

Initial CFA results indicated a borderline RMSEA value. Therefore, two theoretically justifiable error covariances (i4–i7 and i5–i6) were added to the model. Following these modifications, the RMSEA value decreased below the recommended threshold. The final model demonstrated acceptable fit indices (CMIN/df = 2.348, $\chi^2$ $p$ <.001, CFI = 0.909, RMSEA = 0.074, RMR = 0.074, SRMR = 0.064, TLI = 0.900, IFI = 0.910, PGFI = 0.677, PNFI = 0.772), supporting the adequacy of the four-factor structure (Fig. 2) (Bae, 2017; Kline, 2014).

Standardized factor loadings ranged from 0.63 to 0.92 for the first factor, 0.62 to 0.84 for the second factor, 0.61 to 0.90 for the third factor, and 0.60 to 0.87 for the fourth factor, indicating strong item–factor relationships.

### Convergent validity

Convergent validity was evaluated using standardized factor loadings, composite reliability (CR), and average variance extracted (AVE). All factor loadings exceeded the recommended threshold of 0.50, ranging from 0.60 to 0.92. Additionally, CR values for all factors exceeded 0.70, and AVE values exceeded 0.50, indicating that a substantial proportion of the variance was explained by the latent constructs. These findings support the measurement model's convergent validity (Table 3). Given the nature of the analysis, convergent validity was assessed using CFA data.

### Discriminant validity (Fornell–Larcker criterion)

Discriminant validity was assessed using the Fornell–Larcker criterion. The square roots of AVE values for each construct were greater than the corresponding inter-factor correlations, indicating that each construct shared more variance with its own indicators than with other constructs. These findings confirm adequate discriminant validity of the measurement model (Table 3). In addition, strong factor loadings across all factors further supported the distinctiveness of the latent constructs (Fig. 2).

### Construct validity

Construct validity was examined through correlation analyses between the total scale score and its subdimensions. All subdimensions demonstrated strong, positive, and statistically significant correlations with the total Eco-Reproductive Concern Scale score (F1: $r$=.823; F2: $r$=.716; F3: $r$=.830; F4: $r$=.642; all $p$ <.001), indicating that the subdimensions represent a common higher-order construct. Inter-factor correlation coefficients ranged from 0.21 to 0.59, with none exceeding 0.80, indicating the absence of multicollinearity (Table 4).

## Reliability

### Internal consistency

Internal consistency was assessed using Cronbach's alpha and McDonald's omega coefficients. The Ecological Concerns subscale demonstrated Cronbach's alpha and McDonald's omega values of 0.948. The Attitudes and Beliefs subscale yielded values of 0.920 and 0.919, respectively. For the Behavioral Intentions subscale, Cronbach's alpha was 0.928, and McDonald's omega was 0.929. The Values and Sense of Responsibility subscale demonstrated coefficients of 0.865 for both indices. For the total scale, Cronbach's alpha was 0.946, and McDonald's omega was 0.942, indicating excellent internal consistency (Table 5).

### Split-half reliability

Split-half reliability analyses further supported the scale's internal consistency. Cronbach's alpha coefficients for Part 1 and Part 2 ranged from 0.737 to 0.938. Correlations between the two halves ranged from 0.746 to 0.825. Additionally, Spearman–Brown coefficients ranged from 0.855 to 0.904, and Guttman split-half coefficients ranged from 0.833 to 0.903, indicating strong and consistent reliability across the scale and its subdimensions (Table 5).

### Measurement invariance

Measurement invariance across gender was examined using multi-group confirmatory factor analysis, testing configural, metric, scalar, and strict invariance models. The configural invariance model demonstrated acceptable fit ($\chi^2$/df = 2.06, CFI = 0.865, RMSEA = 0.066, SRMR = 0.075), indicating that the factor structure was equivalent across women and men (Table 6).

Metric invariance was supported, as constraining factor loadings to be equal across groups resulted in negligible changes in fit indices (ΔCFI = −0.001, ΔRMSEA = −0.001),

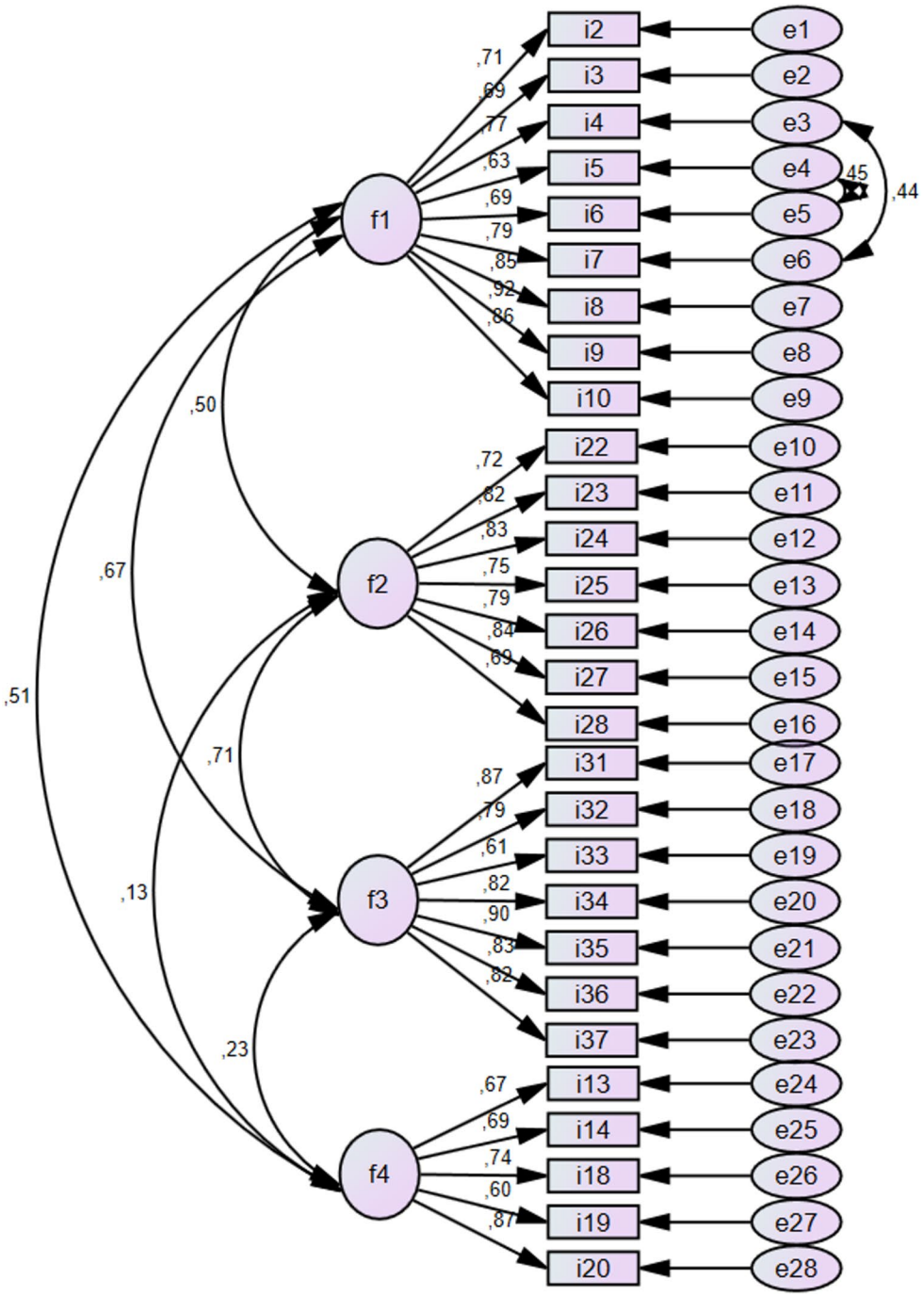



**Fig.2** The Confirmatory Factor Analysis Diagram of the Scale and Fit Index

**Table 3** Fornell–Larcker discriminant validity matrix (CFA)

| | | | AVE square root (AVE) and Correlation | | | |
|---|---|---|---|---|---|---|
| Factors | CR | AVE | **F1** | F2 | F3 | F4 |
| Ecological Concerns (F1) | 0.93 | 0.60 | **0.773** | 0.44 | 0.61 | 0.48 |
| Attitudes and Beliefs (F2) | 0.92 | 0.61 | 0.44 | **0.779** | 0.66 | 0.12 |
| Behavioral Intentions (F3) | 0.94 | 0.68 | 0.61 | 0.66 | **0.825** | 0.23 |
| Values and Sense of Responsibility (F4) | 0.84 | 0.52 | 0.48 | 0.12 | 0.23 | **0.720** |

**Table 4** Results of correlation analysis regarding scale and sub-dimensions

| Factrors (Maen ± SD) | | F1 | F2 | F3 | Ff4 |
|---|---|---|---|---|---|
| Ecological Concerns (F1) (3.61 ± 0.95) | r | 1 | 0.337** | 0.593** | 0.554** |
| | p | | 0.001 | 0.001 | 0.001 |
| Attitudes and Beliefs (F2) (2.89 ± 0.95) | r | 0.337** | 1 | 0.550** | 0.212** |
| | p | 0.001 | | 0.001 | 0.001 |
| Behavioral Intentions (F3) (2.89 ± 0.95) | r | 0.593** | 0.550** | 1 | 0.301** |
| | p | 0.001 | 0.001 | | 0.001 |
| Values and Sense of Responsibility (F4) (4.03 ± 0.73) | r | 0.554** | 0.212** | 0.301** | 1 |
| | p | 0.001 | 0.001 | 0.001 | |
| Eco-reproductive Concern Scale (3.36 ± 0.68) | r | 0.823** | 0.716** | 0.830** | 0.642** |
| | p | 0.001 | 0.001 | 0.001 | 0.001 |

*SD* Standard deviation **. Correlation is significant at the 0.01 level (2-tailed)

and the chi-square difference test was non-significant ($\Delta\chi^2(24) = 30.082$, $p = .182$). Scalar invariance was also established, with acceptable changes in fit indices ($\Delta CFI = -0.002$, $\Delta RMSEA = -0.001$) and a non-significant chi-square difference ($\Delta\chi^2(28) = 40.303$, $p = .062$).(Table 6).

The strict invariance model, which additionally constrained error variances, demonstrated a more pronounced decline in model fit ($\Delta CFI = -0.010$, $\Delta RMSEA = 0.001$), and the chi-square difference test was significant ($\Delta\chi^2(30) = 80.550$, $p < .001$), indicating that strict invariance was not achieved. Overall, the scale demonstrated configural, metric, and scalar invariance across gender, supporting the meaningful comparison of latent means and structural relationships between women and men(Table 6). (Fig.1).

## Discussion

The Eco-Reproductive Concern Scale was developed to assess individuals' reproductive concerns and intentions in the context of climate change and environmental crises. The findings from the present study provide strong initial evidence that the scale is a valid and reliable instrument for evaluating eco-reproductive concerns among adults.

In the present study, approximately 35–37% of participants reported that climate change affects their future decision to have children. This finding suggests that eco-reproductive concerns are not marginal but represent a salient psychosocial phenomenon within this population. Similar to previous studies describing eco-reproductive anxiety or climate-related reproductive concern (Innocenti et al., 2024; Schneider-Mayerson & Leong, 2020), a substantial proportion of individuals in our sample explicitly linked environmental uncertainty to reproductive decision-making. These results provide empirical support for the practical necessity of a multidimensional tool, such as the Eco-Reproductive Concern Scale, which systematically captures these emerging concerns.

Several theoretical frameworks have examined the potential effects of environmental factors on fertility behavior (Peters et al., 2025). The present study approaches

**Table 5** Results regarding reliability

| Scale and sub-dimensions | Item Number | α | Ω | Split-Halt Analysis Results | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Part 1 α | Part 2 α | Correlation Between Forms | Spearman Brown Coefficient | Gutman Split-Half Coefficient |
| Ecological Concerns (F1) | 9 | 0.948 | 0.948 | 0.910 | 0.938 | 0.825 | 0.904 | 0.903 |
| Attitudes and Beliefs (F2) | 7 | 0.920 | 0.919 | 0.870 | 0.871 | 0.795 | 0.886 | 0.869 |
| Behavioral Intentions (F3) | 7 | 0.928 | 0.929 | 0.859 | 0.913 | 0.825 | 0.904 | 0.897 |
| Values and Sense of Responsibility (F4) | 5 | 0.865 | 0.865 | 0.795 | 0.737 | 0.746 | 0.855 | 0.833 |
| Eco-reproductive Concern Scale | 28 | 0.946 | 0.942 | 0.894 | 0.919 | 0.807 | 0.893 | 0.893 |

*F* Factor, *a* Cronbach's alpha coefficients, Ω McDonald omega coefficient

**Table 6** Goodness-of-fit indices for measurement invariance tests

| Model | $\chi^2$ (df) | CFI | RMSEA | SRMR | $\Delta\chi^2$ (df) | $p$ ($\chi^2$) | ΔCFI | ΔRMSEA |
|---|---|---|---|---|---|---|---|---|
| Configural | **1406.27 (684)** | 0.865 | 0.066 | 0.0750 | - | - | - | - |
| Metric | **1436.35 (708)** | 0.864 | 0.065 | 0.0768 | 30.082 (24) | 0.182 | −0.001 | −0.001 |
| Scalar | **1476.66 (736)** | 0.862 | 0.064 | 0.0770 | 40.303 (28) | 0.062 | −0.002 | −0.001 |
| Strict | **1557.21 (766)** | 0.852 | 0.065 | 0.0790 | 80.550 (30) | 0.001 | −0.010 | 0.001 |

*RMSEA* Root Mean Square Error of Approximation, *SRMR* Standardized Root Mean Square Residual, *CFI* Comparative Fit Index

environmental concerns as psychological constructs that may influence reproductive attitudes and intentions. Accordingly, it draws on perspectives that address both sociological and psychological dimensions of fertility behavior, particularly Beck's concept of the "Risk Society" (Beck, 1992) and Miller's Traits-Desires-Intentions-Behavior (TDIB) model (Miller, 1994, 2011).

Beck's theory of the Risk Society provides a sociological framework for understanding how individuals experience and respond to global environmental risks. According to Beck (1992) and Giddens (2003), modern societies are increasingly oriented toward future-related risks that are largely produced by human activity, such as climate change. Unlike earlier societies that primarily faced natural or external risks, contemporary societies generate manufactured risks through industrialization and environmental degradation. Because these risks are human-made, they tend to evoke reflection, ethical concern, and uncertainty about long-term consequences, particularly for future generations. Within this framework, climate change exemplifies a risk that may raise moral and emotional questions about reproduction in an ecologically uncertain world (Beck, 1992; Giddens, 2003; Peters et al., 2025).

From a psychological perspective, Miller's TDIB model helps explain how environmental concerns may influence reproductive decision-making. The model describes a progression from relatively stable traits to desires and, ultimately, to reproductive intentions and behaviors (Miller, 1994, 2011). Within this sequence, environmental concerns are most likely to affect the intention stage, as intentions involve deliberate planning and evaluation of contextual conditions, whereas traits remain relatively stable and desires may involve less reflection on external risks (Miller, 1994, 2011; Peters et al., 2025).

Together, these perspectives suggest that eco-reproductive concerns are not limited to a single attitude but involve multiple, interrelated processes, including emotional responses to environmental risk, value-based considerations, and intentional decision-making. These processes align with Schneider-Mayerson and Leong's (2020) description of eco-reproductive concerns, a broader concept encompassing environmental factors that may influence reproductive plans, such as climate change, environmental degradation, and concerns about future living conditions. Based on this conceptual background, the present study addressed eco-reproductive concerns as a multidimensional construct, and the scale's dimensions were examined accordingly.

Consistent with this conceptual background, the four-factor structure identified through exploratory factor analysis accounted for 70.12% of the total variance, substantially exceeding the commonly accepted 50% threshold for social science measurement tools (Bae, 2017; Howard, 2016; Kline, 2014). This high proportion of explained variance indicates that the Eco-Reproductive Concern Scale captures the underlying construct with considerable strength and coherence. The CFA further supported this structure, with model fit indices falling within acceptable ranges, providing evidence for the construct validity of the Eco-Reproductive Concern Scale. Innocenti et al. (2024) developed a unidimensional scale to assess attitudes related to reproductive intentions in the context of climate change. In contrast, the present study's findings suggest that eco-reproductive concerns may not be fully captured by a single dimension. Rather, these concerns appear to encompass multiple interrelated psychological and value-based components, indicating that a multidimensional approach may provide a more comprehensive understanding of how climate change shapes reproductive considerations.

Examination of item-level factor loadings further supports the theoretical coherence of the scale. Prior to conducting factor analysis, all items met commonly recommended psychometric prerequisites, with corrected item-total correlation coefficients exceeding 0.30 and item-level Cronbach's alpha values above 0.60, indicating adequate internal consistency and item discrimination (DeVellis & Thorpe, 2021; Pallant, 2020). Within this context, Item 8 ("I consider parenthood increasingly risky due to the rising frequency of environmental disasters such as floods, storms, and droughts.") demonstrated one of the highest factor loadings, aligning closely with the conceptual core of future-oriented risk perception and climate-related uncertainty. This finding is consistent with theoretical frameworks emphasizing anticipatory anxiety and future threat appraisal as central components of eco-reproductive concern. Moreover, even the lowest factor loadings observed in the scale exceeded recommended minimum thresholds, indicating that all retained items contributed meaningfully to their respective latent constructs.

Convergent validity was further supported by average variance extracted (AVE) values exceeding the recommended threshold of 0.50 across all factors (Bae, 2017; DeVellis & Thorpe, 2021; Pallant, 2020). These findings indicate that a substantial proportion of the variance in the observed indicators is accounted for by their respective latent constructs. In addition to high composite reliability values, the AVE results suggest that the Eco-Reproductive Concern Scale demonstrates strong internal consistency, reinforcing confidence in its construct validity.

The reliability findings of the present study indicate that the Eco-Reproductive Concern Scale demonstrates strong internal consistency. Cronbach's alpha coefficients for the total scale and its subdimensions exceeded the commonly accepted threshold of 0.70, supporting the internal consistency of the instrument (Souza et al. 2017; Gökdemir &

Yılmaz, 2023). In addition to the high Cronbach's alpha coefficient (0.946), the Spearman-Brown (0.893) and Guttman Split-Half (0.893) coefficients were also notably high and closely aligned with each other. The convergence of these reliability indicators suggests that the two halves of the scale are highly homogeneous and internally consistent (DeVellis & Thorpe, 2021; Pallant, 2020). This pattern strengthens evidence for the scale's reliability by demonstrating that internal consistency is not dependent on a single coefficient and is supported across multiple reliability estimation methods. Comparable levels of internal consistency have been reported in related studies on scale development. For example, Innocenti et al. (2024) reported a Cronbach's alpha coefficient of ($\alpha = 0.85$) for the Climate Change-Related Reproductive Concerns Scale.

The construct validity findings support the conceptual coherence of the Eco-Reproductive Concern Scale. Correlation analyses indicated that the subdimensions were significantly related to one another, while remaining sufficiently distinct, suggesting that they capture related but non-overlapping aspects of eco-reproductive concern. Measurement invariance analyses further strengthened the psychometric evidence for the Eco-Reproductive Concern Scale. The scale demonstrated configural, metric, and scalar invariance across gender, indicating that its factor structure, factor loadings, and item intercepts function equivalently for women and men. This finding suggests that observed score differences reflect true differences in eco-reproductive concerns rather than measurement bias.

A further methodological strength of the present study is the relatively large sample size used for both exploratory and confirmatory factor analyses. Large samples increase the stability of factor solutions and reduce the likelihood that observed structures reflect sample-specific characteristics. The robustness of factor loadings, variance estimates, and reliability coefficients in the current study may therefore be partially attributed to the adequate and well-powered sample, enhancing confidence in the generalizability of the psychometric findings.

### Limitations

Several limitations of the present study should be acknowledged. First, the cross-sectional design precludes causal interpretations regarding the relationship between eco-reproductive concerns and reproductive intentions. Second, the use of convenience sampling may limit the generalizability of the findings to broader populations. In addition, the sociocultural context of Türkiye, where parenthood and family formation are highly valued, may have influenced participants' responses and should be considered when interpreting the results. Future studies employing longitudinal designs and more diverse samples are needed to examine how eco-reproductive concerns evolve over time and across different cultural contexts.

Finally, data were collected via a Google Form. Although the data collection process was anonymous and participants' identity information was not recorded, the platform used was not HIPAA-compliant and not designed for health data, which should be considered a limitation for data security. However, no personally identifiable information was collected in the study, and the data were used solely for research purposes.

## Conclusion

The Eco-Reproductive Concern Scale is a valid and reliable instrument for assessing individuals' reproductive concerns and intentions in the context of climate change. The scale consists of 28 items organized into four subscales: Ecological Concerns, Attitudes and Beliefs, Behavioral Intentions, and Values and Sense of Responsibility. All items are rated on a 5-point Likert-type scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"), with no reverse-coded items. Subscale scores reflect the level of concern within each respective domain, while higher total scale scores indicate greater eco-reproductive concern related to climate change.

In the present sample, many participants had not yet had children but expressed intentions to do so in the future, while a considerable proportion reported that climate change did not directly influence their reproductive decisions. This pattern may reflect the coexistence of widely shared social norms surrounding parenthood with emerging environmental concerns, rather than the absence of eco-reproductive considerations. Accordingly, eco-reproductive concerns may coexist with social, cultural, and economic factors in shaping reproductive decision-making across contexts.

The scale offers a valuable tool for future research, public health policy development, and nursing and counseling practice. By enabling the systematic assessment of eco-reproductive concerns, the scale may support evidence-based interventions to address reproductive decision-making in the context of climate change and environmental crises.

### Relevance for clinical practice

The Eco-Reproductive Concern Scale provides mental health nurses and reproductive health professionals with a structured tool for identifying and assessing climate-related reproductive concerns among individuals of childbearing age. Given the growing prevalence of eco-anxiety and future-oriented uncertainty, particularly among young

adults, the scale may facilitate early recognition of psychosocial distress associated with reproductive decision-making in the context of environmental crises.

In clinical settings, the scale may help nurses initiate sensitive discussions about environmental concerns, reproductive intentions, and future-related anxieties. By systematically assessing eco-reproductive concerns, nurses can tailor counseling interventions, provide evidence-based psychoeducation, and refer individuals for further psychological support when necessary.

Furthermore, the scale may contribute to holistic, person-centered care by integrating environmental and existential dimensions into reproductive and mental health assessments. As climate change increasingly shapes patients' life plans and perceptions of the future, incorporating eco-reproductive concerns into routine psychosocial evaluations may enhance the comprehensiveness and responsiveness of nursing care.

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