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# Lifespan trajectories of negative and positive affect: A coordinated analysis of 14 longitudinal studies

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## Abstract

Lifespan developmental theories suggest age-related shifts in motivation, cognition, emotion regulation, and stressor experience lead to changes in mean levels of negative and positive affect across the lifespan. The present research used coordinated data analysis to examine mean-level affective trajectories in 186,752 participants ranging from 11–104 years old across 14 longitudinal studies. Random-effects models were used to estimate meta-analytic effect sizes. On average, negative affect decreased until early older adulthood, and then remained stable throughout older adulthood. Meanwhile, positive affect remained stable across most of the younger and middle-aged adult lifespan, before starting its descent in later middle-aged adulthood and continuing to decline throughout older adulthood. Studies with older samples showed a clearer flattening effect of negative affect and steeper decline of positive affect in late-life relative to younger samples. These findings suggest that lifespan developmental affect trajectories are nuanced and not a direct inverse of each other.

## Plain language summary

The current project brings together people from across the world to understand how their experiences of positive and negative emotions change. Using 14 different longitudinal studies (i.e., studies where the same people answer the same questions every few years) with over 185,000 people from the United States, Western Europe, and Australia, we investigated how people's emotional experiences changed as they got older. We found that people typically experience the highest frequency of positive emotions in young adulthood and middle-aged adulthood, and then this frequency decreases as people age during older adulthood. Negative emotions follow quite a different pattern, with negative emotions being at their peak in adolescence and young adulthood, before decreasing as people get into the early years of older adulthood. Contrary to expectations, the frequency of negative emotions continued to stay at low levels late in older adulthood. Put in years, the frequency of positive emotions was highest when people were in their 20 s and thirties, began to decrease in their 40 s, and continued to decrease until end of life. Meanwhile, the frequency of negative emotions was highest when people were in their 20 s, decreased until people were in their 60 s, and remained stable at these low levels until the end of life. While experiences of joy, excitement, or happiness may decrease as people get older, the assumption that negative emotions will increase as well is not supported from the current study as feelings of frustration, sadness, and distress remain low in later years.

## Keywords

positive affect, negative affect, lifespan development, age trajectories, coordinated data analysis (CDA)

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## Introduction

Negative and positive affect are core components of well-being and have wide-reaching implications for psychological and physical health (Boehm, 2018; Brown et al., 1998; Chida & Steptoe, 2008; Cross et al., 2018; Diener et al., 1999; Fredrickson, 2004; Willroth et al., 2023). Lifespan developmental theories suggest that mean levels of negative and positive affect change as people age, though empirical evidence supporting the trajectories of these age-based changes is mixed. Understanding general age-related changes in negative and positive affect has been of interest to researchers for decades (e.g., Charles et al., 2001; Mroczek & Kolarz, 1998), as identifying trajectories can point to when in the lifespan an individual may be most vulnerable to experiencing poor affective well-being.

### *Lifespan developmental theories of age-related changes in negative and positive affect*

As age-related shifts in motivation, cognition, emotion regulation, and stressor experience are possible, affect has been suggested to display mean-level changes over the life course (Carstensen, 2006; Carstensen & Mikels, 2005; Graham et al., 2006; Labouvie-Vief, 2003). For example, socioemotional selectivity theory (SST; Carstensen, 1993, 2006, 2021; Carstensen et al., 1999) posits that, as people age, they experience a motivational shift from pursuing future-oriented goals to prioritizing the present moment. Consequently, younger and middle-aged adults may sacrifice their current affective well-being in the pursuit of future-oriented goals, while older adults may avoid negative emotional experiences to prioritize their current affective well-being. Central to this theory is the belief that negative affect decreases later in the lifespan as older adults prioritize less negative emotion-inducing experiences.

In line with the age-related change pattern suggested by the SST, the strength and vulnerability integration (SAVI) theoretical framework (Charles, 2010) argues that people accrue knowledge and experience across the lifespan that may make it easier for them to down-regulate negative affect and up-regulate positive affect, implying decreases in negative affect and increases in positive as people age. However, this framework also notes that these are simply the mean-level trajectories and that some older adults may not follow these trends based on potentially negative events or environmental contexts that they cannot avoid. As such, the presumed negative and positive affect trajectories of SAVI generally align with SST while also noting the likelihood of individual differences in aging-based change.

Dynamic integration theory (DIT) proposes a similar lifespan trajectory of negative and positive affect as these other frameworks (Labouvie-Vief, 2003). According to the DIT, the developmental tasks of younger and middle adulthood contribute to increasing levels of affective complexity. Later, older adults compensate for declining cognitive resources by prioritizing less cognitively demanding positive emotions and curbing the integration of more cognitively demanding negative emotions. Consistent with DIT, evidence has been found that older adults attend to positive rather than negative stimuli more than younger adults (Carstensen & Mikels, 2005; Charles & Carstensen, 2008; Kennedy et al., 2004), helping older adults maintain higher levels of positive affect and lower levels of negative affect.

Taken together, the majority of lifespan theories of affective development predict age-related increases in positive affect and age-related decreases in negative affect. Alternatively, based on Selection–Optimization–Compensation (SOC) theory (Baltes, 1997; Baltes & Baltes, 1990), this pattern may decelerate or reverse in latest life, when cognitive and physical health decline and personal losses increase. Thus, these findings would suggest a quadratic rather than linear form of change. Put differently, negative affect may decrease and positive affect may increase with age-related experience, expertise, and motivations (Charles, 2010; Labouvie-Vief, 2003), up until a change point where age-related health declines and losses could reverse this pattern.

### *Empirical evidence for age-related changes in negative and positive affect*

Empirical evidence is generally consistent with age-related decreases in *negative* affect (Charles et al., 2001; Grühn et al., 2010; Hudson et al., 2016; Jebb et al., 2020; Joiner et al., 2018; Kessler & Staudinger, 2009; Mak & Schneider, 2022; Shi et al., 2009; Stacey & Gatz, 1991; Windsor & Anstey, 2010; Windsor et al., 2013), although not all studies have observed this pattern (e.g., Kunzmann et al., 2000). Moreover, some studies have found evidence that this decline in negative affect slows or reverses in late life (Carstensen et al., 2011; Griffin et al., 2006; Lachman et al., 2015; Schilling et al., 2013). Indeed, a recent traditional meta-analysis based on 129 unique samples with a total of 65,274 participants found that negative affect typically decreases until people's 60s, and then begins to increase (Buecker et al., 2023).

Evidence for age-related trajectories of positive affect is more mixed, with studies finding no association between positive affect and age (Carstensen et al., 2011; Grühn et al., 2010; Shi et al., 2009), positive associations between positive affect and age (Kessler & Staudinger, 2009; Windsor et al., 2013), negative associations between positive affect and age (Griffin et al., 2006; Hudson et al., 2016; Jebb et al., 2020; Kunzmann et al., 2000; Schilling et al., 2013; Stacey & Gatz, 1991), and nonlinear relationships between positive affect and age (Charles, 2010; Gana et al., 2015; Joiner et al., 2018; Lachman et al., 2015; Mak & Schneider, 2022; Windsor et al., 2013). Some studies have found differences when comparing cross-sectional and longitudinal methods within the same sample (Charles et al., 2023; Hansen & Slagsvold, 2012; Joiner et al., 2018), and meta-analytic work based on 128 unique samples with a total of 88,162 participants has found a linear decrease in positive affect starting in childhood (Buecker et al., 2023). In sum, research is highly mixed regarding how experiences of positive affect shift as individuals age.

### The benefits of coordinated data analysis

A recent meta-analysis found, across 65,274 participants for negative affect and 88,162 participants for positive affect, general decreases in both negative and positive affect across most of the lifespan (Buecker et al., 2023). Using individual participant data from 14 longitudinal studies and over 186,000 participants, the current study takes a complementary approach to this meta-analysis in a few primary ways. First, the primary difference between coordinated data analysis (CDA) and traditional meta-analysis is that CDA uses individual participant data and includes the full body of results in the meta-analytic estimate, whereas traditional meta-analysis uses aggregated effect size estimates across studies (Hofer & Piccinin, 2009). Traditional meta-analyses suffer from the file drawer problem because nonsignificant findings are less likely to be submitted and published. Due to this, age findings for positive and negative affect may have been overestimated in the published literature. Second, because the previous meta-analysis did not use individual participant data, the authors had to create 12 age categories starting at age nine and going up to 80+. Given age is a naturally continuous variable, more accurately and precisely evaluating the lifespan developmental trajectories of affect requires modeling age continuously. Based on previous theoretical and empirical evidence, affect is likely to change in a quadratic form; however, individual participant data are necessary to test nonlinear change trajectories of affect more precisely (i.e., to treat age continuously instead of in discrete categories).

Modeling the trajectories of the individual participant data also allows for modeling these trajectories quadratically and the exploration of the extent of individual differences in change trajectories across datasets. Finally, the inclusion criteria in the meta-analysis by Buecker et al. (2023) specified studies must have positive affect *or* negative affect, with many studies only including one or the other. Differences in findings for positive and negative affect in the meta-analysis could be driven by sample and study specific characteristics rather than nuances tied to negative and positive affect themselves. Thus, a strength of the current study is our ability to directly compare positive and negative affect trajectories and to evaluate their between- and within-person associations throughout the aging process.

### The current study

The current study uses a coordinated data analysis approach, which allows for the harmonization of variables across different samples to estimate a meta-analytic effect for the question of interest (e.g., Beauchamp et al., 2022; Graham et al., 2022; Jenkins et al., 2022; Kelly et al., 2016; Piccinin et al., 2013; Yoneda et al., 2022). By using individual participant data from multiple samples, we are better able to ensure that all results are included in our meta-analytic estimate regardless of the direction or significance of the effects. Moreover, in traditional meta-analyses, investigators are limited by the analytic decisions made by the individual study authors, with studies often using different analytic approaches and including different covariates and parameter constraints when drawing their conclusions. The benefit of CDA is that, while we are still limited by the study design differences in the individual datasets, we can hold constant all analytic decisions, such as the constraints of parameters and the inclusion of random effects.

Similar to a traditional meta-analysis, but while using individual participant data, coordinated data analyses also allow for the exploration of study-level moderators. With findings conflicting for age-related affect trajectories across studies, evaluating potential methodological and sample characteristics could shed light onto when and for whom negative and positive affect changes. The current project evaluated four study-level moderators: average baseline age, country in which the study was based, the average number of measurement occasions, and affect scale used. Because these samples have differing age ranges, we evaluated whether trajectories differed based on the average baseline age of the sample. Also, research has highlighted that certain aspects of well-being trajectories may be in part tied to country of residence (Blanchflower, 2021), so the current study will explore whether the linear and quadratic trajectories of affect differ based on country of residence. As the current project has six samples from the United States and eight from other countries (i.e., two from Australia, two from Germany, two from Netherlands, and two from Sweden), this project is limited to comparing trajectories based on residency in the United States or not. On the methodological front, studies differed on numbers of measurement occasions and affect scales used. Though traditional meta-analytic work has indicated these methodological differences do not explain heterogeneity across studies (Buecker et al., 2023), we included these moderators to investigate whether this was the case when using individual participant data.

To address inconsistent findings in previous work, the present research used 14 longitudinal datasets to examine mean-level trajectories of positive and negative affect across the adolescent and adult lifespan in a coordinated data analysis (Beauchamp et al., 2022; Graham et al., 2020; Jenkins et al., 2022; Kelly et al., 2016; Piccinin et al., 2012; Yoneda et al., 2022). The conceptual harmonization of different longitudinal studies using the coordinated data analysis approach allowed 14 independent opportunities for conceptual replication, while also accounting for differences in country of data collection, measurement type, and sample characteristics.

## Method

The current study used 14 longitudinal datasets, including publicly available and archived datasets as well as datasets found through the Integrative Analysis of Longitudinal Studies on Aging and Dementia (IALSA) network, maelstrom.org, and introduced through the review process. The main inclusion criteria were (1) at least three waves of negative *and* positive affect given the necessity of multiple waves to appropriately tease apart age-based changes (e.g., Galambos et al., 2021; Galambos et al., 2020) and (2) the data were accessible to the study team. Thus, we included

14 independent longitudinal datasets with a combined sample size of 186,572 across datasets. See Table 1 for descriptive information about each dataset.

## Samples

Descriptive information for the first six analytic waves from each study can be found in Supplemental Table 1. Means, standard deviations, ranges, and sample sizes for age, negative affect, and positive affect by study and wave are reported here.

*The National Longitudinal Study of Adolescent to Adult Health.* The National Longitudinal Study of Adolescent to Adult Health (ADDH) is a nationally representative sample of United States adolescents that began in 1994–1995 (Harris, 2013). Participants completed the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977; Lewinsohn et al., 1997) every 6 years to gauge their negative and positive affect over the past 7 days, with a total of four measurement occasions over a 24-year period. A total of 6502 participants (Age: $M$ = 15.91, $SD$ = 1.75, range = 11–26 at the analytic baseline; 53% female) completed at least one measurement of affect. There were 5286 individuals who completed at least three measurements and 3336 who completed at least four.

*The Australian Longitudinal Study of Ageing.* The Australian Longitudinal Study of Ageing (ALSA) began in 1992 out of Adelaide, South Australia, with participants who were at least 65 years old (Luszcz et al., 2016). Participants completed the CES-D over varying periods of time to gauge their negative and positive affect over the past 7 days, with a total of eight measurement occasions over a 22-year period. A total of 795 participants (Age: $M$ = 76.16, $SD$ = 5.52, range = 65–94 at the analytic baseline; 59% female) completed at least one measurement of affect. There were 648 individuals who completed at least three measurements and 382 who completed at least four.

*The German Aging Study.* The German Aging Study (Deustches Zentrum für Altersfragen; DEAS) is a nationally representative longitudinal panel study out of Germany that began in 1996 (Klaus et al., 2017; Research Data Centre of the German Centre of Gerontology, 2017, 2022; Simonson et al., 2023). Participants completed the 20-item version of the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988) in 1996, 2002, 2008, 2011, 2014, 2017, and 2020/2021 to gauge their positive and negative affect at the present moment. A total of 17,088 participants (Age: $M$ = 59.70, $SD$ = 11.44, range = 40–93 at the analytic baseline; 49% female) completed at least one measurement of affect. There were 5885 individuals who completed at least three measurements and 2880 who completed at least four.

*German Socio-Economic Panel Study.* The German Socio-Economic Panel Study (GSOEP) is a representative longitudinal panel study out of Germany that began in 1984 (SOEP-core, v38.1, 2023; Brücker et al., 2014; Brücker et al., 2017; Goebel et al., 2019). Participants completed a modified 4-item affective well-being measure developed in the current sample (Schimmack, 2009; Schimmack et al., 2002, 2008). Every year from 2007 until 2021, participants responded to four items that gauged their negative and positive affect in the past 4 weeks. A total of 60,132 participants (Age: $M$ = 45.39, $SD$ = 16.92, range = 17–98 at the analytic baseline; 54% female) completed at least one measurement of affect. There were 39,399 individuals who completed at least three measurements and 33,286 who completed at least four.

*Household, Income, and Labour Dynamics in Australia.* The Household, Income, and Labour Dynamics in Australia (HILDA) Survey is a longitudinal panel study conducted by the Melbourne Institute of Applied Economic and Social

**Table 1.** Descriptive Information by Sample.

| Study | Country | Scale | Year | Follow Up | Interval | Waves | Age | N |
|---|---|---|---|---|---|---|---|---|
| ADDH | United States | CESD | 1994–1995 | 24 | 6.00 | 4 | 15.91 | 6502 |
| ALSA | Australia | CESD | 1992 | 22 | 1.62 | 8 | 76.16 | 795 |
| DEAS | Germany | PANAS | 1996–1997 | 25 | 4.00 | 7 | 59.70 | 17,088 |
| GSOEP | Germany | SOEP-Affect | 2007 | 15 | 1.00 | 15 | 45.39 | 60,132 |
| HILDA | Australia | SF-36 | 2001 | 22 | 1.00 | 22 | 37.56 | 32,845 |
| HRS | United States | PANAS | 2008–2010 | 12 | 4.00 | 4 | 64.63 | 22,147 |
| LASA | Netherlands | CESD | 1992 | 20 | 3.00 | 7 | 66.43 | 4109 |
| LISS | Netherlands | PANAS | 2008 | 16 | 1.07 | 15 | 45.65 | 16,359 |
| LSOG | United States | CESD | 1971 | 30 | 4.30 | 7 | 41.62 | 2932 |
| MIDUS | United States | MIDI | 1995 | 18 | 9.00 | 3 | 46.24 | 7051 |
| NAS | United States | PANAS | 1994–1996 | 18 | 3.00 | 6 | 67.46 | 905 |
| OCTO | Sweden | CESD | 1991 | 11 | 2.00 | 5 | 83.31 | 701 |
| SATSA | Sweden | CESD | 1984 | 30 | 4.30 | 7 | 71.57 | 606 |
| WLS | United States | CESD | 1993 | 18 | 9.00 | 3 | 53.60 | 14,580 |

Note. Year represents the first year in which data were collected. Follow Up represents the maximum amount of time between the first and final measurement occasion. Waves represents the maximum number of waves of affect. Age represents the average age of the sample at the first analytic time point.

Research at the University of Melbourne out of Australia that began in 2001. Participants completed the 5-item mental health section from the SF-36 questionnaire (Butterworth & Crosier, 2004; Ware et al., 2001) to gauge their positive and negative affect in the past 4 weeks. Every year since 2001, participants responded to these items. A total of 32,845 participants (Age: $M$ = 37.56, $SD$ = 17.45, range = 14–99 at the analytic baseline; 53% female) completed at least one measurement of affect. There were 24,320 individuals who completed at least three measurements and 22,167 who completed at least four.

*The Health and Retirement Study.* The Health and Retirement Study (HRS) is a nationally representative longitudinal panel study out of the United States that began in 1992 (Juster & Suzman, 1995; Sonnega et al., 2014). Half of the sample completed an affect assessment in 2008, and the other half of the sample completed it in 2010. Every 4 years from their personal start date, each group filled out an affect survey again. During the time of analyses, the former has up to four measurement occasions while the latter has up to three. Participants completed the PANAS to report how frequently they had experienced different negative and positive emotions over the past 30 days. A total of 22,147 participants (Age: $M$ = 64.63, $SD$ = 10.48, range = 18–101 at the analytic baseline; 60% female) completed at least one measurement of affect. There were 8168 individuals who completed at least three measurements and 1811 who completed at least four.

*The Longitudinal Aging Study of Amsterdam.* The Longitudinal Aging Study of Amsterdam (LASA) began in 1992 out of Amsterdam in the Netherlands with participants who were 55 to 85 years old (Hoogendijk et al., 2016), sample from various geographical parts of the country and from urban and more rural areas to ensure national representativeness. Participants completed the CES-D every 3 years to gauge their negative and positive affect over the past 7 days, with a total of seven measurement occasions over a 20-year period. A total of 4109 participants (Age: $M$ = 66.43, $SD$ = 8.31, range = 54–86 at the analytic baseline; 55% female) completed at least one measurement of affect. There were 2631 individuals who completed at least three measurements and 2131 who completed at least four.

*Longitudinal Internet studies for Social Sciences.* The Longitudinal Internet studies for the Social Sciences (LISS) began in Netherlands in 2008 and include participants who are at least 16 years of age. Participants completed the PANAS every year to gauge their positive and negative affect in the moment they filled out the survey. A total of 16,359 participants (Age: $M$ = 45.65, $SD$ = 17.19, range = 15–96 at the analytic baseline; 54% female) completed at least one measurement of affect. There were 8610 individuals who completed at least three measurements and 6937 who completed at least four.

*The Longitudinal Study of Generations.* The Longitudinal Study of Generations (LSOG) is an intergenerational study out of California that began in 1971 (Silverstein & Vern, 1971). Participants completed the CES-D every 4–5 years to gauge their negative and positive affect over the past 7 days, with a total of seven measurement occasions over a 30-year period. A total of 2932 participants (Age: $M$ = 41.62, $SD$ = 17.00, range = 14–99 at the analytic baseline; 58% female) completed at least one measurement of affect. There were 1856 individuals who completed at least three measurements and 1495 who completed at least four.

*The Midlife in the United States Study.* The Midlife in the United States Study (MIDUS) is a nationally representative sample from the United States that began in 1995 (Brim & Featherman, 1998; Brim, Ryff, Kessler, et al., 2004). Participants completed the Midlife Development Inventory (MIDI) to gauge their negative and positive affect over the past 30 days, with a total of three measurement occasions over an 18-year period. A total of 7051 participants (Age: $M$ = 46.24, $SD$ = 12.52, range = 20–75 at the analytic baseline; 53% female) completed at least one measurement of affect. There were 2503 individuals who completed three measurement occasions, and a fourth measurement occasion has not been collected.

*The Veteran Affairs Normative Aging Study.* The Veteran Affairs Normative Aging Study (NAS) is an all-male study through the United States Department of Veteran Affairs that began in 1963. Beginning in 1994, participants completed the PANAS every 3 years to gauge their negative and positive affect over the past 30 days, with a total of six measurement occasions over an 18-year period. A total of 905 participants (Age: $M$ = 67.46, $SD$ = 6.78, range = 51–89 at baseline; 100% male) completed at least one measurement of affect. There were 660 individuals who completed three measurement occasions and 472 who completed at least four.

*The Origins of Variance in the Oldest-Old.* The Origin of Variance in the Oldest-Old: Octogenarian Twins Study (OCTO) is a study of Swedish twin pairs who are at least 80 years old that began in 1991. Participants completed the CES-D every 2 years to gauge their negative and positive affect over the past 7 days, with a total of five measurement occasions over an 11-year period. A total of 701 participants (Age: $M$ = 83.31, $SD$ = 2.98, range = 79–97 at baseline; 68% female) completed at least one measurement of affect. There were 353 individuals who completed three measurement occasions and 259 who completed at least four.

*The Swedish Adoption/Twin Study of Aging.* The Swedish Adoption/Twin Study of Aging (SATSA) began in 1984 to study the genetic versus environmental factors associated with aging (Finkel & Pedersen, 2004; Gatz & Pedersen, 2013; Pedersen, 2015; Pedersen et al., 1991). Participants completed CES-D to gauge their negative and positive affect over the past 7 days, with a total of seven measurement occasions unevenly spaced over a 30-year period. A total of 606 participants (Age: $M$ = 71.6, $SD$ = 10.41, range = 50–96 at baseline; 61% female) completed at least one measurement of affect. There were 395 individuals who completed three measurement occasions and 212 who completed at least four.

*Wisconsin Longitudinal Study.* The Wisconsin Longitudinal Study began in 1957 to follow high school graduates into older adulthood as well as some of their family members, with the first affect assessment beginning in 1993. Participants completed the CES-D to gauge their negative and positive affect over the past 7 days, with a total of three measurement occasions unevenly spaced over an 18-year period. A total of 14,580 participants (Age: $M$ = 53.60, $SD$ = 4.96, range = 29–85 at baseline; 53% female) completed at least one measurement of affect. There were 6233 individuals who completed three measurement occasions, and a fourth measurement occasion has not been collected.

## Measures

*Positive affect and negative affect.* All studies assessed at least three waves of negative and positive affect. Seven studies used the CES-D to assess affect (i.e., ADDH, ALSA, LASA, LSOG, OCTO, SATSA, and WLS; $N$ = 30,255), four studies used PANAS to assess affect (i.e., DEAS, HRS, LISS, and NAS; $N$ = 56,499), and the final studies each used different measures (i.e., HILDA used SF-36 mental health subscale, MIDUS used MIDI, and GSOEP used SOEP-affective well-being measure). Between studies, the versions of the measures for the CES-D and PANAS varied. For example, ADDH used a 9-item version and ALSA used a 20-item version of the CES-D; DEAS had participants rate the PANAS items based on the current moment, and HRS had them rate it based on the past 30 days.

Across studies, affect was coded so higher scores represented more frequent experiences of negative affect and more frequent experiences of positive affect. Because the Likert scales differed across studies, all scales were percent of maximum possible (POMP) scored then divided by 10. The resulting scores ranged from 0 (the minimum score possible) to 10 (the maximum score possible). In other words, if a Likert scale ranged from 1 (never) to 5 (all the time), 1 would now be represented by 0 and 5 would be represented by 10. Table S2 shows the specific items used to assess affect within each study. In the cases where we had raw items for these measures, we reported Cronbach's alphas at each wave for negative affect in Table S3 and positive affect in Table S4.

*Age.* Age was used as the time metric to model affect trajectories. Age was centered at 65 years in each study, with the exception of ADDH and OCTO. Because the maximum age in ADDH was younger than 65, age was centered at 20. Likewise, because the minimum age in OCTO was older than 65, age was centered at 90. Given that the age ranges and age scaling in ADDH and OCTO were different from the other samples, ADDH and OCTO were not included in the meta-analytic estimates. If age was missing at a time point during which a participant reported affect, their age was imputed based on the sum of the number of years between their baseline age report and that time point. For all samples, age was divided by 10, so 1 unit represented one decade.

*Sex.* All studies assessed baseline sex dichotomously, wherein 0 = male and 1 = female. Because all participants in NAS identified as males, NAS was not included in analyses where sex was a predictor.

## Attrition analyses

Attrition analyses were used to evaluate whether there were differences in sex, age, or affect for individuals who participated in less than three (study discontinuers) versus at least three waves (study continuers) of data collection. Based on a chi-square test, people who identified as male were significantly more likely to discontinue study participation than people who identified as female in 7 of the 13 samples (see Table S5). There were no significant differences in attrition based on sex for ALSA, DEAS, GSOEP, LISS, OCTO, or SATSA. Based on an independent samples t-test, study discontinuers were on average older relative to study continuers in 10 of the 14 samples (see Table S6). Study discontinuers were on average younger in GSOEP and LISS, and there was no significant difference in mean age for attrition in HILDA or MIDUS. Based on an independent samples t-test, study discontinuers had significantly higher negative affect than study continuers in 9 of the 14 samples (see Table S7). There was no significant difference in negative affect in ADDH, ALSA, DEAS, LISS, or NAS. Based on an independent samples t-test, study discontinuers had significantly lower positive affect than study continuers in 9 of the 14 samples (see Table S8). There was no significant difference in positive affect in ALSA, HILDA, NAS, OCTO, or SATSA. Though there were between-study differences, generally people were more likely to stay in the study if they identified as female, were older, had lower negative affect, and had higher positive affect.

## Analytic plan

Analyses were performed in *R* 4.4.0 (R Core Team, 2022) using the lmer() function from the *lme4* package (Bates et al., 2015). All cleaning, analytic, and meta-analytic scripts can found on OSF: https://osf.io/9rj82/. An alpha level of .01 was used to determine significance due to the large within-study sample sizes.

*Multilevel models for affect trajectories.* Each dataset was arranged by nesting affect assessments within persons, thereby allowing within-person change in affect for each individual to be modeled. The multilevel models consider all data points, including respondents with only one measurement occasion of affect. All models were estimated using Maximum Likelihood (ML) estimation. Age was used as the time variable to estimate affect trajectories in the current study. All models were conducted for both negative and positive affect, so the term "affect" will be used in describing the following formulas. Level 1 will refer to time ($t$) and Level 2 will refer to person ($i$).

First, intercept-only models were conducted to estimate the amount of variability in affect scores occurring at the within- versus between-person level.

Level 1

$$affect_{ti} = \beta_{0i} + e_{ti}$$

Level 2

$$\beta_{0i} = \gamma_{00} + r_{ti}$$

Second, age was included as a Level 1 predictor with random intercepts but no random slopes to estimate average affect trajectories as people age.

Level 1

$$affect_{ti} = \beta_{0i} + \beta_{1i}age_{ti} + e_{ti}$$

Level 2

$$\beta_{0i} = \gamma_{00} + r_{0i}$$
$$\beta_{1i}age_{ti} = \gamma_{10}$$

Third, a random slope for age was added to allow for differences between individuals in their affect trajectories as they aged.

Level 1

$$affect_{ti} = \beta_{0i} + \beta_{1i}age_{ti} + e_{ti}$$

Level 2

$$\beta_{0j} = \gamma_{00} + r_{0i}$$
$$\beta_{1i}age_{ti} = \gamma_{10} + r_{1i}$$

Fourth, for studies with at least four waves of affect (all studies except MIDUS and WLS), a quadratic term was added to estimate quadratic affect trajectories.

Level 1

$$affect_{ti} = \beta_{0i} + \beta_{1i}age_{ti} + \beta_{1i}age_{ti}^2 + e_{ti}$$

Level 2

$$\beta_{0i} = \gamma_{00} + r_{0i}$$
$$\beta_{1i}age_{ti} = \gamma_{10} + r_{1i}$$
$$\beta_{2i}age_{ti}^2 = \gamma_{20}$$

*Meta-analyses.* To summarize the average effects across studies, we used random-effects models to estimate meta-analytic effect sizes for the intercept-only, linear change, and quadratic change models, as well as sex by linear age interaction models. Each meta-analysis included an overall effect (weighted by total number of observations), with corresponding standard errors/confidence intervals, as well as estimates of heterogeneity ($I^{2,}$ Q) (Borenstein et al., 2017). We used the significance test of the Q statistic to guide our decision to test and report the results of study-level moderation analyses. For statistically heterogeneous main effects, we tested four study-level moderators: average baseline age (centered at age 65), country that the study was based in (1 = United States; 0 = non-United States), affect scale used (1 = CES-D; 0 = PANAS, MIDI, SF-36, SOEP-affect), and the total number of measurement occasions (centered at three waves).

ADDH and OCTO were excluded from meta-analyses because they had different age ranges that did not overlap with the age centering of the other 12 studies. Additionally, if a study was not included in a specific analysis because it did not meet inclusion criteria (e.g., NAS for the sex analyses), it was not included in the meta-analyses.

*Additional Analyses.* To better understand the connection between negative and positive affect, the statsBy() function from the *psych* package (Revelle, 2019) was used to calculate the correlation between negative and positive affect at the between- and within-person level. The between-person correlations represent how average levels of negative affect for individuals across the length of the study were associated with average levels of positive affect for individuals across the length of the study. The within-person correlations represent how changes in negative affect at a given time point relative to one's average negative affect levels are associated with changes in positive affect at that same time point relative to one's average positive affect levels.

Moreover, as a measurement-based sensitivity analysis that was requested during the review process, all random-effect models conducted to estimate meta-analytic effect sizes were reconducted excluding the seven samples that used the CES-D. By including these additional analyses, we were able to compare how the meta-analytic estimates for the linear and quadratic models changed when excluding studies that used the CES-D to assess affect.

## Results

Table 2 shows the meta-analytic effects across all negative affect models. Table 3 shows the individual study results for the negative affect linear change models, Table 4 shows the individual study results for the negative affect quadratic change models, and Table 5 shows the results of the model comparison for the linear and quadratic change models. Table 6 shows the meta-analytic effects across all positive affect models. Table 7 shows the individual study results for the positive affect linear change models, and Tables 8 and 9 show the individual study results for the positive affect quadratic change models. All other results, weighted and unweighted plots, and full meta-analytic reports can be found in the supplemental materials on OSF: https://osf.io/9rj82/.

### *Negative Affect*

*Intercept-Only Model.* The ICCs from the intercept-only model for negative affect ranged across the 14 samples from 0.30 to 0.64 (Table S9). These ICCs indicated that the amount of variability in negative affect ranged from 30% to 64% at the between-person level. Across studies, ADDH had the least amount of between-person variability while

**Table 2.** Meta-Analytic Summary of Negative Affect Models With 95% Confidence Intervals (CI).

| Model | Estimate | Lower CI | Upper CI | *SE* | *Z* | *p* |
|---|---|---|---|---|---|---|
| Intercept | **1.67** | 1.30 | 2.04 | 0.19 | 8.82 | <.001 |
| Linear | −0.02 | −0.11 | 0.08 | 0.05 | −0.39 | .700 |
| Quadratic | **0.06** | 0.03 | 0.10 | 0.02 | 3.86 | <.001 |
| Sex-intercept | −0.02 | −0.04 | 0.00 | 0.01 | −1.92 | .055 |
| Sex-slope | **0.33** | 0.20 | 0.45 | 0.06 | 5.25 | <.001 |

Note. The estimate represents the meta-analytic estimate across studies for that specific effect (e.g., linear comes from linear model and quadratic comes from quadratic model). Bolded estimates represent $p < .01$.

**Table 3.** Results of Linear Negative Affect Models With 95% Confidence Intervals (CI).

| Sample | Coefficient | Est. | Lower CI | Upper CI | *SE* | *t* | *p* |
|---|---|---|---|---|---|---|---|
| ADDH | Intercept | **1.51** | 1.47 | 1.54 | 0.02 | 84.97 | <.001 |
| | Age | **−0.18** | −0.22 | −0.13 | 0.02 | −7.95 | <.001 |
| ALSA | Intercept | **0.74** | 0.62 | 0.85 | 0.06 | 12.46 | <.001 |
| | Age | **0.13** | 0.07 | 0.20 | 0.03 | 3.98 | <.001 |
| DEAS | Intercept | **2.62** | 2.60 | 2.63 | 0.01 | 278.12 | <.001 |
| | Age | **−0.13** | −0.14 | −0.12 | 0.01 | −18.67 | <.001 |
| GSOEP | Intercept | **3.28** | 3.26 | 3.29 | 0.01 | 408.15 | <.001 |
| | Age | **−0.07** | −0.08 | −0.06 | 0.00 | −20.56 | <.001 |
| HILDA | Intercept | **2.05** | 2.02 | 2.08 | 0.01 | 140.82 | <.001 |
| | Age | **−0.07** | −0.08 | −0.06 | 0.00 | −15.55 | <.001 |
| HRS | Intercept | **1.97** | 1.95 | 1.99 | 0.01 | 191.49 | <.001 |
| | Age | **−0.15** | −0.16 | −0.13 | 0.01 | −18.24 | <.001 |
| LASA | Intercept | **0.73** | 0.69 | 0.77 | 0.02 | 38.03 | <.001 |
| | Age | **0.17** | 0.14 | 0.20 | 0.01 | 11.00 | <.001 |
| LISS | Intercept | **1.69** | 1.66 | 1.72 | 0.02 | 105.91 | <.001 |
| | Age | **−0.13** | −0.14 | −0.12 | 0.01 | −20.72 | <.001 |
| LSOG | Intercept | **1.39** | 1.33 | 1.46 | 0.03 | 41.89 | <.001 |
| | Age | **−0.09** | −0.12 | −0.07 | 0.01 | −7.40 | <.001 |
| MIDUS | Intercept | **1.21** | 1.17 | 1.25 | 0.02 | 60.80 | <.001 |
| | Age | **−0.09** | −0.11 | −0.07 | 0.01 | −8.94 | <.001 |
| NAS | Intercept | **1.48** | 1.40 | 1.55 | 0.04 | 39.69 | <.001 |
| | Age | −0.04 | −0.10 | 0.02 | 0.03 | −1.32 | .187 |
| OCTO | Intercept | **0.92** | 0.78 | 1.06 | 0.07 | 12.53 | <.001 |
| | Age | −0.12 | −0.32 | 0.08 | 0.10 | −1.18 | .241 |
| SATSA | Intercept | **1.13** | 0.98 | 1.27 | 0.07 | 15.67 | <.001 |
| | Age | **0.45** | 0.33 | 0.57 | 0.06 | 7.45 | <.001 |
| WLS | Intercept | **1.01** | 0.99 | 1.04 | 0.01 | 87.05 | <.001 |
| | Age | **−0.14** | −0.16 | −0.12 | 0.01 | −14.60 | <.001 |

Note. Bolded estimates represent $p < .01$.

SATSA had the most between-person variability. The remainder of variability in negative affect is a combination of true within-person variability and variance due to measurement error. These intercept-only models suggest that some individuals generally experience more or less negative affect on average, but that individuals also vary in their negative affect experiences over time (in some studies more than others), setting the foundation to evaluate within-person change.

*Linear Growth Model.* The linear growth model tested whether there were mean-level changes in negative affect across the lifespan. In preliminary analyses, we report results from the models that included fixed and random slopes, to allow for individual differences in affect trajectories. See Table S10 for full model output for the random intercepts-only model for each individual sample, Table S11 for the random intercepts and random slope model, and Table S12 for the model comparison between models with versus without random slopes for each sample. Only OCTO did not have significantly better fit with the inclusion of random slopes for negative affect ($p$ = .048).

*Overall Meta-Analytic Effect.* The meta-analytic estimate for the fixed age slope for the models was not significant, suggesting there was not a consistent pattern of change across the 12 samples ($B = -0.02$, 95% $CI$ [−0.11, 0.08], $p$ = .700). There was significant heterogeneity across the samples ($I^2 = 99.78$, $Q = 624.05$, $df = 11$, $p < .001$). Table 2 reports the meta-analytic summary for the negative affect linear models. The linear negative affect trajectories for each sample are displayed in Figure 1. Supplemental

**Table 4.** Results of Quadratic Negative Affect Models With 95% Confidence Intervals (CI).

| Sample | Coefficient | Estimate | Lower CI | Upper CI | *SE* | *t* | *p* |
|---|---|---|---|---|---|---|---|
| ADDH | Intercept | **1.51** | 1.46 | 1.55 | 0.02 | 69.17 | <.001 |
| | **Linear age** | **−0.17** | −0.23 | −0.12 | 0.03 | −5.82 | <.001 |
| | Quadratic age | 0.00 | −0.09 | 0.08 | 0.04 | −0.09 | .932 |
| ALSA | **Intercept** | **0.98** | 0.80 | 1.15 | 0.09 | 10.78 | <.001 |
| | Linear age | −0.24 | −0.46 | −0.02 | 0.11 | −2.12 | 0.034 |
| | **Quadratic age** | **0.12** | 0.05 | 0.19 | 0.04 | 3.44 | <.001 |
| DEAS | **Intercept** | **2.58** | 2.56 | 2.61 | 0.01 | 234.26 | <.001 |
| | **Linear age** | **−0.12** | −0.14 | −0.11 | 0.01 | −17.41 | <.001 |
| | **Quadratic age** | **0.03** | 0.02 | 0.03 | 0.00 | 5.29 | <.001 |
| GSOEP | **Intercept** | **3.28** | 3.27 | 3.30 | 0.01 | 391.90 | <.001 |
| | **Linear age** | **−0.08** | −0.09 | −0.07 | 0.00 | −15.69 | <.001 |
| | Quadratic age | 0.00 | −0.01 | 0.00 | 0.00 | −2.30 | .021 |
| HILDA | **Intercept** | **2.08** | 2.05 | 2.10 | 0.01 | 138.96 | <.001 |
| | Linear age | −0.01 | −0.02 | 0.01 | 0.01 | −0.72 | .470 |
| | **Quadratic age** | **0.01** | 0.01 | 0.02 | 0.00 | 9.94 | <.001 |
| HRS | **Intercept** | **1.88** | 1.85 | 1.90 | 0.01 | 160.46 | <.001 |
| | **Linear age** | **−0.23** | −0.24 | −0.21 | 0.01 | −24.19 | <.001 |
| | **Quadratic age** | **0.09** | 0.08 | 0.10 | 0.01 | 16.50 | <.001 |
| LASA | **Intercept** | **0.72** | 0.68 | 0.76 | 0.02 | 37.20 | <.001 |
| | Linear age | 0.05 | 0.00 | 0.09 | 0.02 | 2.05 | .041 |
| | **Quadratic age** | **0.08** | 0.06 | 0.11 | 0.01 | 6.94 | <.001 |
| LISS | **Intercept** | **1.66** | 1.63 | 1.69 | 0.02 | 103.47 | <.001 |
| | **Linear age** | **0.05** | 0.02 | 0.07 | 0.01 | 4.11 | <.001 |
| | **Quadratic age** | **0.06** | 0.05 | 0.06 | 0.00 | 19.43 | <.001 |
| LSOG | **Intercept** | **1.35** | 1.28 | 1.41 | 0.03 | 39.40 | <.001 |
| | Linear age | −0.01 | −0.05 | 0.03 | 0.02 | −0.42 | .672 |
| | **Quadratic age** | **0.03** | 0.02 | 0.04 | 0.00 | 5.70 | <.001 |
| NAS | **Intercept** | **1.49** | 1.42 | 1.57 | 0.04 | 39.91 | <.001 |
| | **Linear age** | **−0.21** | −0.31 | −0.12 | 0.05 | −4.25 | <.001 |
| | **Quadratic age** | **0.12** | 0.06 | 0.17 | 0.03 | 4.35 | <.001 |
| OCTO | **Intercept** | **0.92** | 0.78 | 1.06 | 0.07 | 12.53 | <.001 |
| | Linear age | −0.10 | −0.44 | 0.24 | 0.17 | −0.57 | .570 |
| | Quadratic age | 0.03 | −0.35 | 0.41 | 0.19 | 0.16 | .869 |
| SATSA | **Intercept** | **1.12** | 0.98 | 1.25 | 0.07 | 15.99 | <.001 |
| | Linear age | 0.10 | −0.10 | 0.29 | 0.10 | 0.98 | .328 |
| | **Quadratic age** | **0.21** | 0.12 | 0.30 | 0.05 | 4.40 | <.001 |

Note. Bolded estimates represent $p < .01$.

Figure 1 included ADDH and OCTO in the average trajectory line.

*Between-Study Differences.* When considering individual study results, we found evidence for statistically significant linear increases in negative affect in three studies, statistically significant linear decreases in negative affect in nine studies, and no linear change in negative affect in two studies (see Table 3). Within each sample, the intercept represents average negative affect scores at age 65 in all samples, except for ADDH and OCTO, where the intercepts represent average negative affect scores at age 20 and 80, respectively. On a scale from 0 to 10, starting negative affect was lowest in ALSA ($\beta_{0j}$ = 0.54) and highest in GSOEP ($\beta_{0j}$ = 3.28). Across all studies, a one-unit change in age represented 10 years; thus, the fixed age slope represents how much negative affect changed on average negative affect as people aged 10 years. Negative affect increased in ALSA, LASA, and SATSA, with the greatest increase in SATSA ($\beta_{1j}$ = 0.45). Meanwhile, negative affect decreased in ADDH, DEAS, GSOEP, HILDA, HRS, LISS, LSOG, MIDUS, and WLS, with the greatest decrease in ADDH ($\beta_{1j}$ = −0.18). Finally, negative affect did not show statistically significant mean-level change in NAS and OCTO.

Four study-level moderators were included to account for heterogeneity among studies: average baseline age, country, scale, and number of measurement occasions. There were no significant differences in negative affect trajectories based on studies having a higher baseline age ($B$ = 0.01, 95% *CI* [0.00, 0.01], $p$ = .018), more measurement occasions ($B$ = 0.00, 95% *CI* [0.02, −0.02], $p$ = .821), residing in the United States ($B$ = −0.14, 95% *CI* [-0.32, 0.04], $p$ = .121), or the affect scale used ($B$ = 0.19, 95% *CI* [0.02, 0.35], $p$ = .025).

*Within-Study Differences.* The final aspect of these analyses considered individual differences in negative affect trajectories within studies. When comparing fixed slope and random slope linear models, all studies showed significant variability in random slopes ($p < .006$), except for OCTO ($p = .048$). This means that there were individual differences in average negative affect and negative affect change

**Table 5.** Model Comparison Results for Negative Affect Linear and Quadratic Models.

| Sample | Model | Parameters | AIC | BIC | Chi-Square | *df* | *p* |
|---|---|---|---|---|---|---|---|
| ADDH | **Linear** | 6 | 86535.46 | 86583.26 | | | |
| | Quadratic | 7 | 86537.46 | 86593.23 | 0.01 | 1 | .933 |
| ALSA | Linear | 6 | 9395.33 | 9431.52 | | | |
| | **Quadratic** | 7 | 9385.61 | 9427.84 | 11.72 | 1 | .001 |
| DEAS | Linear | 6 | 113747.02 | 113798.04 | | | |
| | **Quadratic** | 7 | 113721.12 | 113780.65 | 27.9 | 1 | <.001 |
| GSOEP | **Linear** | 6 | 1250743.16 | 1250807.41 | | | |
| | Quadratic | 7 | 1250739.87 | 1250814.83 | 5.29 | 1 | .021 |
| HILDA | Linear | 6 | 1077561.42 | 1077625.16 | | | |
| | **Quadratic** | 7 | 1077467.93 | 1077542.29 | 95.5 | 1 | <.001 |
| HRS | Linear | 6 | 164542.62 | 164595.11 | | | |
| | **Quadratic** | 7 | 164273.38 | 164334.62 | 271.24 | 1 | <.001 |
| LASA | Linear | 6 | 44753.21 | 44798.68 | | | |
| | **Quadratic** | 7 | 44707.19 | 44760.24 | 48.02 | 1 | <.001 |
| LISS | Linear | 6 | 243363.77 | 243418.40 | | | |
| | **Quadratic** | 7 | 242994.52 | 243058.25 | 371.25 | 1 | <.001 |
| LSOG | Linear | 6 | 41923.37 | 41967.35 | | | |
| | **Quadratic** | 7 | 41893.07 | 41944.39 | 32.3 | 1 | <.001 |
| NAS | Linear | 6 | 8513.74 | 8550.34 | | | |
| | **Quadratic** | 7 | 8496.96 | 8539.65 | 18.78 | 1 | <.001 |
| OCTO | **Linear** | 6 | 6537.12 | 6570.30 | | | |
| | Quadratic | 7 | 6539.09 | 6577.81 | 0.03 | 1 | .870 |
| SATSA | Linear | 6 | 6915.41 | 6949.20 | | | |
| | **Quadratic** | 7 | 6898.76 | 6938.17 | 18.66 | 1 | <.001 |

Note. Bolded model names represent significantly better model fit. Quadratic trajectories indicated better model fit for 9 of the 12 samples (all but ADDH, GSOEP, and OCTO).

**Table 6.** Meta-Analytic Summary of Positive Affect Models With 95% Confidence Intervals (CI).

| Model | Estimate | Lower CI | Upper CI | *SE* | *Z* | *p* |
|---|---|---|---|---|---|---|
| Intercept | **6.79** | 6.27 | 7.32 | 0.27 | 25.38 | <.001 |
| Linear | **−0.15** | −0.25 | −0.05 | 0.05 | −2.98 | .003 |
| Quadratic | **−0.09** | −0.14 | −0.04 | 0.03 | −3.35 | <.001 |
| Sex-intercept | 0.01 | −0.03 | 0.04 | 0.02 | 0.31 | .753 |
| Sex-slope | −0.11 | −0.22 | 0.00 | 0.06 | −1.99 | .046 |

Note. The estimate represents the meta-analytic estimate across studies for that specific effect (e.g., linear comes from linear model and quadratic comes from quadratic model). Bolded estimates represent $p < .01$.

trajectories in 13 out of 14 samples (see Table S12 for model comparison information). The correlation between the random intercepts and random slopes ranged from −0.43 to 0.63. Higher levels of negative affect at age 65 were associated with a greater change in negative affect in four samples: GSOEP, HILDA, LISS, and LSOG, suggesting potential regression to the mean (Campbell & Kenny, 1999). However, higher levels of negative affect at age 65 were associated with less change in negative affect in the other nine samples: ADDH, ALSA, DEAS, HRS, LASA, MIDUS, NAS, SATSA, and WLS.

We evaluated sex as a person-level factor that may partially explain individual differences in negative affect trajectories. See Table S13 for full complete output for the sex moderation models. The meta-analytic summary for average sex differences suggested that women scored significantly higher on negative affect then men across samples ($B$ = 0.33, 95% $CI$ [0.20, 0.45], $p < .001$), though there was also significant heterogeneity ($I^2$ = 97.18, $Q$ = 416.39, $df$ = 10, $p$ = < .001). Within individual studies, women reported significantly higher negative affect than men in all samples ($\gamma_{01}$ ranged from 0.18 to 0.71), except for LISS and SATSA. Finally, the meta-analytic summary also confirmed a nonsignificant effect of sex on linear negative affect trajectories ($B$ = −0.02, 95% $CI$ [−0.04, 0.00], $p$ = .055), though there was significant heterogeneity ($I^2$ = 66.45, $Q$ = 31.82, $df$ = 10, $p < .001$).

*Quadratic Growth Model.* Next, we tested quadratic trajectories of negative affect across the lifespan. Eight studies met the inclusion criteria of at least four waves of affect reports to estimate quadratic growth models for negative affect (see Table 4). See Table S14 for the complete output for each of the quadratic growth models.

*Overall Meta-Analytic Effect.* The meta-analysis indicated a slightly U-shaped quadratic effect ($B$ = 0.06, 95% CI [0.03,

**Table 7.** Results of Linear Positive Affect Models With 95% Confidence Intervals (CI).

| Sample | Coefficient | Estimate | Lower CI | Upper CI | *SE* | *t* | *p* |
|---|---|---|---|---|---|---|---|
| ADDH | Intercept | **7.28** | 7.24 | 7.33 | 0.02 | 317.42 | <.001 |
| | Age | **0.45** | 0.39 | 0.50 | 0.03 | 16.13 | <.001 |
| ALSA | Intercept | **8.51** | 8.32 | 8.70 | 0.10 | 87.06 | <.001 |
| | Age | **−0.39** | −0.50 | −0.28 | 0.06 | −6.88 | <.001 |
| DEAS | Intercept | **6.15** | 6.13 | 6.17 | 0.01 | 597.75 | <.001 |
| | Age | **−0.15** | −0.16 | −0.13 | 0.01 | −19.86 | <.001 |
| GSOEP | Intercept | **6.24** | 6.22 | 6.25 | 0.01 | 720.67 | <.001 |
| | Age | **−0.20** | −0.21 | −0.19 | 0.00 | −55.29 | <.001 |
| HILDA | Intercept | **5.97** | 5.94 | 6.01 | 0.02 | 354.28 | <.001 |
| | Age | **−0.10** | −0.11 | −0.09 | 0.00 | −20.76 | <.001 |
| HRS | Intercept | **6.35** | 6.32 | 6.37 | 0.01 | 489.68 | <.001 |
| | Age | **−0.16** | −0.18 | −0.14 | 0.01 | −15.92 | <.001 |
| LASA | Intercept | **7.50** | 7.43 | 7.57 | 0.04 | 210.69 | <.001 |
| | Age | **−0.51** | −0.57 | −0.46 | 0.03 | −18.81 | <.001 |
| LISS | Intercept | **5.80** | 5.76 | 5.83 | 0.02 | 371.55 | <.001 |
| | Age | **0.06** | 0.05 | 0.07 | 0.01 | 10.00 | <.001 |
| LSOG | Intercept | **7.59** | 7.50 | 7.68 | 0.05 | 164.95 | <.001 |
| | Age | **−0.07** | −0.10 | −0.04 | 0.02 | −4.20 | <.001 |
| MIDUS | Intercept | **6.14** | 6.09 | 6.19 | 0.03 | 249.95 | <.001 |
| | Age | **0.10** | 0.08 | 0.12 | 0.01 | 8.87 | <.001 |
| NAS | Intercept | **5.28** | 5.16 | 5.39 | 0.06 | 91.73 | <.001 |
| | Age | **−0.23** | −0.32 | −0.14 | 0.05 | −5.01 | <.001 |
| OCTO | Intercept | **8.25** | 8.02 | 8.48 | 0.12 | 70.03 | <.001 |
| | Age | **0.82** | 0.47 | 1.18 | 0.18 | 4.50 | <.001 |
| SATSA | Intercept | **6.72** | 6.53 | 6.91 | 0.10 | 69.36 | <.001 |
| | Age | **−0.26** | −0.40 | −0.12 | 0.07 | −3.61 | <.001 |
| WLS | Intercept | **8.69** | 8.66 | 8.72 | 0.01 | 563.70 | <.001 |
| | Age | 0.01 | −0.02 | 0.04 | 0.01 | 0.77 | .441 |

Note. All of the following models include random intercepts and random slopes for age. Bolded estimates represent $p$ < .01.

0.10], $p$ < .001), suggesting that negative affect initially decreased throughout early adulthood and middle-aged adulthood, where it then stabilized, and remained fairly consistent throughout older adulthood. There was also significant heterogeneity in estimates across the studies ($I^2 = 99.51$, $Q = 619.13$, $df = 9$, $p < .001$). See Figure 2 for visualization of the quadratic trajectories. The thick black line indicates the overall average pattern also indicated a U-shaped curve. Though ADDH and OCTO were included in the figure, they were not included in the estimating of the average trajectory as they were unable to be included in the meta-analysis. Supplemental Figure 2 included ADDH and OCTO in the average trajectory line.

*Between-Study Differences.* Table 4 shows the individual results of the quadratic models for each of the samples. Model comparisons suggested that the quadratic growth models were a better fit data than the linear growth trajectories for nine studies: ALSA, DEAS, HILDA, HRS, LASA, LISS, LSOG, NAS, and SATSA. The linear trajectory showed better fit in three studies: ADDH, GSOEP, and OCTO (see Table 5). Once again, four moderators were tested as potential explanation for differences in estimates across studies. Studies with higher baseline age were more likely to have an increase in negative affect later on ($B$ = 0.09, 95% $CI$ [0.06, 0.12], $p$ = < .001; meta-analytic slope: $B$ = .003, 95% $CI$ [.001, .005], $p$ < .001). However, number of measurement occasions ($B$ = −0.01, 95% $CI$ [0.00, −0.01], $p$ = .048), residing in the United States ($B$ = 0.02, 95% $CI$ [−0.06, 0.09], $p$ = .633), and the scale used were not related to trajectories across the lifespan ($B$ = 0.05, 95% $CI$ [−0.02, 0.12], $p$ = .174).

For the nine studies that showed significantly better model fit with the quadratic age term, the patterns surrounding these quadratic changes differed across studies. ALSA, LASA, and SATSA showed stability in negative affect from middle-aged to early older adulthood, with an increase in negative affect later on in older adulthood. DEAS showed a decrease in negative affect from middle-aged to older adulthood, then a stabilization in negative affect around age 80. To varying degrees of magnitude, HILDA, HRS, LISS, LSOG, and NAS showed a decrease in negative affect until late adulthood, followed by a later increase. For the three studies that had better model fit with linear change, ADDH and GSOEP showed significant decline in negative affect, while OCTO showed no significant linear change in negative affect. Additionally, model comparisons were not made for MIDUS and WLS as they only had three waves of data; both showed significant linear decline in negative affect.

## Positive Affect

*Intercept-Only Model.* The ICCs from the intercept-only model for positive affect ranged across the 14 samples from .29 to .64 (Table S15). These ICCs indicated that the amount of variability in negative affect ranged from 29% to 64% at the between-person level. Across studies, ALSA

**Table 8.** Results of Quadratic Positive Affect Models With 95% Confidence Intervals (CI).

| Sample | Coefficient | Estimate | Lower CI | Upper CI | *SE* | *t* | *p* |
|---|---|---|---|---|---|---|---|
| ADDH | **Intercept** | **7.46** | 7.40 | 7.51 | 0.03 | 265.50 | <.001 |
| | **Linear age** | **0.73** | 0.65 | 0.80 | 0.04 | 19.19 | <.001 |
| | **Quadratic age** | **−0.62** | −0.73 | −0.51 | 0.06 | −10.87 | <.001 |
| ALSA | **Intercept** | **7.97** | 7.67 | 8.28 | 0.16 | 51.19 | <.001 |
| | Linear age | 0.46 | 0.06 | 0.85 | 0.20 | 2.27 | .023 |
| | **Quadratic age** | **−0.27** | −0.40 | −0.15 | 0.06 | −4.39 | <.001 |
| DEAS | **Intercept** | **6.25** | 6.23 | 6.27 | 0.01 | 529.66 | <.001 |
| | **Linear age** | **−0.18** | −0.20 | −0.16 | 0.01 | −23.32 | <.001 |
| | **Quadratic age** | **−0.08** | −0.09 | −0.07 | 0.00 | −16.66 | <.001 |
| GSOEP | **Intercept** | **6.23** | 6.21 | 6.24 | 0.01 | 694.16 | <.001 |
| | **Linear age** | **−0.18** | −0.19 | −0.17 | 0.01 | −32.32 | <.001 |
| | **Quadratic age** | **0.01** | 0.00 | 0.01 | 0.00 | 4.90 | <.001 |
| HILDA | **Intercept** | **6.02** | 5.99 | 6.05 | 0.02 | 355.03 | <.001 |
| | Linear age | −0.02 | −0.03 | 0.00 | 0.01 | −1.95 | .051 |
| | **Quadratic age** | **0.02** | 0.02 | 0.02 | 0.00 | 11.72 | <.001 |
| HRS | **Intercept** | **6.50** | 6.47 | 6.53 | 0.01 | 432.88 | <.001 |
| | **Linear age** | **−0.05** | −0.07 | −0.03 | 0.01 | −4.66 | <.001 |
| | **Quadratic age** | **−0.14** | −0.15 | −0.12 | 0.01 | −19.90 | <.001 |
| LASA | **Intercept** | **7.53** | 7.46 | 7.60 | 0.04 | 210.38 | <.001 |
| | **Linear age** | **−0.31** | −0.40 | −0.23 | 0.04 | −7.37 | <.001 |
| | **Quadratic age** | **−0.14** | −0.18 | −0.09 | 0.02 | −6.14 | <.001 |
| LISS | **Intercept** | **5.80** | 5.77 | 5.84 | 0.02 | 371.51 | <.001 |
| | Linear age | −0.02 | −0.04 | 0.00 | 0.01 | −2.25 | .025 |
| | **Quadratic age** | **−0.03** | −0.03 | −0.02 | 0.00 | −9.41 | <.001 |
| LSOG | **Intercept** | **7.64** | 7.55 | 7.73 | 0.05 | 165.33 | <.001 |
| | **Linear age** | **−0.22** | −0.27 | −0.16 | 0.03 | −8.03 | <.001 |
| | **Quadratic age** | **−0.05** | −0.06 | −0.03 | 0.01 | −6.84 | <.001 |
| NAS | **Intercept** | **5.26** | 5.14 | 5.37 | 0.06 | 90.13 | <.001 |
| | Linear age | 0.02 | −0.12 | 0.16 | 0.07 | 0.23 | .817 |
| | **Quadratic age** | **−0.17** | −0.25 | −0.10 | 0.04 | −4.37 | <.001 |
| OCTO | **Intercept** | **8.21** | 7.98 | 8.44 | 0.12 | 69.82 | <.001 |
| | Linear age | −0.06 | −0.68 | 0.55 | 0.31 | −0.20 | .838 |
| | **Quadratic age** | **−1.20** | −1.87 | −0.53 | 0.34 | −3.52 | <.001 |
| SATSA | **Intercept** | **6.72** | 6.53 | 6.90 | 0.10 | 70.17 | <.001 |
| | Linear age | 0.06 | −0.20 | 0.31 | 0.13 | 0.42 | .676 |
| | **Quadratic age** | **−0.16** | −0.28 | −0.05 | 0.06 | −2.78 | .006 |

Note. All the models included random intercepts and random slopes for age. Bolded estimates represent $p$ < .01.

had the least amount of between-person variability while DEAS had the most between-person variability.

*Linear Growth Model.* The linear growth model tested whether there were mean-level changes in positive affect across the lifespan. In primary analyses, we report results from the models that included fixed and random slopes, to allow for individual differences in affect trajectories. See Table S16 for full model output for the random intercepts-only model, Table S17 for the random intercepts and random slope model, and Table S18 for the model comparison of with versus without random slopes. Only ALSA, MIDUS, and SATSA did not have significantly better fit with the inclusion of random slopes for positive affect ($p$ = .615).

*Overall Meta-Analytic Effect.* The meta-analytic estimate for the fixed age slope in these models was statistically significant and negative, suggesting a pattern of linear decline in positive affect over time across the 14 samples ($B = -0.15$, 95% $CI$ [−0.25, −0.05], $p = .003$). There was significant heterogeneity across the samples ($I^2 = 99.76$, $Q = 2159.85$, $df = 11$, $p < .001$). Table 6 reports the meta-analytic summary for the positive affect linear models. The linear positive affect trajectories for each sample are displayed in Figure 3. Though ADDH and OCTO were included in the figure, they were not included in the estimation of the average trajectory as they were unable to be included in the meta-analysis. Supplemental Figure 3 included ADDH and OCTO in the average trajectory line.

*Between-Study Differences.* When considering individual study results, we found evidence for statistically significant linear increases in positive affect in four studies, statistically significant linear decreases in positive affect in nine studies, and no linear change in positive affect in one study (see Table 7). Starting positive affect was lowest in NAS ($\beta_{0j}$ = 5.28) and highest in WLS ($\beta_{0j}$ = 8.69). Positive affect increased in ADDH, LISS, MIDUS, and OCTO, with the greatest increase in OCTO ($\beta_{1j}$ = 0.82). Meanwhile, positive affect decreased in ALSA, DEAS, GSOEP, HILDA, HRS, LASA, LSOG, NAS, and SATSA, with the greatest decrease in LASA

**Table 9.** Model Comparison Results for Positive Affect Linear and Quadratic Models.

| Sample | Model | Parameters | AIC | BIC | Chi-Square | *df* | *p* |
|---|---|---|---|---|---|---|---|
| ADDH | Linear | 6 | 97090.90 | 97138.70 | | | |
| | **Quadratic** | 7 | 96977.68 | 97033.45 | 115.22 | 1 | <.001 |
| ALSA | Linear | 6 | 13046.11 | 13082.30 | | | |
| | **Quadratic** | 7 | 13029.13 | 13071.35 | 18.98 | 1 | <.001 |
| DEAS | Linear | 6 | 116693.60 | 116744.62 | | | |
| | **Quadratic** | 7 | 116419.37 | 116478.90 | 276.23 | 1 | <.001 |
| GSOEP | Linear | 6 | 1325974.51 | 1326038.75 | | | |
| | **Quadratic** | 7 | 1325952.63 | 1326027.58 | 23.88 | 1 | <.001 |
| HILDA | Linear | 6 | 1166530.89 | 1166594.63 | | | |
| | **Quadratic** | 7 | 1166402.32 | 1166476.68 | 130.57 | 1 | <.001 |
| HRS | Linear | 6 | 185904.18 | 185956.67 | | | |
| | **Quadratic** | 7 | 185512.21 | 185573.46 | 393.97 | 1 | <.001 |
| LASA | Linear | 6 | 63493.91 | 63539.38 | | | |
| | **Quadratic** | 7 | 63458.34 | 63511.39 | 37.57 | 1 | <.001 |
| LISS | Linear | 6 | 232063.92 | 232118.54 | | | |
| | **Quadratic** | 7 | 231977.63 | 232041.36 | 88.28 | 1 | <.001 |
| LSOG | Linear | 6 | 47745.93 | 47789.89 | | | |
| | **Quadratic** | 7 | 47701.55 | 47752.83 | 46.38 | 1 | <.001 |
| NAS | Linear | 6 | 11173.15 | 11209.72 | | | |
| | **Quadratic** | 7 | 11156.54 | 11199.21 | 18.61 | 1 | <.001 |
| OCTO | Linear | 6 | 8254.67 | 8287.84 | | | |
| | **Quadratic** | 7 | 8244.53 | 8283.23 | 12.13 | 1 | <.001 |
| SATSA | Linear | 6 | 8466.67 | 8500.44 | | | |
| | **Quadratic** | 7 | 8461.00 | 8500.40 | 7.66 | 1 | .006 |

Note. Bolded model names represent significantly better model fit. Quadratic trajectories indicated better model fit for 12 of the 12 samples.

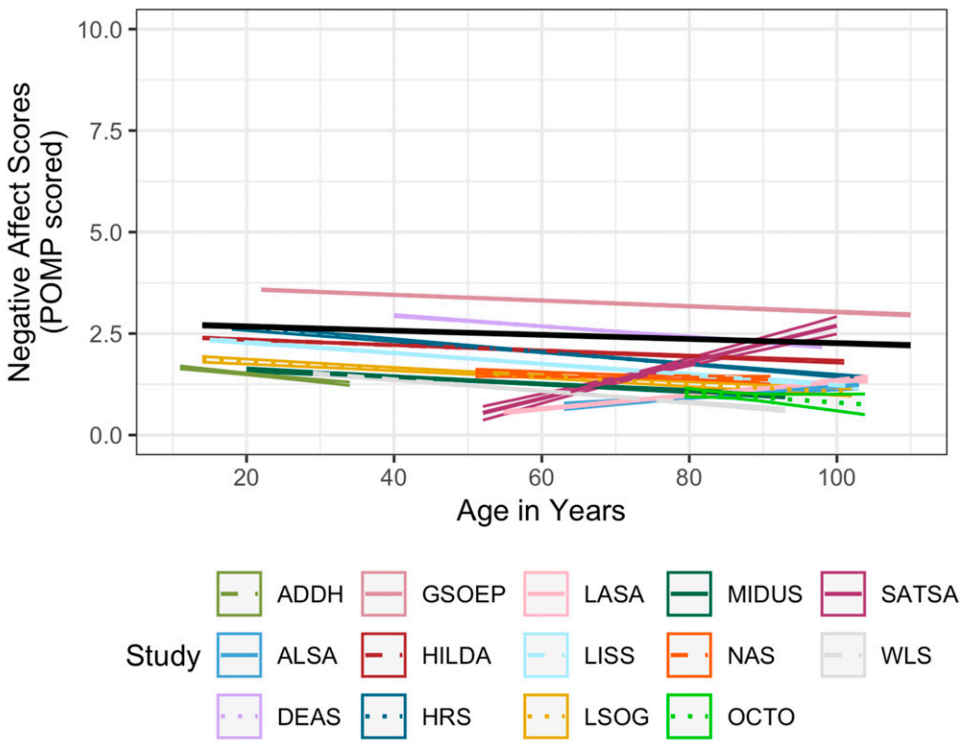


**Figure 1.** Linear trajectories of negative affect with 95% confidence intervals are shown. The bold black line depicts the meta-analytic trajectory (N-weighted).

($\beta_{1j} = -0.51$). Finally, positive affect did not show statistically significant mean-level change in WLS.

Four study-level moderators were included to evaluate why findings may have differed among studies: average baseline age, country, scale, and number of measurement occasions. Studies with higher baseline age were associated with stronger decreases in positive affect (meta-analytic intercept:

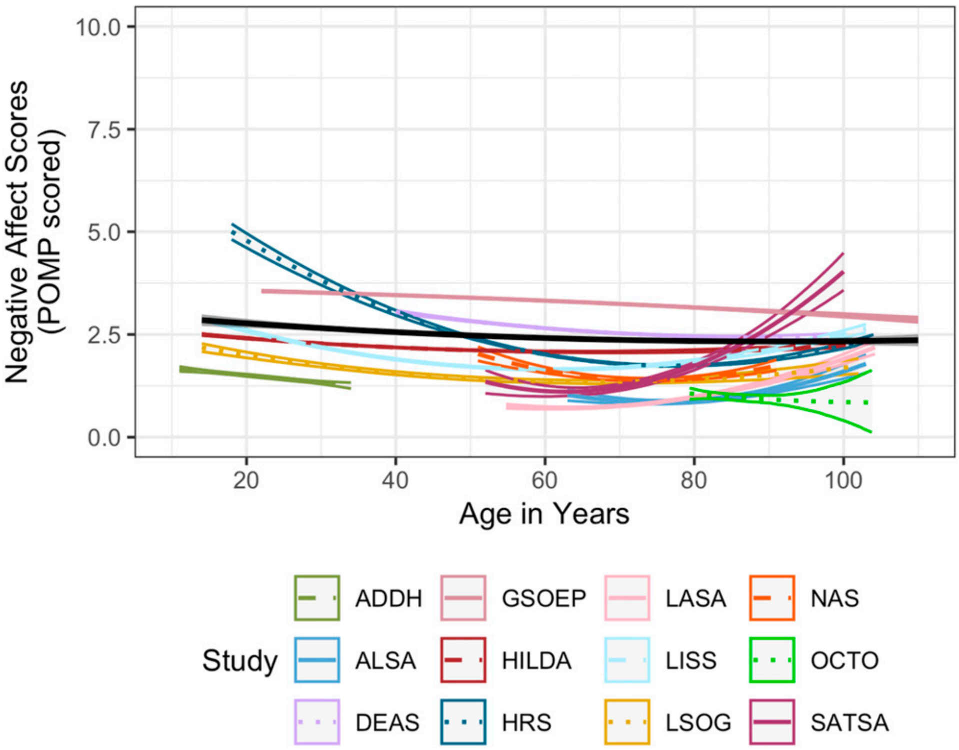


**Figure 2.** Quadratic trajectories of negative affect with 95% confidence intervals. The black line is average trajectory (N-weighted). Nine studies showed evidence of a U-shaped curve, and the meta-analytic average was significant.

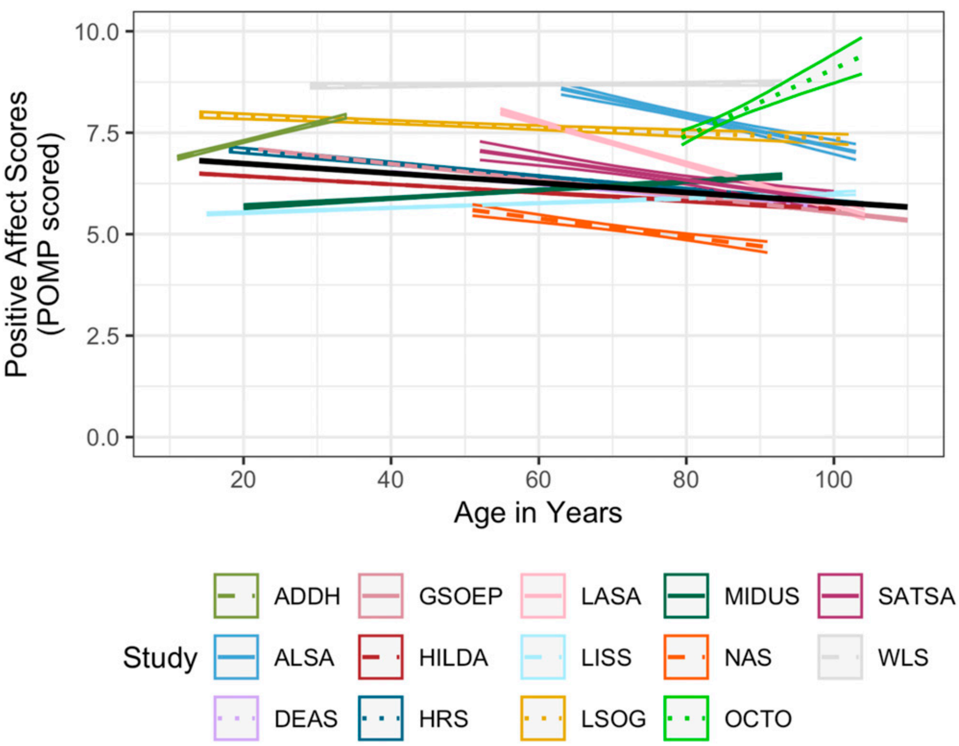


**Figure 3.** Linear trajectories of positive affect. The black line is average trajectory (N-weighted).

−0.24, 95% *CI* [−0.34, −0.14], $p$ = < .001; meta-analytic slope: $B = -0.01$, 95% *CI* [−0.02, 0.00], $p$ = .003). However, number of measurement occasions ($B = 0.00$, 95% *CI* [0.02, −0.02], $p = .927$), residing in the United States ($B = 0.15$, 95% *CI* [−0.04, 0.34], $p$ = .127), and the scale used were not related to trajectories across the lifespan ($B = -0.14$, 95% *CI* [−0.34, 0.05], $p = .153$).

*Within-Study Differences.* The final aspect of these analyses considered individual differences in positive affect trajectories *within* studies. When comparing fixed slope and random slope linear models, all studies showed significant variability in random slopes ($p < .001$), except for ALSA, MIDUS, and SATSA ($p = .073$, .119, and .615, respectively). This means that there were individual differences in average positive affect and positive affect change trajectories in 11 out of 14 samples (see Table S18 for model comparison information). The correlation between the random intercepts and random slopes ranged from −0.36 to 0.72. Higher initial levels of positive affect at age 65 were associated with a greater decrease in positive affect in four studies: ADDH, HRS, LASA, and NAS, suggesting potential regression to the mean (Campbell & Kenny, 1999). However, higher initial levels of positive affect at age 65 were associated with less change in positive affect in the other seven samples: DEAS, GSOEP, HILDA, LISS, LSOG, OCTO, and WLS.

We evaluated sex as a person-level factor that may partially explain individual differences in positive affect trajectories. See Table S19 for full complete output for the sex moderation models. There was no significant difference in levels of positive affect for men and women ($B = -0.11$, 95% $CI$ [−0.22, 0.00], $p$ .046), though there was also significant heterogeneity ($I^2 = 94.40$, $Q = 81.00$, $df = 10$, $p < .001$). Within individual studies, there was a significant difference in positive affect based on sex in five samples: ALSA, GSOEP, HILDA, LASA, and LISS. In all cases, women scored significantly lower than men on positive affect ($\gamma_{01}$ ranged from −0.75 to −0.09). Finally, the meta-analytic summary also confirmed a nonsignificant effect of sex on linear positive affect trajectories ($B = 0.01$, 95% $CI$ [-0.03, 0.04], $p = .753$), though there was significant heterogeneity ($I^2 = 83.86$, $Q = 82.28$, $df = 10$, $p < .001$).

*Quadratic Qrowth Model.* Next, we tested quadratic trajectories of positive affect across the lifespan. Twelve studies met the inclusion criteria of at least four waves of affect reports to estimate quadratic growth models for positive affect (see Table 8). See Table S20 for the complete output for each of the quadratic growth models.

*Overall Meta-Analytic Effect.* The meta-analysis indicated a slightly inverted, U-shaped quadratic effect ($B = -0.09$, 95% $CI$ = [−0.14, −0.04], $p < .001$), suggesting that positive affect remained stable throughout younger and middle-aged adulthood, before decreasing during older adulthood. There was also significant heterogeneity in estimates across the studies ($I^2 = 99.78$, $Q = 1051.69$, $df = 9$, $p < .001$). See Figure 4 for visualization of the quadratic trajectories. The thick black line indicates the overall average pattern also indicated an inverted U-shaped curve. Though ADDH and OCTO were included in the figure, they were not included in the estimation of the average trajectory as they were unable to be included in the meta-analysis. Supplemental Figure 4 included ADDH and OCTO in the average trajectory line.

*Between-Study Differences.* Table 8 shows the individuals results of the quadratic models for each of the samples. Model comparisons suggested that the quadratic growth models were a better fit for the data in all 12 studies: ADDH, ALSA, DEAS, GSOEP, HILDA, HRS, LASA, LISS, LSOG, NAS, OCTO, and SATSA. The linear trajectory showed better fit in no studies (see Table 9). Once again, four moderators were tested as potential explanation for differences in estimates across studies. Studies with higher baseline age were associated with a sharpening effect of the

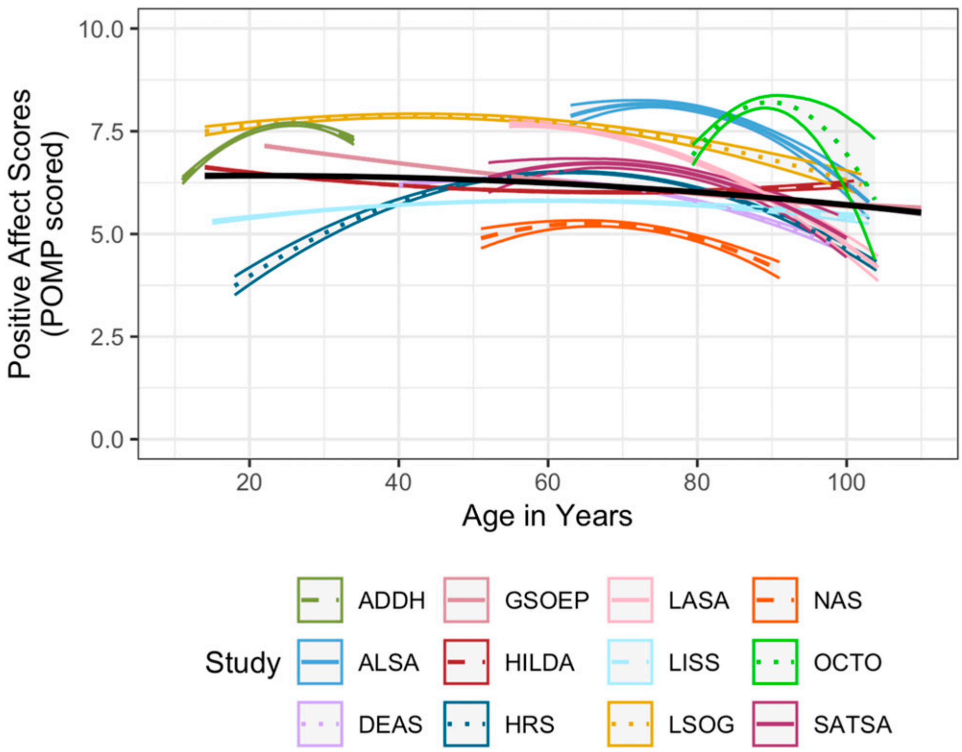


**Figure 4.** Quadratic trajectories of positive affect. The black line is average trajectory (N-weighted). All 12 studies showed evidence of a U-shaped curve.

positive affect declines that occur with age (meta-analytic intercept: $B = -0.13$, 95% $CI$ [−0.16, −0.11], $p < .001$; meta-analytic slope: $B = -0.01$, 95% $CI$ [−0.01, 0.00], $p < .001$), while more measurement occasions were associated with a weakening effect of the positive affect decline (meta-analytic intercept: $B = -0.18$, 95% $CI$ [−0.12, −0.25], $p < .001$; meta-analytic slope: $B = 0.01$, 95% $CI$ [0.02, 0.00], $p < .001$). However, residing in the United States ($B = -0.04$, 95% $CI$ [−0.15, 0.08], $p = .536$) and the scale used to assess positive affect were not related to differences in quadratic trajectories across the lifespan ($B = -0.08$, 95% $CI$ [-0.19, 0.03], $p = .136$).

Though all studies showed significantly better model fit with the quadratic age term, the patterns surrounding these quadratic changes differed across studies, with two samples showing u-shaped trajectories. In GSOEP, positive affect had a sharper decline in younger and middle-aged adulthood, with the magnitude of the decline weakening later on in the lifespan. In HILDA, positive affect showed a small increase later on in the lifespan. All other studies with at least four waves showed some version of an inverted U-shaped curve, and of the studies with only three waves, MIDUS showed a significant increase in positive affect, and WLS showed no significant change in positive affect.

### Negative and Positive Affect Between- and Within-person Associations

As an exploratory step to understand differences in negative versus positive affect trajectories, we calculated the between- versus within-person associations between negative and positive affect for each sample. Table S21 shows the between- and within-person associations of negative and positive affect for all 14 samples. Supplemental Figure 5 illustrates the differences and magnitudes of these associations in a forest plot, as well as a more in-depth discussion of these findings. Between-person correlations for negative and positive affect ranged from −0.71 to 0.00, with all samples showing a significant, negative association, except for LISS and NAS. Within-person correlations for negative and positive affect ranged from −0.47 to 0.10, with all samples showing a significant, negative association, except for LISS and NAS. The magnitudes of the associations were significantly stronger at the between-person level than within-person levels for all samples except for LISS, where there was no difference, and NAS, where the reverse was true.

### Sensitivity Analyses

Next, we reconducted our random-effects models excluding the seven samples ($N = 30{,}225$) that used the CES-D to assess affect. This exclusion left DEAS, GSOEP, HILDA, HRS, LISS, MIDUS, and NAS in the linear trajectory analyses ($N = 156{,}527$, $k = 7$), and DEAS, GSOEP, HILDA, HRS, LISS, and NAS in the quadratic trajectory analyses ($N = 149{,}476$, $k = 6$). Table S22 shows the summary information represented in Table 1 of the manuscript with only these samples in the first table, and Table S23 shows the samples using the CES-D measures in the second table. In our supplemental materials, we provide an in-depth discussion of how these results changed (see pp. 54–76).

For negative affect, the linear trajectory went from being nonsignificant to showing a significant decline ($B = -0.10$, 95% CI [−0.13, −0.07], $p < .001$) (see Supplemental Figure 23). The quadratic trajectory for negative affect, which indicated better model fit for 75% of the samples that had 4+ waves of data, remained unchanged (B = 0.05, 95% CI [0.01, 0.08], $p = .009$) (see Supplemental Figure 24). For positive affect, the linear trajectory went from showing significant decline to being nonsignificant ($B = -0.09$, 95% CI [−0.19, 0.00], $p = .050$) (see Supplemental Figure 25). The quadratic trajectory for positive affect, which indicated better model fit for 100% of the samples that had 4+ waves of data, was no longer significant ($B = -0.06$, 95% CI [−0.12, 0.00], $p = .050$) (see Supplemental Figure 26). Supplemental Figures 27 and 28 show the overlay of the linear and quadratic trajectories for negative and positive affect when including and excluding the CES-D samples with 95% confidence bands, with the quadratic trajectories showing nearly complete overlap across all age points.

### Results Summary

Figure 5 plots the average negative and positive affect lifespan trajectories. In both cases, negative and positive affect show a quadratic relationship with age at the meta-analytic level. For the 12 studies with sufficient waves to be included in the quadratic analyses, nine samples had better model fit with the quadratic models for negative affect, and all 12 samples had better fit with the quadratic models for positive affect, suggesting that age-based affect trajectories are generally quadratic regardless of valence. Separate plots with the negative and positive affect trajectories for each study can be found in Supplemental Figures 6–19. Supplemental Figure 20 depicts this graph with a truncated y-axis for a closer look at these trajectories. Supplemental Figures 21 and 22 show the trajectories represented in Figure 5 and Supplemental Figure 20 if ADDH and OCTO were included in the meta-analytic average.

## Discussion

This work evaluated trajectories of negative and positive affect across the lifespan using 14 longitudinal studies with a combined sample size of ~187,000 participants. For both negative and positive affect, quadratic trajectories better described how affect changed as people aged. However, the inflection point of the quadratic trajectories differed based on affect valence. In line with the Buecker et al. (2023) meta-analysis, negative affect decreased during younger adulthood, though the current work found a different pattern for late life. On average, negative affect declined with an inflection point (i.e., nadir) in participants' 60s then stabilized throughout the rest of the older adult lifespan. By contrast, positive affect remained stable until reaching an inflection point (i.e., apex) in participants' 40s where individuals' positive affect begins to decline until the end of life, which runs contrary to the linear decline found in the Buecker et al. (2023) meta-analysis. Thus, the current findings aligned with previous traditional meta-analytic

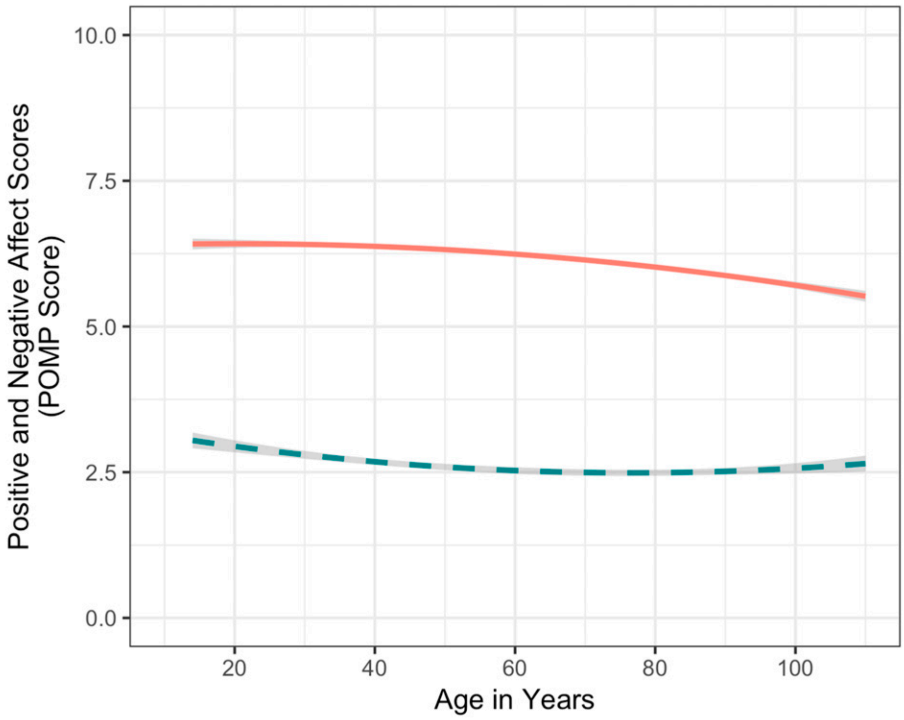


**Figure 5.** Quadratic trajectories of positive (solid line) and negative affect (dashed line).

work for young and middle-aged adulthood before diverging in older adulthood. Moreover, despite the general pattern across samples, we still observed some inconsistencies in the nonlinear change patterns (e.g., participants in SATSA increased in negative affect as they aged) across the individual samples, speaking to the complexity of lifespan developmental trajectories and unevaluated study-level and/or person-level moderators.

### *Implications*

Findings from the current study have implications for several theoretical frameworks on affect change over the life course. For example, SST suggests that older adults experience less negative affect due to their choices to focus on more short-term, pro-hedonic goals (Carstensen, 1993, 2006, 2021; Carstensen et al., 1999), while SAVI and DIT note that, through the accrual of life experiences, older adults are better able to attend to positive stimuli (Charles, 2010; Labouvie-Vief, 2003). The negative affect trajectories observed in the current study were generally consistent with these theories of adult development and aging; however, the positive affect trajectories diverged from the predicted pattern. These differences in trajectories between negative and positive affect could suggest crucial emotion regulation process differences that arise in older adulthood. Though this research suggests older adults may not be as able to up-regulate positive emotions relative to middle-aged adults, older adults indeed appear to be able to down-regulate their negative emotions throughout older adulthood. While prior research has emphasized that older adults attend to positive stimuli more than younger adults (Carstensen & Mikels, 2005; Reed & Carstensen, 2012), these findings reorient this perspective by purporting that the down-regulation or avoidance of negative emotions may be central to older adults' emotion regulatory strengths.

Other developmental theories note that, as individuals age, they experience more losses than gains, and thus must be more selective in the choices they make to compensate for these respective losses (Baltes, 1997; Baltes & Baltes, 1990). In line with SST, SAVI, and DIT, but contrary to SOC, the current study found a maintained stability of lower negative affect as people aged even toward the end of the adult lifespan at the aggregate level, though some sample-specific findings often still found an uptick in negative affect in late life. These differences in lifespan developmental affect trajectories could be tied to the selection process older adults make amid broader aging-related declines. Older age is often associated with limitations in daily physical functioning and is sometimes associated with reliance on care partners (Marks, 1996; Vaughan et al., 2016). This loss of independence may impact the selection process of how older adults regulate their emotion, with research suggesting that affective declines are sharper among older adults who perceive less control over their lives (Gerstorf et al., 2008). For example, there may be fewer opportunities for individuals to select into desirable situations to increase positive emotions.

However, given the knowledge and experience accrued throughout the lifespan (Charles, 2010), they may still be better able to effectively reappraise life stressors to keep negative emotions at bay. Notably, these processes may not be tied solely to the experience of aging, but also the experience of feeling one's future time become more limited (e.g., Gerstorf et al., 2008; Schilling et al., 2013). Moreover, theoretical frameworks have emphasized that age-associated changes are potentially a proxy for health-related changes and proximity to death (i.e., terminal decline) (Gerstorf & Ram, 2013). This perspective could also contextualize the variability in change trajectories across samples.

In addition, these findings reiterate the significance of a lifespan developmental perspective for emotion processes. With previous work emphasizing the importance of disentangling potential age-period-cohort (APC) effects (Charles et al., 2023), it is worth noting that some of these age findings could be confounded with time or cohort effects, though the current study did not meet the appropriate conditions to test potential APC effects given the lack of coverage across different ages by time periods and cohorts. For example, quadratic positive affect findings for GSOEP and HILDA were the inverse pattern of the majority of the other samples. Participants in these studies were on average younger (e.g., compared to HRS) and used different affect measures from samples (e.g., LISS) that started collecting affect at a similar time point, pointing to potential explanations tied to cohorts as well as measurement. Finally, contrary to previous cross-sectional work (e.g., Mrcozek & Kolarz, 1998), the current study found that there were no sex differences in how negative or positive affect changed across age.

### *Limitations and Future Directions*

There are limitations in the current work that set the foundation for valuable next steps in the investigation of affect across the lifespan. First, while the current study benefitted from using longitudinal methodology, participants reported their emotional experiences at each measurement occasion through retrospective questionnaires, with requested windows of reflection ranging from "in the current moment" to the past 30 days. These types of affect questionnaires are subject to biases and may rely on different sources of information relative to in-the-moment reports of affective experiences (Robinson & Clore, 2002a, 2002b). When viewing affect through the lens of the trait–state debate, recent calls have pointed out that measuring emotions at the within- versus between-person level likely requires a different assessment approach (Brose et al., 2020). Moreover, with daily experiences of affect often being associated differentially with age relative to long-term affect trajectories (Charles et al., 2023; Röcke et al., 2009), these findings may not translate into how age is tied to experiences of emotion in daily life. In-the-moment affective experiences are central to many conceptualizations of affective trajectories across the lifespan. The use of measurement burst designs could address the disconnect between short- and long-term findings. By tracking individuals' emotions at a momentary level over many years, we would be able to better chart actual momentary experiences of emotions as they pertain to past theoretical mechanistic work on age-related differences in affect while evaluating whether and how people's short-term reports of emotions and retrospective reports of emotions diverge (or converge) as they age.

Second, the current study was generally underpowered (k = 14) to test meta-analytic moderators (Hedges & Pigott, 2004; Hempel et al., 2013); thus, we must interpret differences among samples with caution. Though findings were generally consistent across samples, a larger study sample would allow for greater power in testing moderators, as well as more opportunities for exploring more nuanced reasons for differences in findings. For example, rather than comparing United States samples to non–United States samples, we could evaluate differences between specific countries or world regions. Additionally, given the current samples came from the United States, Germany, Australia, Sweden, and Netherlands, these findings may not be generalizable to non-Western cultures or less educated, wealthy samples. Increasing the representation of large-scale, publicly available longitudinal datasets that assess affect in non-WEIRD (Henrich et al., 2010) countries would help solidify what lifespan developmental changes in negative and positive affect likely look like as individuals age more holistically.

Third, one challenge with the coordinated data analysis approach is balancing precision with inclusivity (Graham et al., 2022). With only four samples using the classic PANAS measure (i.e., DEAS, LISS, HRS, and NAS), the decision was made for greater inclusion of negative and positive emotions to increase both study-level power as well as representation of different ages across different countries. However, this came at the cost of precise measurement of affect. The operationalization and measurement of a construct should be driven by its definition (Flake & Fried, 2020). The current study used the CES-D, a measure that assesses constructs beyond discrete positive and negative emotions (i.e., assesses depressed affect, positive activity, somatic activity, and interpersonal functioning; Radloff, 1977). For example, though the CES-D captures experiences of emotions (e.g., "I felt sad" and "I was scared"), this measure also reflects both cognitive (e.g., "I worried about things I normally don't worry about") and behavioral (e.g., "I cried") aspects of emotional experience and expression.

Interestingly, in sensitivity analyses in which samples that used the CES-D were excluded, quadratic results for negative affect remained the same while quadratic results for positive affect changed. These findings align with those from previous traditional meta-analytic work which found no measurement-based differences in affect trajectories (Buecker et al., 2023). This may point to the negative emotional experiences across these measures being more consistent in how they are experienced as people age. Alternatively, this could simply be an artifact of measurement given all affect measures (excluding the PANAS) had more negatively valenced than positively valenced items, thus were capturing positive affect less holistically (and perhaps less consistently). Additionally, with many of the current samples providing only aggregate affect scores instead of individual measure items, we were unable to test longitudinal measurement invariance. Strict longitudinal measurement invariance ensures that the loadings of the items, the variances, of the items, and the associations between the variances of the items on a latent variable are consistent over time (Liu et al., 2017). Without establishing this, we are unable to disentangle trajectories in negative and positive affect attributed to aging from age-related changes in the measurement of affect itself.

Finally, the current study focused on two components of well-being: negative and positive affect. Previous research has found that age-based differences in affect extends beyond the valence of emotions to the levels of *arousal* (i.e., activation levels) tied to those emotions. Some findings suggest that older adults have more frequent experiences of low arousal positive emotions than younger adults do but may not differ in frequency of low arousal negative emotions (Kessler & Staudinger, 2009; Mak & Schneider, 2022). Thus, a more comprehensive assessment of affect tied to the level of activity of the discrete emotion may further unveil age-based changes. Moreover, well-being is a broad construct that includes cognitive evaluations, like life satisfaction and sense of purpose, and social experiences, such as social connectedness and loneliness (Willroth, 2022). Though there have been some theoretical and empirical endeavors into understanding how other elements of psychosocial well-being may change with age (Baird et al., 2010; Galambos et al., 2015; Mann et al., 2021; Pfund & Lewis, 2020), a more comprehensive evaluation of aging-related changes across well-being components is warranted. One valuable pathway to build from the current work would be to evaluate how these age trajectories vary based on other aspects of well-being, and whether these changes co-occur within individuals.

## Conclusion

The present research used a coordinated data analysis spanning the adolescent and adult portions of the human lifespan to evaluate the generalizability of lifelong trajectories of negative and positive affect across diverse methods and samples. Our study provides strong evidence across 14 longitudinal studies to clarify the mixed findings of previous research, finding that positive affect remains relatively stable in young adulthood before beginning to decline in midlife whereas negative affect declines throughout most of adulthood reaching its nadir in older adulthood before stabilizing. Affect balance, conceptualized long ago by scholars as central to understanding well-being (Bradburn, 1969), may vary in important ways over the human lifespan. These findings suggest that older adults may experience the affective benefit of lower negative emotion but may experience declines in positive emotion.

## Declaration of conflicting interests

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## Open science statement

All *R* scripts for data wrangling, analyses, meta-analysis, and creating tables and figures are available on OSF: https://osf.io/9rj82/. Supplemental tables with more extensive results and descriptive statistics are also available through this link. The current project was not preregistered as data collection and analysis were carried out across several years before preregistration was the default approach in our research group. Finally, the following datasets are publicly available:

- ADDH (https://addhealth.cpc.unc.edu/data/#public-use)
- HILDA (https://melbourneinstitute.unimelb.edu.au/hilda#accessing)
- HRS (https://hrsdata.isr.umich.edu/data-products/public-survey-data?_gl=1*1t5mbbn*_ga*MTIzNDU0Njg4LjE2OTIzODkzMjg.*_ga_FF28MW3MW2*MTcwNDQ4MDk4Ni4yLjAuMTcwNDQ4MDk4Ni4wLjAuMA)
- LISS (https://www.lissdata.nl/use-the-panel)
- LSOG (https://www.icpsr.umich.edu/web/NACDA/studies/22100/datadocumentation)
- MIDUS (https://www.icpsr.umich.edu/web/ICPSR/series/203)
- WLS (https://researchers.wls.wisc.edu/data/survey-data/)

Other datasets can be accessed after approval through request:

- ALSA (https://dataverse.ada.edu.au/dataset.xhtml?persistentId=doi:10.26193/J01NCT)
- DEAS (https://www.dza.de/en/research/fdz/access-to-data/application)
- GSOEP (https://www.eui.eu/Research/Library/RequestForms/Register-micro-data)
- LASA (https://lasa-vu.nl/en/request-data/)
- NAS (https://www.maelstrom-research.org/study/va-nas)
- OCTO (https://www.gu.se/en/psychology/our-research/lifespan-development-adult-development-and-aging-life-lab)
- SATSA (https://ki.se/en/meb/satsa-the-swedish-adoptiontwin-study-of-aging *or* email: nancy.pedersen@ki.se)

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## Supplemental Material

Supplemental material for this article is available online.

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