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Research paper

Association of optimism, self-efficacy, and resilience with life engagement among middle-aged and older adults with severe climate anxiety: Sensitivity of a path model

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ABSTRACT

Background: Life engagement is an important proxy of successful ageing that may depend on psychological capital factors (e.g., optimism, self-efficacy, and resilience), especially among older adults with severe climate anxiety. This study aimed to assess the association of optimism with life engagement and ascertain whether this relationship is mediated by self-efficacy and resilience among older adults with severe climate anxiety.

Methods: The data came from the Climate Psychology in Ageing Study 2024, a national survey involving 3994 middle-aged and older adults aged 50 years or over in Ghana. Multistage sampling was used to select the participants across Ghanaian cities, and the Climate Anxiety Scale was used to classify participants into severe, moderate, or mild climate anxiety. A path analysis (through structural equation modelling) was used to quantify the association. The sensitivity of the path model was investigated with data on moderate and mild climate anxiety.

Results: Optimism was associated with higher life engagement among older adults with severe and moderate climate anxiety but not among those with mild climate anxiety. Self-efficacy and resilience partially mediated the association of optimism with life engagement among older adults with severe and moderate climate anxiety but fully mediated this relationship among older adults with mild climate anxiety.

Conclusion: Psychological capital may be more strongly associated with life engagement among older adults with severe climate anxiety, and policy-driven human development programmes enhancing this capital can facilitate life engagement.

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1. Introduction

Climate change is a disorientating global phenomenon accompanying events such as rising sea levels, landslides, floods, tsunamis, and extreme temperatures. These events cause climate anxiety, which is the individual's heightened somatic, mental, and emotional distress in response to alterations in climatic situations (Whitmarsh et al., 2022). Climate anxiety is a type of eco-anxiety, which is the individual's fear that the ecological foundation of life is near collapse (Hajek and Konig, 2022). A mild level of climate anxiety is good for the planet as it can motivate positive behaviour change in response to the climate crisis (Taylor, 2020).

At severe climate anxiety, however, individuals can lose control over their psychological capital, which includes optimism, self-efficacy, and resilience (Sharma, 2013; Wojcieszek et al., 2023). Psychological capital accompanies positive expectancies that enable individuals to overcome life challenges. Researchers contend that positive expectancies facilitate positive ageing (Waterworth et al., 2019; Yao et al., 2024), defined as the maintenance of a positive attitude and making the best use of the benefits of old age (Bartholomaeus et al., 2019). Positive ageing encapsulates optimism in ageing and the avoidance of a negative attitude to ageing, even in adverse life situations. Researchers (Lim et al., 2024; Martinez-Moreno et al., 2020; Remm et al., 2023) recognise optimism, resilience, and self-efficacy as psychological capital for positive ageing. Resilience is the ability to recover quickly from difficulties or trauma (Rosowsky, 2019), whereas self-efficacy is the ability to achieve a goal or perform an activity (Zulkosky, 2009). Optimism is a person's hopefulness or confidence about the success of something or the future. Although optimism, resilience, and self-efficacy may be necessary for social engagement in people experiencing adverse life situations, there is no evidence about whether they can influence life engagement among older adults with severe climate anxiety.

Life engagement is a proxy of successful ageing (Ng et al., 2011) and was framed out of Lowe and Khan's successful ageing framework (Rowe and Kahn, 1997; Rowe and Kahn, 2015). It is more relevant to optimal health than traditional measures of social engagement because it encompasses sustained participation in activities for supporting others and engaging with career, volunteering, and economic activities. The maintenance of these activities is necessary for autonomy in later life, and sustaining autonomy over the life course is the hallmark of successful ageing (Heide, 2022; Ng et al., 2011). Life engagement is necessary for life satisfaction since it involves essential life activities such as supporting people and working to make a living, but it may be constrained by climate anxiety.

Severe climate anxiety can reduce or impair psychological capital and the positive affect necessary for life engagement, given that life engagement requires cognitive and functional capacity. This view is corroborated by research (Hofer and Hargittai, 2021; Liang, 2024) confirming a negative association between generalised anxiety and social engagement. Yet, older adults experience more positive emotions than younger adults and are better able to continue a normal life despite adverse life experiences (Barbeau et al., 2022; Jiang and Fung, 2019; Waterworth et al., 2019). In the study of Waterworth and colleagues, older adults reported the relevance of positive affect in life engagement. Some older adults in this study revealed that a positive attitude implicit in optimism facilitated their social engagement during adversity. Thus, optimism may predict higher life engagement among older adults experiencing adverse life events, but there has been no quantification of this association.

Research suggests optimism is positively associated with self-efficacy (Hajek and Konig, 2019; Karademas, 2006; Karademas et al., 2007) and resilience (Hou and Chen, 2024; Martinez-Moreno et al., 2020). Self-efficacy and resilience are positively related (Hu et al., 2018; Martinez-Moreno et al., 2020), and both relate to indicators of social engagement (Levasseur et al., 2017; Nagao-Sato et al., 2023; Remm et al., 2023; Wu and Sheng, 2019). This nexus has been assessed by researchers mostly in the general population but implies a potential mediation of the association of optimism with life engagement by self-efficacy and resilience. Yet, no study has examined this potential mediation among older adults with severe climate anxiety. If older adults experience more positive affect and are more socially adaptive to adversity, their psychological capital may predict life engagement, probably in those experiencing severe climate anxiety. This study aimed to test this hypothesis with a path model by answering two research questions: (1) are the psychological capital factors associated with life engagement, and (2) do self-efficacy and resilience mediate the association of optimism with life engagement?

A severe climate anxiety level is more disorientating than mild and moderate levels (Hajek and Konig, 2022; Taylor, 2020), implying that the association of the psychological capital factors with life engagement may change across severe, moderate, and mild climate anxiety levels. Hence, this study assessed the sensitivity of the path model across four groups: middle-aged and older adults in the general population and the severe, moderate, and mild climate anxiety groups. Sensitivity is a change in the strength or direction of the relationships in the path model across these groups. This study clarifies the current debate about how the psychological capital of older adults with different levels of climate anxiety may predict life engagement. Implications for healthcare and individual action are delineated.

2. Theoretical framework

The Disengagement Theory of Ageing (DTA) proposed by Cumming and colleagues (Cumming et al., 1960; Ragini and Salwan, 2022) is one of the earliest theories of ageing. It asserts that individuals lose skills, functional capacity, and social ties as they age, resulting in social disengagement. The individual experiences a gradual decline in intrinsic capacity and a shrinking time perspective, which is the individual's perception of the brevity of their life. As the individual ages, their time perspective becomes shorter, which discourages social engagement (Cumming et al., 1960; Ragini and Salwan, 2022). Yet, the rate of loss of intrinsic capacity due to ageing depends on environmental and personal factors, including whether the individual ages in a high-income setting (Asiamah, 2017; Asiamah et al., 2023). This assertion unfolds a shortcoming of the DTA, which is its failure to recognise the ability of people to maintain social activities and well-being over the life course by drawing on their life experiences, environmental resources (e.g., social support, and services), and personal resources (e.g., income, self-efficacy, resilience, and optimism).

The DTA is opposed to the Activity Theory of Ageing (ATA) (Asiamah, 2017; Ho et al., 2024) and the Continuity Theory of Ageing (CTA) (Atchley, 1989). The ATA and CTA agree that individuals can maintain social and physical activities in later life by adapting their life experiences and resources (e.g., social networks). In contexts where social support, environmental resources (e.g., parks and safety), and financial resources (e.g., income) are available to the individual over the life course, social and physical activities can be maintained through the adaptive utilisation of life experiences (Asiamah, 2017; Asiamah et al., 2023). Individuals can delay the ageing process and maintain physical functioning in older age in such contexts. The CTA further suggests beliefs can be maintained over the life course. Since the CTA's imports are held from a functionalist perspective, such beliefs include self-efficacy for social activities over the life course.

Building on the CTA's argument about beliefs is the Socioemotional Selectivity Theory (SST) (Carstensen, 2006), which avers that life goals change as people age. This change impels older adults to engage in social and economic activities that are emotionally rewarding. Although the SST alludes to the DTA's idea of shrinking time perspective, it provides a more optimistic view of ageing. Lifespan changes in daily life challenges necessitate and accompany increased emotion-focused problem-solving capabilities empowered by self-efficacy (Löckenhoff and Carstensen, 2004). Hence, older adults experience more positive affect than younger

people during a crisis and may, therefore, better function socially during adversity. Suffice it to say psychological capital factors are more likely to facilitate social and physical functioning among older adults during a crisis. This thinking is supported by researchers (Strough et al., 2024; Waterworth et al., 2019), but the Strength and Vulnerability Integration (SAVI) model (Charles, 2010) is at odds with it.

The SAVI model argues that unavoidable stressors are more harmful to the well-being of older adults than they are to the well-being of younger people. Since life engagement is an indicator of well-being, it could be inferred that older adults with severe climate anxiety would report lower life engagement. The import of the SAVI model is, nevertheless, counteracted by Strough and colleagues' study (Strough et al., 2024), which found that depressive symptoms and psychological distress following a hurricane were few among older adults. Anxiety about a crisis is more likely to predict social isolation and disengagement in younger adults than among older adults (Hajek and Konig, 2022). Other studies (Lee, 2023; Remm et al., 2023; Waterworth et al., 2019) found that older adults could draw on their positive affect and psychological capital (i.e., optimism, and resilience) to maintain well-being and social interactions following adverse life events. What is unexplored is the association of psychological capital with life engagement (as depicted in Fig. 1) among older adults experiencing severe climate anxiety and whether this nexus is consistent across lower levels of climate anxiety.

As reported earlier, the association among the psychological capital factors (i.e., H_2, H_3, and H_4) is backed by the empirical literature and is the basis of the indirect link of optimism with life engagement. Other paths in the model necessary for this indirect association (i.e., H_1, H_4, and H_6) are analogous to available evidence. Specifically, studies (Koga et al., 2024; Pavey et al., 2015; Waterworth et al., 2019) suggest optimism facilitates social activities implicit in life engagement. Research also supports the relationship between self-efficacy and proxies of life engagement (Fu et al., 2018; Remm et al., 2023; Wu and Sheng, 2019) and between resilience and social engagement (Levasseur et al., 2017; Nagao-Sato et al., 2023; Remm et al., 2023). Yet, this comparable evidence is not elaborate or informative enough to support decision-making since it was not based on an integrated path model or older adults with severe climate anxiety.

The hypothesised indirect association is worth testing on older adults experiencing severe climate anxiety. The self-efficacy and resilience of this group would depend on optimism since researchers (Remm et al., 2023; Waterworth et al., 2019; Zhang et al., 2023) have reasoned and evidenced that an optimistic outlook during adverse life events fosters resilience and self-efficacy. Although the paths in Fig. 1 can be bidirectional, an influence of the psychological capital factors on life engagement is more plausible from the perspective of our theoretical framework.

The psychological capital factors may more strongly predict life engagement among older adults with severe climate anxiety since they are less useful during normalcy or in the absence of adversity. If so, the strength of the association depicted in the path model would vary between groups with different climate anxiety levels. The hypothesised positive association is expected to be weaker among older adults with mild climate anxiety, given that this group may have a shorter time perspective, an antecedent to social exclusion in old age (Asiamah, 2017; Ragini and Salwan, 2022). Individuals with lower anxiety about environmental problems are older adults with a shorter time perspective (Hajek and Konig, 2022; Whitmarsh et al., 2022). Such older adults are likely to isolate themselves (Asiamah et al., 2021; Stout et al., 2024) and fail to benefit from the psychological capital needed for life engagement during adverse life events. This thought necessitated fitting the path model across the three levels of climate anxiety.

As Fig. 1 indicates, the strength of the association can be increased or decreased by covariates or confounders, which are lurking variables on the causal paths (Asiamah et al., 2019; Koohsari et al., 2020). The potential confounders include gender, education, income, and marital status, and their inclusion in the model was motivated by evidence suggesting optimism can be influenced by personal and environmental factors (Takemura et al., 2022; Tetzner and Becker, 2019). People who age with optimistic people are more likely to show optimism when experiencing adverse life events. Higher optimism may be due to higher income and perceived good health.

3. Methods

3.1. Design

This study employed a cross-sectional design including statistical procedures against confounding and Common Methods Bias (CMB). Structural Equation Modelling (SEM) was utilised to fit the path model across the climate anxiety groups.

3.2. Study context, participants, and sample size

The study setting was Ghana, a country in West Africa with a population of 30,832,019 as of 2021 (GSS, 2021). In Ghana, 60 years is the minimum old age (Kpessa-Whyte, 2018), but this study targeted people aged 50 years or over, referred to as "middle-aged and older adults" (García Pérez and Villanueva Gutiérrez, 2025; Sadhu et al., 2025). Studies (Abd El Qadir et al., 2025; García Pérez and Villanueva Gutiérrez, 2025) in gerontology have studied people aged 50 years or over based on some assumptions. Firstly, some people aged 50 years can feel older if their socioeconomic status and life expectancy are low. Generally, life expectancies and socioeconomic status in low- and middle-income countries such as Ghana are low, so many people aged 50 years in such countries may experience health problems characteristic of older ages. By making 50 the minimum old age in this study, we increase the chance of including middle-aged individuals who are

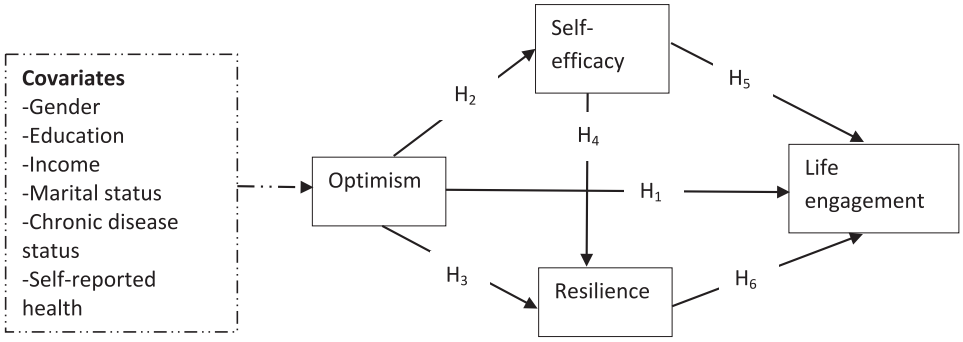

Fig. 1. Nexus between optimism, self-efficacy, resilience, and life engagement.
Note: H1 – the association of optimism with life engagement; H2 – the association of optimism with self-efficacy; H3 – the association of optimism with resilience; H4 – the association of self-efficacy with resilience; H5 – the association of self-efficacy with life engagement, and H6 – the association of resilience with life engagement.

already experiencing old age.

Thus, the participants of this study were community-dwelling middle-aged and older adults aged 50 years or over, a group we subsequently refer to as "older adults". Multistage sampling was utilised to select the participants. The country was put into three national blocks (i.e., northern, middle, and southern zones), and seven representative cities with rural and urban settlements were randomly selected across the blocks. Tamale and Wa were in the northern zone; Accra and Cape Coast were in the southern zone, whereas Kumasi, Ho, and Koforidua were in the middle zone. The selected cities were divided into cardinal blocks (i.e., north, south, east, and west) and participants were randomly selected from each block. We calculated the minimum sample needed with Daniel Soper's sample size calculator (Zewdie et al., 2024) and recommended statistics (i.e., effect size = 0.25; power = 0.8, and α = 0.05; number of latent variables = 4; number of observed variables = 40). Although the minimum sample of 209 reached was sufficient for fitting each path model, we collected data on as many participants as possible to maximise the power of our tests.

3.3. Data collection and ethics

This study received ethics review and clearance from the University of Essex, School of Health and Social Care (TH2425–0021) following ethics clearance from the Kwame Nkrumah University of Science and Technology, Faculty of Social Sciences and Humanities (HuSSREC/AP/52/VOL. 3). All the participants provided written informed consent and participated in the study voluntarily. Data were collected from July 2 to August 23, 2024. Questionnaires were hand-delivered by field research assistants at locations agreed with the participants. Eleven minutes was the average time for completing a questionnaire, and 3994 questionnaires were returned and analysed. Fig. 2 shows the sample size for each city.

3.4. Variables and measurement

3.4.1. Optimism

Optimism was measured with a 9-item standardised scale adopted in whole with its descriptive anchors and codes (i.e., 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree) from Coelho and colleagues (Coelho et al., 2018). Some of its items are "I believe that I will accomplish the main goals of my life" and "I am confident about the future". This tool was preferred to others because it is relatively short and suited for older adults. It yielded a satisfactory Cronbach's α coefficient = 0.72 in the consolidated data and a minimum of 0.71 for the three groups (i.e., mild, moderate, and severe climate anxiety groups). Its negative item (i.e., I think everything will go wrong)

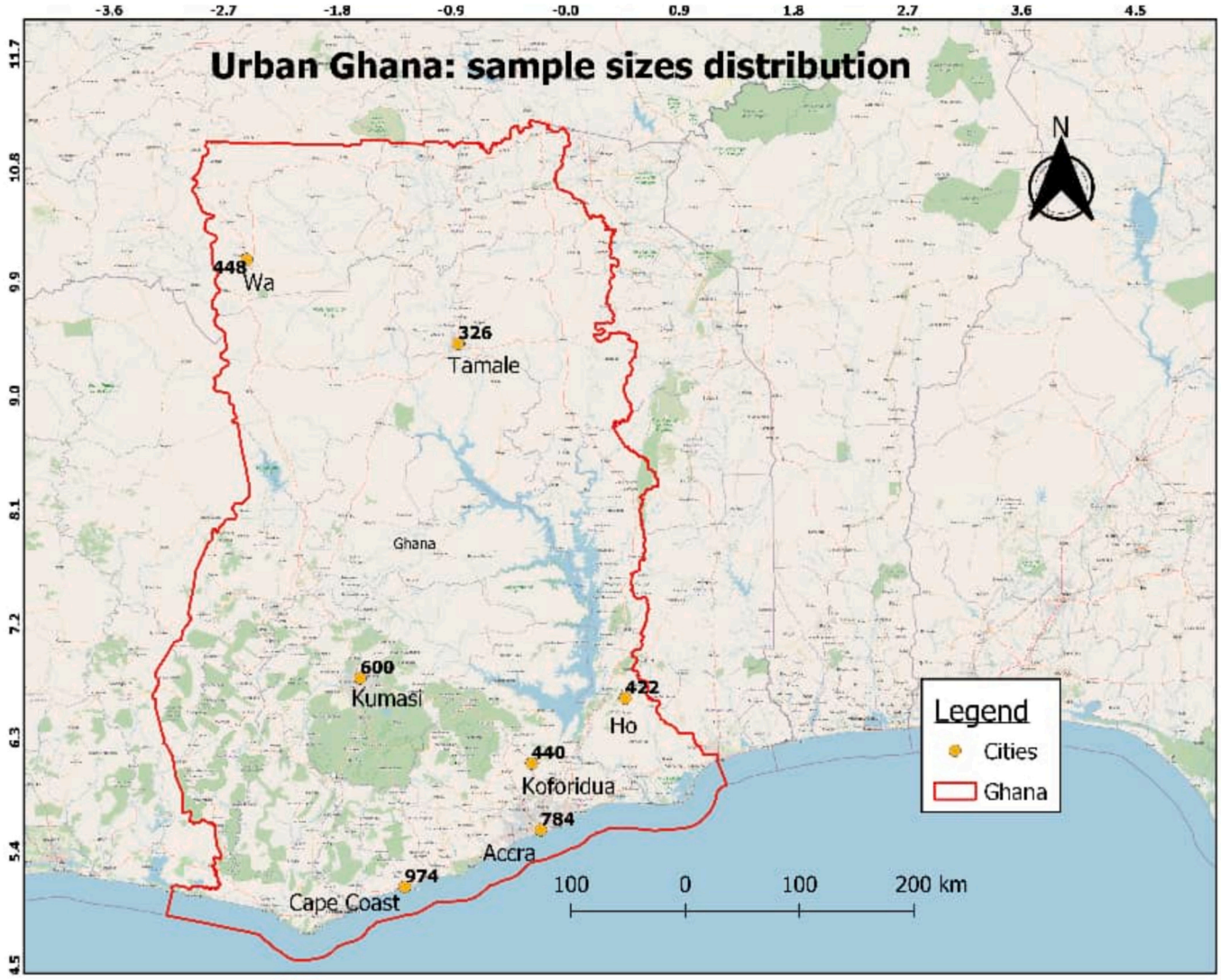

Fig. 2. A map of cities, their location in Ghana, and sample sizes.

was reverse-coded to align it with the other items. We generated data on the scale by summing up the nine items. Scores on this scale ranged from 9 to 45, with larger scores indicating higher optimism.

3.4.2. Self-efficacy

Self-efficacy was measured with an 8-item scale from the literature (Tadaka et al., 2016). This questionnaire was adopted wholly with its descriptive anchors coded as: 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree. Its items include "I can participate in the activities or volunteer work of my neighbourhood associations" and "When I notice a person I do not know in the neighbourhood, I can speak to them". It produced a satisfactory Cronbach's α coefficient = 0.87 for the consolidated data and a minimum of 0.76 for the groups. This scale was preferred to other measures because it is brief, suits older adults, and is well aligned with the aim of this study. Data on the scale were generated by summing the eight items. Scores on the scale ranged between 8 and 40, with higher scores indicating higher self-efficacy.

3.4.3. Resilience

Resilience was measured with a 10-item scale adopted from the literature (Tourunen et al., 2021). The scale was adopted wholly and coded as follows: 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree. Some of its items are "I am able to deal with change" and "I am able to handle unpleasant or painful feelings like sadness, fear and anger". It produced a satisfactory Cronbach's α = 0.86 in the consolidated data and a minimum of 0.79 for the groups. It was chosen for its briefness and suitability for older adults. Scores generated through item summation ranged from 10 to 50, with larger scores indicating higher resilience.

3.4.4. Life engagement

Life engagement was measured with the 9-item life-engagement subscale of the successful ageing scale adopted in whole from Ng et al. (Ng et al., 2011). Its five descriptive anchors were coded as follows: 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree. This tool was chosen because it is relatively short and constitutes a wider scope of activities (i.e., social, economic, and volunteering). Some of its items are "I provided concern and support to enrich the lives of nuclear family members" and "I make a financial or productive contribution to my career and work". Its Cronbach's α was satisfactory (i.e., consolidated α = 0.91; groups' α ≥ 0.82). Scores generated through item summation ranged from 9 to 45, with larger scores indicating higher or more frequent life engagement.

3.4.5. Potential confounders

All potential confounders were coded into two groups to make their incorporation into the path model possible. Gender (men – 1, and women – 2), self-reported health (poor – 1, and good – 2), chronic disease status (none – 1, one or more – 2), and marital status (not married – 1, and married – 2) were originally measured as dichotomous variables. CDS was measured by asking respondents to report the number of chronic diseases they had. Education was measured by asking the participants to report their highest level of formal education, and the responses were coded into two groups (i.e., basic education or no education – 1, and secondary education or higher – 2). Income was the individual's net monthly income in Ghana cedis (₵), and the responses were coded into two groups (<1500–1, and greater than or equal to 1500–2). Age was the individual's chronological age coded into two groups (50–69–1, and 70 or older – 2).

3.4.6. Climate anxiety and its groupings

Climate anxiety was measured with the 13-item Climate Anxiety Scale adopted in whole with its seven descriptive anchors (i.e., 1 – not at all, 2 – practically never, 3 – seldom, 4 – sometimes, 5 – most of the time, 6 – almost always, and 7 – always) from the literature (Clayton and Karazsia, 2020). Some of its items are "thinking about climate change makes it difficult for me to concentrate" and "I write down my thoughts about climate change and analyse them". It produced a satisfactory Cronbach's α = 0.9 in the consolidated data and a minimum of 0.78 for the groups. The data were generated with the item averaging method, which involves summing up the 13 items and dividing the total score by 13. Thus, scores ranged from 1 to 7, and larger scores signified higher climate anxiety.

We classified participants into severe, moderate, and mild climate anxiety groups with existing score thresholds (Whitmarsh et al., 2022): 1.00–3.31 (mild), 3.32–5.15 (moderate), and 5.16–7.00 (severe). About 46 % (n = 1844) of the participants were in the mild climate anxiety group, 40 % (n = 1594) were in the moderate climate anxiety group, and 14 % (n = 556) were in the severe climate anxiety group. Appendix A shows items of scales used.

3.5. Pilot study and scale transferability

The scales used in this study were not validated in Ghana, so we made sure they were transferable to the Ghanaian context. In a structured interview, the participants chose to complete the questionnaire in English instead of in any Ghanaian language. Hence, the questionnaire was piloted in English on 41–50 participants from each of the seven selected cities (total sample = 335) between June 3 and 27, 2024. The pilot study enabled us to identify and correct some typographical errors on two of the scales. The participants easily completed the questionnaire, and the Cronbach's α coefficients from the pilot study ranged from 0.76 to 0.91.

3.6. Questionnaire structure and validation

A self-reported questionnaire with two main sections was used to collect the data. The first section presented measures of optimism, self-efficacy, life engagement, resilience, and climate anxiety. The second section constituted questions measuring the confounding variables. The first section was preceded by a preamble stating the research aim, benefits of the research to society, ethical considerations, and instructions for survey completion. To avoid or minimise CMB, we adopted standard measures and put scales in unique sub-sections. The context for completing each scale or section was provided. Finally, we utilised Harman's one-factor method based on exploratory and confirmatory factor analyses (maximum likelihoods) to assess the factor structures of scales. Exploratory factor analysis yielded satisfactory results evidencing the absence of CMB. As suggested in the literature (Fuller et al., 2016; Podsakoff et al., 2003), each scale yielded at least two factors, where each factor produced <40 % of the total variance. The confirmatory factor analysis confirmed each factor structure from the exploratory factor analysis, and items of the scales had satisfactory factor loadings ≥0.5 (Podsakoff et al., 2003).

3.7. Statistical analysis

Data were analysed with SPSS 28 (IBM SPSS Inc., New York, USA) and AMOS 28 in two stages. In the first stage, data were summarised, missing data were analysed, and relevant statistical assumptions (i.e., linearity of the path model, and multivariate normal distribution) were assessed.

A "missing completely at random" test was performed to ascertain whether the 1 % to 3 % missing data on five indicator variables were randomly missing. This test was not significant at $p > 0.05$, suggesting the data were missing randomly (Woods et al., 2024). This outcome allowed us to handle missing data with the "multiple imputation" method (Woods et al., 2024). Box plots, kurtosis, and skewness evidenced the absence of outliers based on recommendations from the literature (Cain et al., 2017). Multivariate normality was assessed and confirmed through the path models used to quantify the associations

based on Cain and colleagues' (Cain et al., 2017) procedure. The critical ratios of the multivariate estimators of all models were between 1.96 and − 1.96 at 95 % confidence interval. The linearity of each hypothesised path was confirmed with *curve estimation* (Cleophas et al., 2016) at $p > 0.001$ for the linear function.

In the second stage, we fitted the crude or non-adjusted path model without the covariates on the severe climate anxiety group. The adjusted version of this model shown in Fig. 3 included the covariates. The crude and adjusted models were fitted to evaluate the potential impact of the covariates on the hypothesised effects. Versions of these models were fitted on the consolidated data and on the moderate and mild climate anxiety groups. The indirect effects were estimated with the 'user-defined estimands' procedure in Amos based on equations in Appendix B and 2000 bias-corrected bootstraps. Bootstrapping was based on a 95 % confidence interval. Estimates of model fit were generated through each path model, and the statistical significance of the result was detected at a minimum of $p < 0.05$.

4. Results

In Table 1, 53 % ($n = 2118$) of the participants were men whereas 88 % ($n = 3507$) were between 50 and 69 years. The average optimism (Mean = 34.76; SD = 5.59) and life engagement (Mean = 34.61; SD = 6.6) was about 35.

Optimism was positively associated with life engagement (β = 0.19; critical ratio = 6.52; $p < 0.001$; two-tailed) in the severe climate anxiety model (see Table 2). This association was consistent between the consolidated data (β = 0.11; critical ratio = 8.09; p < 0.001; two-tailed) and moderate climate anxiety model (β = 0.15; critical ratio = 6.52; p < 0.001; two-tailed) but was not significant in the mild climate anxiety model. Thus, higher optimism was associated with high life engagement in only the severe and moderate climate anxiety groups. Self-efficacy (β = 0.42; critical ratio = 12.53; p < 0.001; two-tailed) and resilience (β = 0.34; critical ratio = 9.45; p < 0.001; two-tailed) were positively associated with life engagement in the severe climate anxiety model. This result is consistent across the three other models.

In Table 3, self-efficacy (β = 0.19; p < 0.001; CI: 0.10–0.29) and resilience (β = 0.13; p < 0.001; CI: 0.08–0.19) each mediated the association of optimism with life engagement in the severe climate anxiety model, suggesting that self-efficacy and resilience transmitted the influence of optimism on life engagement. Self-efficacy and resilience (β = 0.08; p < 0.001; CI: 0.04–0.13) serially mediated the association of optimism with life engagement. Serial mediation means self-efficacy transmitted the influence of optimism on resilience, which in turn transmitted the influence on life engagement. These direct and indirect relationships in the severe climate anxiety model were consistent across the other three models. Yet, while the indirect effects of optimism through self-efficacy and resilience on life engagement were complete (absolute) in the mild climate anxiety model, they were partial in the other three models. All adjusted models had a good fit (see Table 4), although the severe climate anxiety model showed the best fit in terms of all fit indices, including chi-square = 1.43 ($p > 0.05$), RMSEA = 0.023, and 64.3 % of the total variance explained on life engagement.

Table 1
Summary and descriptive statistics on all variables ($N = 3994$).

Variable	Group	*n (%)*	*Mean*	*SD*	*Range*
Gender	women	1876 (47)			
	men	2118 (53)			
Education[a]	Basic or none	771 (19)			
	secondary+	3223 (81)			
Income (₵)[a]	<1500	1841 (46)			
	1500 or more	2153 (54)			
Age (yrs)[a]	50–69	3507 (88)			
	70 or older	487 (12)			
Chronic disease status	none	2641 (66)			
	one or more	1353 (34)			
Marital status	not married	1311 (33)			
	married	2683 (67)			
Self-reported health	poor	775 (19)			
	good	3219 (81)			
Climate anxiety severity	mild	1844 (46)			
	moderate	1594 (40)			
	severe	556 (14)			
Optimism	—	—	34.76	5.59	12–91
Resilience	—	—	38.66	6.58	10–50
Self-efficacy	—	—	31.11	5.56	8–40
Life engagement	—	—	34.61	6.60	9–45

[a] Multiple groups were recoded into two groups for structural equation modelling; n – frequency; SD – standard deviation; —Not applicable

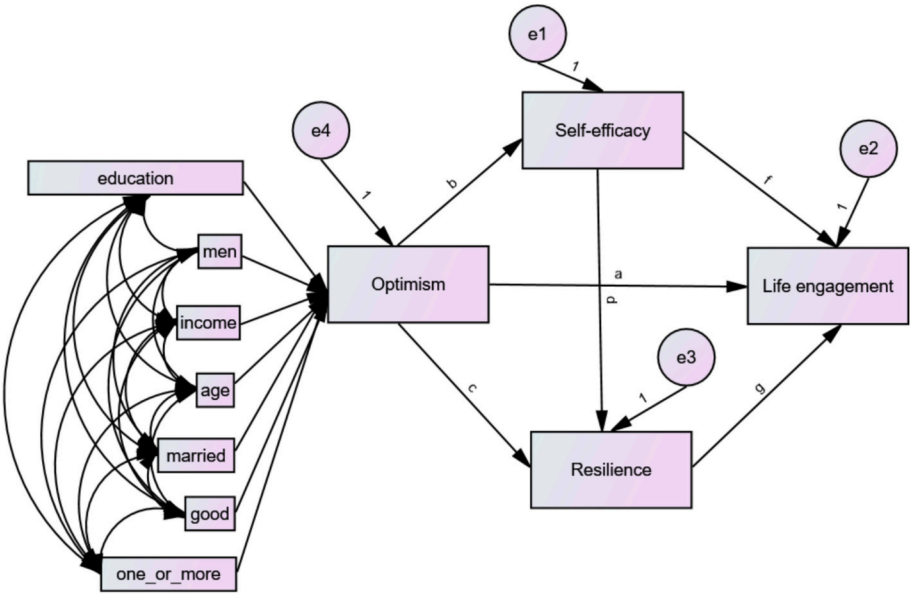

Fig. 3. The adjusted statistical model.

Table 2
Association of optimism, self-efficacy, and resilience with life engagement across levels of climate anxiety (N = 3994).

Dependent	Path	Predictor	Unstandardised Estimate (B)	*SE* (of B)	Critical ratio	95 % CI (of B)		Beta (β)	Unstandardised Estimate (B)	*SE* (of B)	Critical ratio	95 % CI (of B)		β
						Lower	Upper					Lower	Upper	
			Model 1: Severe climate anxiety (N = 556)						Model 2: Moderate climate anxiety (N = 1594)					
			Baseline											
Self-efficacy	<—	Optimism	0.398	0.042	9.397	0.213	0.566	0.370**	0.478	0.019	24.762	0.436	0.519	0.527**
Resilience	<—	Optimism	0.376	0.039	9.558	0.24	0.523	0.307**	0.409	0.023	17.856	0.347	0.471	0.387**
Resilience	<—	Self-efficacy	0.614	0.037	16.759	0.464	0.762	0.538**	0.453	0.025	17.904	0.383	0.525	0.388**
Life engagement	<—	Self-efficacy	0.483	0.038	12.534	0.38	0.571	0.420**	0.347	0.028	12.232	0.262	0.434	0.289**
Life engagement	<—	Resilience	0.343	0.036	9.445	0.26	0.434	0.341**	0.362	0.026	14.131	0.293	0.430	0.352**
Life engagement	<—	Optimism	0.237	0.036	6.515	0.155	0.324	0.192**	0.168	0.026	6.521	0.103	0.232	0.154**
			Adjusted											
Self-efficacy	<—	Optimism	0.398	0.042	9.397	0.213	0.566	0.370**	0.478	0.019	24.762	0.436	0.519	0.527**
Resilience	<—	Optimism	0.376	0.039	9.558	0.24	0.523	0.307**	0.409	0.023	17.856	0.347	0.471	0.387**
Resilience	<—	Self-efficacy	0.614	0.037	16.759	0.464	0.762	0.538**	0.453	0.025	17.904	0.383	0.525	0.388**
Life engagement	<—	Self-efficacy	0.483	0.038	12.534	0.38	0.571	0.420**	0.347	0.028	12.232	0.262	0.434	0.289**
Life engagement	<—	Resilience	0.343	0.036	9.445	0.26	0.434	0.341**	0.362	0.026	14.131	0.293	0.43	0.352**
Life engagement	<—	Optimism	0.237	0.036	6.515	0.155	0.324	0.192**	0.168	0.026	6.521	0.103	0.232	0.154**
Optimism	<—	Age (70 yrs. or older)[a]	1.411	0.497	2.841	0.554	2.214	0.120*	1.101	0.447	2.463	0.181	1.976	0.062*
Optimism	<—	SRH (good)[b]	0.49	0.539	0.909	−0.571	1.532	0.046	1.811	0.342	5.3	1.124	2.484	0.145**
Optimism	<—	MS (married)[c]	0.902	0.418	2.158	0.114	1.684	0.092*	1.417	0.287	4.943	0.849	1.977	0.127**
Optimism	<—	CDS (one or more)[d]	−1.659	0.52	−3.192	−2.755	−0.558	−0.159**	−0.611	0.303	−2.02	−1.186	−0.011	−0.053*
Optimism	<—	Education (secondary+)[e]	0.054	0.511	0.105	−0.841	1.047	0.005	−0.325	0.325	−1.003	−0.988	0.349	−0.025
Optimism	<—	Gender (men)[f]	−0.079	0.371	−0.212	−0.782	0.649	−0.009	−0.375	0.267	−1.407	−0.887	0.143	−0.034
Optimism	<—	Income (₵ 1500+)[g]	0.645	0.434	1.487	−0.063	1.362	0.065	−0.022	0.269	−0.082	−0.559	0.503	−0.002
			Model 3: Mild climate anxiety (N = 1844)						Model 4: Consolidated data (N = 3994)					
			Baseline											
Self-efficacy	<—	Optimism	0.354	0.023	15.482	0.264	0.436	0.339**	0.431	0.014	30.368	0.38	0.481	0.433**
Resilience	<—	Optimism	0.45	0.026	17.609	0.386	0.528	0.355**	0.417	0.016	26.181	0.374	0.463	0.354**
Resilience	<—	Self-efficacy	0.43	0.025	17.548	0.365	0.492	0.354**	0.471	0.016	29.465	0.423	0.515	0.399**
Life engagement	<—	Self-efficacy	0.602	0.023	26.144	0.549	0.655	0.517**	0.538	0.016	32.929	0.497	0.581	0.454**
Life engagement	<—	Resilience	0.221	0.02	10.892	0.175	0.265	0.230**	0.264	0.015	18.005	0.227	0.298	0.263**
Life engagement	<—	Optimism	0.043	0.024	1.801	−0.011	0.095	0.036	0.129	0.016	8.086	0.093	0.165	0.109**
			Adjusted											
Self-efficacy	<—	Optimism	0.354	0.023	15.482	0.267	0.439	0.339**	0.431	0.014	30.368	0.38	0.481	0.433**
Resilience	<—	Optimism	0.45	0.026	17.609	0.385	0.527	0.355**	0.417	0.016	26.181	0.374	0.463	0.354**
Resilience	<—	Self-efficacy	0.43	0.025	17.548	0.365	0.491	0.354**	0.471	0.016	29.465	0.423	0.515	0.399**
Life engagement	<—	Self-efficacy	0.602	0.023	26.144	0.551	0.657	0.517**	0.538	0.016	32.929	0.497	0.581	0.454**

(*continued on next page*)

Table 2 (*continued*)

Dependent	Path	Predictor	Unstandardised Estimate (B)	*SE* (of B)	Critical ratio	95 % CI (of B) Lower	Upper	Beta (β)	Unstandardised Estimate (B)	*SE* (of B)	Critical ratio	95 % CI (of B) Lower	Upper	β
			Model 1: Severe climate anxiety (N = 556)						Model 2: Moderate climate anxiety (N = 1594)					
			Baseline											
Life engagement	<—	Resilience	0.221	0.02	10.892	0.174	0.264	0.230**	0.264	0.015	18.005	0.227	0.298	0.263**
Life engagement	<—	Optimism	0.043	0.024	1.801	−0.011	0.094	0.036	0.129	0.016	8.086	0.093	0.165	0.109**
Optimism	<—	Age (70 yrs. or older)[a]	−0.271	0.427	−0.635	−1.144	0.575	−0.016	0.838	0.274	3.056	0.306	1.396	0.049*
Optimism	<—	SRH (good)[b]	0.804	0.413	1.948	−0.054	1.746	0.048	1.598	0.241	6.624	1.095	2.080	0.113**
Optimism	<—	MS (married)[c]	0.091	0.301	0.304	−0.507	0.688	0.007	1.057	0.191	5.525	0.663	1.424	0.089**
Optimism	<—	CDS (one or more)[d]	−0.898	0.297	−3.023	−1.536	−0.225	−0.076*	−0.864	0.199	−4.352	−1.301	−0.467	−0.073**
Optimism	<—	Education (secondary+)[e]	−0.212	0.353	−0.601	−0.939	0.513	−0.014	−0.148	0.224	−0.659	−0.592	0.350	−0.010
Optimism	<—	Gender (men)[f]	0.414	0.267	1.549	−0.133	0.949	0.036*	−0.044	0.174	−0.253	−0.392	0.298	−0.004
Optimism	<—	Income (₵ 1500+)[g]	−0.146	0.27	−0.54	−0.716	0.391	−0.013	0.370	0.176	2.100	0.020	0.715	0.033

SE – standard error; CI – confidence interval; SRH – self-reported health; MS – marital status; CDS – chronic disease status; CI was based on 2000 bias-corrected sampling iterations; [a]reference group is people aged 50–69 years; [b]reference group is people with poor health; [c]reference group is older adults who were not married; [d]reference group is people with no chronic disease; [e]reference group is people with basic or no education; [f]reference group is women; [g]reference group is older adults who earned <1500 cedis.

** $p < 0.001$.

* $p < 0.05$.

5. Discussion

5.1. Summary of results

This study assessed the association of optimism with life engagement and ascertained whether this relationship is mediated by self-efficacy and resilience among older adults with severe climate anxiety. Optimism was associated with higher life engagement among older adults with severe and moderate climate anxiety but not among those with mild climate anxiety. Self-efficacy and resilience partially mediated the association of optimism with life engagement among older adults with severe and moderate climate anxiety but fully mediated this relationship among older adults with mild climate anxiety.

5.2. Discussion of results

Although empirical evidence suggests optimism can be associated with social engagement (Koga et al., 2024; Pavey et al., 2015; Waterworth et al., 2019), this is the first study to confirm a positive link between optimism and life engagement among older adults with severe climate anxiety. This evidence is important because life engagement encompasses employment, financial autonomy, and support for familial and peripheral social ties, which traditional measures of social engagement do not include. Work engagement and financial independence in old age are necessary for quality of life and the individual's maximum impact on the economy. Our results imply that older adults with high optimism can remain engaged with life, despite experiencing severe climate anxiety.

Optimism was found to be indirectly associated with life engagement, an outcome from a confirmation of all hypotheses (i.e., H_1-H_6) in the severe climate anxiety group. This result means self-efficacy and resilience transmitted the influence of optimism on life engagement. Notable is the serial mediation of the optimism-life-engagement link by self-efficacy and resilience (i.e., the mediators), which means self-efficacy transmitted the influence from optimism on resilience, which in turn transmitted the influence on life engagement. The above mediation is partial among older adults with severe climate anxiety, implying that optimism can still predict higher life engagement without the intervention of the mediators. With partial mediation, the potential mediators (i.e., self-efficacy, and resilient) are less important (O'Rourke and MacKinnon, 2015; Reinhold et al., 2018) since the primary predictor (i.e., optimism) can still predict the dependent variable (life engagement) without them. Although our confirmation of the six hypotheses is supported in the general population, this study is the first to confirm the above mediation among older adults with severe climate anxiety.

The direct and indirect association of optimism with life engagement was consistent between severe and moderate climate anxiety groups, although optimism's strongest direct relationship with life engagement was in the severe climate anxiety group. Optimism did not predict life engagement in the mild climate anxiety group, setting the basis for the complete mediation of the optimism-life-engagement relationship by self-efficacy and resilience. Thus, self-efficacy and resilience are necessary for life engagement in the mild climate anxiety group. The direct and indirect standardised regression weights are generally smaller for the moderate and mild groups, which supports our argument that psychological capital may more strongly predict life engagement in the severe climate anxiety group.

The results support our theoretical synthesis centred on the SST, and the fundamental theoretical idea corroborated is that psychological capital may better support life engagement and possibly well-being among older adults experiencing severe climate anxiety. Climate anxiety is an indicator of adverse life experiences, so our results could be generalised to older adults experiencing other extreme events. Noteworthy is our confirmation of the direct and indirect association of optimism with life engagement on the consolidated data. This outcome

Table 3
Indirect effects of optimism on life engagement through self-efficacy, and resilience.

Parameter	Beta (β)	95 % CI		p	Beta (β)	95 % CI		p
		Lower	Upper			Lower	Upper	
	Model 1: Severe climate anxiety (N = 556)				Model 2: Moderate climate anxiety (N = 1594)			
Baseline								
OPT– > SE– > LE	0.192	0.097	0.291	***	0.166	0.126	0.207	***
OPT– > RES– > LE	0.129	0.077	0.193	***	0.148	0.116	0.183	***
OPT– > SE– > RES– > LE	0.084	0.042	0.134	***	0.078	0.057	0.101	***
Adjusted								
OPT– > SE– > LE	0.192	0.097	0.291	***	0.166	0.126	0.207	***
OPT– > RES– > LE	0.129	0.077	0.193	***	0.148	0.116	0.183	***
OPT– > SE– > RES– > LE	0.084	0.042	0.134	***	0.078	0.057	0.101	***
	Model 3: Mild climate anxiety (*N* = 1844)				Model 4: Consolidated data (N = 3994)			
Baseline								
OPT– > SE– > LE	0.213	0.159	0.267	***	0.232	0.201	0.263	***
OPT– > RES– > LE	0.099	0.075	0.126	***	0.110	0.091	0.129	***
OPT– > SE– > RES– > LE	0.034	0.023	0.046	***	0.054	0.043	0.065	***
Adjusted								
OPT– > SE– > LE	0.213	0.159	0.267	***	0.232	0.201	0.263	***
OPT– > RES– > LE	0.099	0.075	0.126	***	0.11	0.091	0.129	***
OPT– > SE– > RES– > LE	0.034	0.023	0.046	***	0.054	0.043	0.065	***

OPT – optimism; SE – self-efficacy; LE – life engagement; RES – resilience; CI – confidence interval; estimates were based on 2000 bias-corrected sampling interactions at 95 % CI.
*** $p < 0.001$.

Table 4
Fit statistics of the baseline and adjusted models.

Model name	Chi-square	GFI	TLI	RMSEA	R square[a]
Baseline models					
Consolidated data	293.21	0.901	0.876	0.543	0.493
Severe climate anxiety	187.34	0.921	0.911	0.432	0.643
Moderate climate anxiety	211.41	0.919	0.901	0.472	0.464
Mild climate anxiety	342.21	0.894	0.891	0.621	0.454
Adjusted models					
Consolidated data	1.921	0.988	0.956	0.054	0.493
Severe climate anxiety	1.432	0.999	0.976	0.023	0.643
Moderate climate anxiety	1.661	0.997	0.962	0.042	0.464
Mild climate anxiety	2.122	0.977	0.954	0.061	0.454

[a] the variance explained by all dependent variables on life engagement in the model; GFI – goodness of fit index; TLI – Tucker-Lewis Index; RMSEA – root mean square error of approximation.

is important because no study had tested the path model on older adults, and the evidence on the whole sample offers a better opportunity for inference and decision-making, especially in contexts where decision-makers are not interested in evidence on the climate anxiety groupings. By extending the evidence beyond the three groupings, this study builds on research (Hajek and Konig, 2019; Strough et al., 2024; Waterworth et al., 2019) regarding the role of psychological capital among older adults' well-being. Evidence on the whole sample also supports an application of the results to policymaking for the older adult population.

5.3. Implications for practice and policy

Older adults can maintain life engagement when experiencing severe climate anxiety, which implies older adults with functional capacity can participate in community engagement activities (e.g., relief work, and volunteering) even if they are anxious about the climate crisis. Items relating to volunteering and community engagement are part of the life engagement scale used, and older adults are known to volunteer and support relief work (Ezulike et al., 2024; Sharifi et al., 2024). This study suggests older people may have the psychological capability to support community programmes (e.g., relief work) when they are severely anxious about crises. Thus, they may prove useful in situations where neighbours are expected to support each other in response to crises. That said, older adults' perception as the least productive group of the population may be wrong in contexts experiencing crises.

A full mediation was seen in only the mild climate anxiety group, which means resilience and self-efficacy are necessary for the positive influence of optimism on life engagement in this group. This result implies that training to enhance self-efficacy and resilience would better support life engagement in this group, compared with the other two groups. In any case, training opportunities for boosting psychological capital would be needed by all older adults. These opportunities can only be well targeted if stakeholders (e.g., governments and employers) invest regularly in research aimed at classifying older individuals into the three groups. Routine monitoring of climate anxiety levels is necessary for supporting older adults and determining which group needs the most support and training.

Researchers (Hajek and Konig, 2022; Ogunbode et al., 2022) have observed that individuals with severe climate anxiety would depend more on the healthcare system. Our result suggests older adults with high psychological capital can maintain life engagement despite their moderate or severe climate anxiety. Such older adults may be protected from diseases requiring hospitalisation, given that life or social engagement is associated with well-being and protects against disease (Hajek and Konig, 2022; Ng et al., 2011; Sommerlad et al., 2023; Thomas, 2012), especially if maintained over time (Thomas, 2012). This insight signifies the important role of psychological capital in maintaining life engagement despite moderate or severe climate anxiety. Investment in training aimed at enhancing older adults' psychological capital could, thus, alleviate the burden of mental health disorders from climate anxiety and their healthcare. Even so, this study could not assess whether psychological capital is associated with higher life engagement in the long term, so future studies should test our path model using data collected over time.

Our results have implications for West Africa and similar less developed sub-regions. West African countries are tropical nations experiencing heatwaves disproportionately (Putsoane et al., 2024). Heat-related mortality and hospitalisation are expected to increase over time in these countries (Lüthi et al., 2023; Manyuchi et al., 2022). In a situation where hospitalisation and mortality increase due to extreme

weather, older adults would seek social isolation or experience mental health declines. Helping older adults to improve their resilience, self-efficacy, and optimism in such contexts can maximise life engagement. Yet, unique socioeconomic and cultural factors not considered in this study (e.g., religious practices, and poverty) may affect climate anxiety, perceptions about extreme weather, and life engagement. Less educated individuals devoted to traditional African religions, for example, may misconstrue climate crises as collective punishment from God or gods. Such individuals may possess high psychological capital but would be unable to savour it to maintain life engagement due to their religious beliefs. Given the paucity of climate anxiety research in West Africa, these socio-cultural dynamics should be further studied.

This study also implies resilience, self-efficacy, and optimism can be associated with higher life engagement, which characterises frequent participation in social, economic, and employment-related activities. Individuals who have higher self-efficacy and are more optimistic and resilient can better maintain their inclusion in society as they age. Hence, investing in human development programmes for enhancing self-efficacy, optimism, and resilience is a potential strategy for encouraging life engagement in old age. Such programmes would be more beneficial as community engagement initiatives in contexts experiencing extreme climate events where older residents are more likely to seek safety by socially isolating themselves. Social isolation may compound the health risks of climate change, so reducing it at the population level during the crises is imperative. Governments are encouraged to adopt a national policy that makes human development programmes for improving psychological capital a national priority.

Economic problems in West Africa and similar sub-regions may worsen during the climate crisis. Hence, the above-mentioned policy should ideally prioritise the enhancement of self-efficacy over the improvement of other psychological capital factors, given that self-efficacy best predicts life engagement in our consolidated data. Investing in training for enhancing only self-efficacy may yield the best impact on the population in a situation where stakeholders cannot fund training for improving all the three psychological capital factors. Given the following limitations of this study, future researchers should employ the best research design to assess the relative impacts of the psychological capital factors on life engagement and health, enabling stakeholders to prioritise the most economically rewarding factor(s).

5.4. Limitations and strengths

This study may not provide evidence representative of the general population, given that it focused on older adults in Ghana. The results from this study may not fully describe situations in developed countries (e.g., the United Kingdom, Germany, and Australia) where there is probably more welfare and social support for older adults. Governmental support for older adults in Ghana is limited (Braimah and Rosenberg, 2021; Kpessa-Whyte and Tsekpo, 2020), so ratings of climate anxiety may be higher in Ghana, compared to ratings from developed countries. This study could not eliminate confounding and establish causation between the variables as it adopted the cross-sectional design. Hence, future research should include any confounding variables not included in this study and employ experimental designs if possible. This study utilised self-reported and subjective measures, implying it was vulnerable to response or social desirability bias. The use of these measures was unavoidable since there was no objective method for measuring the psychological capital factors.

This was the first study to integrate the three psychological capital factors in a single model for path analysis. Testing the path model concurrently with SEM mitigated the risk of confirming non-existent relationships or reaching wrong effect sizes. This study enhances stakeholders' understanding of whether psychological capital predicts higher life engagement among older adults with severe climate anxiety. It adds to and corroborates the theoretical view that older adults experience more positive affect and are, therefore, more likely to remain engaged with life even when experiencing severe climate anxiety. The sensitivity analysis enabled us to explore the relationships in the whole older adult sample for the first time. It also made way for assessing the stability of the effect sizes across levels of climate anxiety, unfolding important implications for practice, and allowing researchers and decision-makers to understand how the psychological capital factors may predict life engagement at different levels of climate anxiety. A multi-stage sampling method was used in this study to maximise the size and representativeness of the sample, and the statistical analyses included assumptions tests and checks against confounding.

6. Conclusion

Psychological capital may be more strongly associated with higher life engagement among older adults with severe climate anxiety. This study suggests a need for human development programmes aimed at improving the resilience, optimism, and self-efficacy of older adults. These programmes may be rolled out through a national policy adopted to provide older adults with psychological capital against climate anxiety. Such a policy may enforce training of older adults through community engagement initiatives accessible to older adults. Even so, decision-makers should be cognizant of socio-cultural factors (e.g., religion, poverty, and education) that may discourage participation in the initiatives and weaken the optimal impact of psychological capital on health indicators. Future studies exploring socio-cultural dynamics in the impact of psychological capital on health outcomes among older adults experiencing severe, mild, and low climate anxiety are needed.

CRediT authorship contribution statement

Nestor Asiamah: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Henry Kofi Mensah:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Data curation, Conceptualization. **Edward Wilson Ansah:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Data curation, Conceptualization. **Eric Eku:** Writing – review & editing, Validation, Supervision, Resources, Data curation, Conceptualization. **Nana Benyi Ansah:** Writing – review & editing, Visualization, Resources, Data curation, Conceptualization. **Emelia Danquah:** Writing – review & editing, Visualization, Supervision, Resources, Data curation, Conceptualization. **Cosmos Yarfi:** Writing – review & editing, Validation, Supervision, Resources, Funding acquisition, Data curation, Conceptualization. **Isaac Aidoo:** Writing – review & editing, Resources, Funding acquisition, Data curation, Conceptualization. **Frank Frimpong Opuni:** Writing – review & editing, Validation, Resources, Conceptualization. **Simon Mawulorm Agyemang:** Writing – review & editing, Validation, Resources, Data curation, Conceptualization.

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Declaration of competing interest

The authors had no conflict of interest.

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Appendix A. Scales used to measure optimism, climate anxiety, resilience, self-efficacy, and life engagement

Appendix A1
Items of the climate change anxiety scale

No	Item	1	2	3	4	5	6	7
1	Thinking about climate change makes it difficult for me to concentrate.							
2	Thinking about climate change makes it difficult for me to sleep.							
3	I have nightmares about climate change.							
4	I find myself crying because of climate change.							
5	I think, "why can't I handle climate change better?							
6	I go away by myself and think about why I feel this way about climate change.							
7	I write down my thoughts about climate change and analyze them.							
8	I think, "why do I react to climate change this way?"							
9	My concerns about climate change make it hard for me to have fun with my family or friends.							
10	I have problems balancing my concerns about sustainability with the needs of my family.							
11	My concerns about climate change interfere with my ability to get work or school assignments done.							
12	My concerns about climate change undermine my ability to work to my potential.							
13	My friends say I think about climate change too much.							

Note: 1 – not at all, 2 – practically never, 3 – seldom, 4 – sometimes, 5 – most of the time, 6 – almost always, and 7 – always.

Appendix A2
Items of the optimism scale

No	Item	1	2	3	4	5
1	I believe that I will accomplish the main goals of my life.					
2	When I think about the future, I am positive.					
3	More good than bad things happen to me.					
4	I think everything will go wrong.					
5	I see each challenge as an opportunity for success.					
6	I find positive aspects even when things go wrong.					
7	I see the positive side of things.					
8	I am confident to overcome problems.					
9	I am confident about the future.					

Note: 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree.

Appendix A3
Items of the resilience scale

No	Item	1	2	3	4	5
1	I am able to deal with change					
2	I can deal with whatever comes my way					
3	I try to see the funny side of things when I am faced with problems					
4	Dealing with stress can make me stronger					
5	I tend to bounce back after being sick, injury, or other hardships					
6	I believe I can achieve what I want, even if there are problems					
7	Under pressure, I still think clearly					
8	I do not lose hope from failure					
9	I think of myself as a strong person when dealing with life's challenges and difficulties					
10	I am able to handle unpleasant or painful feelings like sadness, fear and anger					

Note: 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree.

Appendix A4
Items of the self-efficacy for social inclusion

No	Item	1	2	3	4	5
1	I can participate in the activities or volunteer work of my neighbourhood associations.					
2	I can create an environment in which my neighbours can comfortably gather.					
3	I can encourage nearby neighbours to come out to gatherings.					
4	I can discuss my concerns about residents at neighbourhood gatherings or community meetings held by local government.					
5	I can check in on elderly neighbours if I do not see them for a few days.					
6	I can help older neighbours with grocery shopping, garbage disposal, and other chores.					
7	I can check in on neighbourhood households where there are no signs of activity there.					
8	When I notice a person I do not know in the neighbourhood, I can speak to them.					

Note: 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree.

Appendix A5
Items of the life engagement scale

No	Item	1	2	3	4	5
1	I provided concern and support to enrich the lives of nuclear family members (e.g., husband or wife).					
2	I provided concern and support to enrich the lives of extended family members (e.g., niece or uncle).					
3	I provided concern and support to enrich the lives of my neighbours.					
4	I provided concern and support to enrich the lives of friends, colleagues, or workmates.					
5	Overall, I was concerned about and supportive of people around me to enrich their lives.					
6	I make a financial or productive contribution to my family.					
7	I make a financial or productive contribution to my career and work.					
8	I make a financial or productive contribution to my community or non-profit making organizations.					
9	Overall, I contributed to society (including contributions made to my family, my career and work, and the community).					

Note: 1 – strongly disagree, 2 – disagree, 3 – somewhat agree, 4 – agree, and 5 – strongly agree

Appendix B. Equations used to compute the indirect effects and coefficients through user-defined estimtands

Opt_self_efficacy_engagement=b*f
Opt_resiliece_engagement=c*g
Opt_self_efficacy_resilience_engagement=b*d*g

Note: b, c, d, f, and g represent effect sizes (please see Fig. 3).

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