

Phenotyping arts engagement as a health behaviour using 20 years of the American Time Use Survey

*Dr Jessica K Bone¹

Dr Feifei Bu¹

Dr Jill K Sonke²

Prof Daisy Fancourt¹

1. Research Department of Behavioural Science and Health, Institute of Epidemiology & Health Care, University College London, London, UK

2. Center for Arts in Medicine, University of Florida, Gainesville, Florida, US

*Corresponding author

Research Department of Behavioural Science and Health, Institute of Epidemiology & Health Care, University College London, London, UK

jessica.bone@ucl.ac.uk

Abstract

Arts engagement is becoming recognised as a health behaviour, but there has not yet been any national monitoring of engagement levels or trends in disparities over time. We provide the first behavioural phenotyping of arts engagement between 2003 and 2023 in the United States, using a nationally representative sample from the American Time Use Survey (n=236,270). Daily arts engagement rates remained stable from 2003 to 2023, with small underlying increases in participatory engagement (dancing, performing, arts and crafts, writing) and slight declines in receptive engagement (attending performing arts, museums, watching dancing). Listening to and making music did not change over time. There were less consistent trends in time spent on the arts. People increasingly did arts activities alone and at home. There were disparities in engagement, with differing trends according to sex, age, and income. Our findings demonstrate the importance of national monitoring of arts engagement alongside other health behaviours.

Introduction

The arts are complex human behaviours, comprising different types of creative practices, multiple modes of engagement, and diverse art forms.¹ Engagement can involve active participation (e.g. painting, making music, storytelling, dancing), receptive consumption of art that has been created and is now experienced by an audience (e.g. going to a museum, cultural event, theatre, or concert), and broader creative activities (e.g. gardening, cooking, rituals, hobby groups). These activities, which we collectively refer to as arts engagement, are ubiquitous in human culture and have long had a role in health and wellbeing. In the last few decades, there has been increasing empirical research on arts and health, with evidence that the arts can be used to manage and treat illness, prevent ill health, and in wider health promotion.^{2,3} Arts engagement has been linked to lower risk of developing depression,⁴ chronic pain,⁵ and cognitive decline,⁶ ageing free from disease or impairment,⁷ and enhanced psychological⁸ and social wellbeing.^{3,9} Given this evidence, arts engagement is increasingly being recognised and acknowledged as a health behaviour in research and in policy.¹⁰⁻¹³

Detailed phenotyping of health behaviours is critical to monitor levels of engagement, particularly where there are disparities in behaviours, or high-risk populations that face barriers to engagement. National and international surveillance systems, including the World Health Organization (WHO) Global Health Observatory,¹⁴ allow monitoring of health behaviours. Identifying trends in other health behaviours, including physical activity,¹⁵ substance use,¹⁶ and diet,¹⁷ has been important for setting recommendations and targets. However, similar targets for arts engagement do not yet exist. We have relatively little understanding of arts behaviours – who engages, in which art forms, where, and with whom. Arts engagement is not yet included in international surveillance systems, making monitoring challenging. Additionally, the lack of data on long-term trends makes it difficult to assess how behaviours might be changing over time, the impact of changes to funding and federal policies, and what kinds of barriers and enablers people face to participation. Monitoring patterns of arts engagement is thus critical to understand the implications of previous policy, support future policy, and to identify high-risk populations, who may not be accessing the arts.

We have previously explored trends in arts engagement from 1993 to 2016 in the United States (US), finding fluctuations in rates of attending art performances and decreases in creative group membership over time.¹⁸ However, our study was limited to the narrow definition of arts engagement used in the General Social Survey (GSS), and the types of arts activities measured changed over time, which may have influenced findings. Similar issues affect the Survey of Public Participation in the Arts (SPPA; National Endowment for the Arts) and public opinion polls by Americans for the Arts (AFTA), which provide snapshots of arts behaviours in the US every 3-5 years.^{19,20} The SPPA has historically focussed on a limited number of more exclusive arts activities (e.g. classic music, opera, ballet), and the SPPA, GSS, and AFTA all ask people about engagement in the arts over the last year,¹⁸⁻²² which is subject to large recall biases.

The limitations of existing measures of arts engagement become most apparent when compared to other health behaviours. Physical activity is generally measured in minutes, with different types of activity separated. Diet is measured using portion sizes for various food groups or 24-hour dietary recalls. Asking whether someone has been to a museum in the past year, in contrast, lacks detail. Other behavioural aspects of engagement, including when in the day, where, and with whom activities are

done, are rarely measured. Existing evidence thus does not have the granularity needed to understand everyday arts engagement. Additionally, more comparisons are needed of data from recent years to before the COVID-19 pandemic, which hugely disrupted the provision of, funding for, and engagement with the arts.^{23,24}

In this study, we aimed to address these limitations by analysing time use survey data, which identifies, quantifies, and classifies people's behaviours within a specific 24-hour window, providing more detail than previous studies, substantially reducing recall bias, and enabling analysis of patterns in behaviours over multiple years.²⁵ Specifically, we analysed data from the American Time Use Survey (ATUS), which includes over 10,000 individuals each year, providing nationally representative estimates for an average day in the US. ATUS is particularly valuable for understanding arts behaviours, as it captures an accurate, detailed, and reliable picture of what people did, where they were, and who they were with minute to minute over the last day. We aimed to: 1) estimate rates of engagement in the arts on an average day; 2) determine how long people spent on the arts, both overall and for different art forms; 3) explore who arts activities were done with; 4) identify where arts activities were done; 5) examine potential disparities by exploring variation across different subgroups of the population; and 6) describe the national trends in these measures from 2003 to 2023.

Results

We included 236,270 individuals aged 15 and over (mean age=45.14, SD=18.63) who completed ATUS once between 2003 and 2023. We excluded 2020, as data collection was paused during the COVID-19 pandemic. After weighting, 52% were female, 81% were of White race, 53% were married, and 63% were employed (Table 1).

Overall engagement

ATUS asked participants to recall their activities on the day before the interview, reporting the number of minutes spent on each activity they did during the 24-hour period. We focussed specifically on engagement in arts activities on an average day (Figure 1). Overall, between 2003 and 2023, engagement equated to 6 minutes per day (SD=37) spent on any arts activities (Table S3). However, only 5% of participants engaged in one or more arts activities; the remaining 95% reported no engagement. The 12,637 participants who did arts activities spent an average of 1 hour and 59 minutes (SD=109; median=90) on these activities per day. Figure 2 (panel A-C) shows how these measures fluctuated between 2003 and 2023. The overall averages were very similar to those just for 2023 (Supplementary Materials). Regression models showed no associations between year (treated as linear) and these measures, indicating that there was no linear change in participation from 2003 and 2023 (Table S4-5).

Social context

Most participants did arts activities alone (50%), with multiple people (15%), or with a friend (14%). It was less common to do arts with a partner (8%), other family member (7%), or child (6%). Figure 2D shows how participation with others changed over time. In 2003, 57% of participants doing arts activities did them with others. This dropped to a low of 41% in 2021 and recovered to 49% by 2023.

Using Poisson regression with robust standard errors, the proportion who did arts with others (vs alone) decreased by 1% per year from 2003 to 2023 (prevalence ratio [PR]=0.99, 95% confidence interval [CI]=0.98, 0.99, $p<0.001$).

Location

Most participants did arts activities in their own home (60%) or other community locations (26%; e.g. outdoors, place of worship, whilst travelling). Doing arts in other places was less common: 4% were in others' homes, 4% at school, 2% in the workplace, 0.1% at a library, and 4% in multiple locations. In 2003, 39% of those who did arts activities engaged outside the home, but this decreased to 19% in 2021, before then recovering to 28% by 2023 (Figure 2E). The proportion of participants who reported doing arts activities outside the home (vs at home) decreased over time (PR=0.99, 95% CI=0.98, 0.99, $p<0.001$).

Specific activities

Examining domains separately, 2% of participants did participatory activities (dancing, performing, arts and crafts, writing), 1% receptive (attending performing arts, museums, watching dancing), and 2% listened to or made music (examined separately as it included both participatory and receptive elements). Among those who engaged, 2 hours and 8 minutes (SD=116) was spent on participatory activities per day, 2 hours and 41 minutes (SD=100) on receptive, and 1 hour and 26 minutes (SD=88) listening to/making music, although there was substantial variability between participants. Poisson regression models showed that from 2003 to 2023, participatory engagement increased slightly, whilst receptive engagement decreased (Figure 3A). Linear regression showed that trends in time spent on domains also differed, with evidence for increases in the time spent engaging among the whole sample just for participatory activities (Figure 3B), and increases in the time spent engaging only among those who engaged for receptive activities (Figure 3C).

Participation rates for specific activities varied but were generally low (0.01% watched dancing - 2% listened to/made music; Figure 3 panel D-E). Yet participation rates increased by 4% per year for writing (PR=1.04, 95% CI=1.02, 1.06, $p<0.001$) and 3% for arts and crafts both as a hobby (PR=1.03, 95% CI=1.02, 1.04, $p<0.001$) and with children (PR=1.03, 95% CI=1.00, 1.05, $p=0.026$). In contrast, rates decreased by 4% per year for performing (PR=0.96, 95% CI=0.95, 0.978 $p<0.001$) and 2% for attending performing arts (PR=0.98, 95% CI=0.97, 0.99, $p=0.004$). The overall time spent on each activity was also low (Figure 4). The average amount of time spent on specific activities by those who did the activity ranged from 55 minutes (arts and crafts with children) to 2 hours and 44 minutes (attending performing arts). In linear regression models, only time spent attending performing arts was associated with year, with evidence for an additional 1.61 minutes spent attending performances each year (coef=1.61, 95% CI=0.30, 2.92, $p=0.016$).

The role of individual characteristics

We then explored the role of individual characteristics in overall engagement. Looking at participation rates descriptively (Figure 5), engagement was highest in the youngest (aged 15-24) individuals, those living in metropolitan areas, and those with no disability. In contrast, participation rates were similar

across males and females, racial groups, and people with different levels of education and income. The time spent on art activities was less clearly differentiated across population groups (Figure 6), with some indication that it was higher in males, the oldest individuals, those living in non-metropolitan areas, and those with a disability.

We explored whether time trends differed across population groups, adding interactions between year (treated as linear) and individual characteristics to regression models used in the main analysis (Table S6). We then repeated analyses stratified by the individual characteristics (Table S7). Time trends in participation rates differed according to sex, age group, and income (Figure 5). Exploring sex differences, participation rates increased in females over time, but did not change in males. Females' average participation rate started at 4.8% in 2003 and peaked at 6.8% in 2019. For age groups, participation rates were highest in those aged 15-24 and remained stable both in this group and those aged 66 and over but increased in those aged 25-65 years (3.8% in 2003, peaked at 5.1% in 2018). Looking at income, there was weak evidence for increases in people with an annual family income under \$60,000, but this was not present in those with more income. For example, those earning \$30,000-\$59,999 had a participation rate of 4.8% in 2003, which peaked at 6.9% in 2021. In contrast, trends in time spent on the arts by those who engaged only differed across racial groups. The amount of time spent on arts activities was stable in participants of White, Black, and Asian race, but decreased from 2003 to 2023 in those of American Indian, Alaskan Native, Hawaiian/Pacific Islander, or multiple racial groups (Figure 6).

Discussion

This study provides the first behavioural phenotyping of daily arts engagement in the US from 2003 to 2023. Overall rates of engagement were stable over time. This appeared to be a result of a slight increase in participatory engagement (dancing, performing, arts and crafts, writing) combined with a small decrease in receptive engagement (attending performing arts, museums, watching dancing). Despite this decrease, the amount of time spent on receptive activities by those who participated did increase slightly over the 20-year period. There were also increases in the time spent on participatory activities among the whole sample, but this was likely driven by rising participatory engagement rates. Most people did arts activities alone and at home, and the proportion doing so increased over time. There was some evidence for disparities in engagement, with differing trends according to sex, age, and family income. Sex differences increased over time, with participation rates stable in males but increasing in females, whereas disparities due to age and income may have decreased over time.

The lack of change in overall engagement was surprising given previous evidence for declines in creative group membership¹⁸ and attending visual and performing arts¹⁹ during this period, alongside the general perception that arts participation is declining in the US.²⁶ Whilst it is reassuring that there have not been dramatic decreases in engagement, the lack of increases is concerning. Despite growing awareness of the potential health benefits of the arts,¹⁰⁻¹³ alongside efforts to increase access to the arts,^{27,28} engagement levels have not changed. In contrast, during a similar period, other health indicators improved in the US. For example, average daily participation rates in sports and exercise rose by 4% from 2003 to 2015²⁹ and use of tobacco products declined 33% among young adults and 22% among adults from 2002 to 2022.³⁰ Arts engagement thus appears to be falling behind other health

behaviours. This is particularly concerning given that even small increases in daily arts engagement could have large public health and economic impacts at the population level.³¹

Underlying the overall stability, there were small changes in specific activities, including declines in performing and attending performing arts. The latter is consistent with SPPA data suggesting falling attendance of visual and performing arts in the US from 2017 to 2022.¹⁹ A surprisingly low proportion of arts activities were done with others or outside the home, and this also declined from 2003 to 2023. These declines may reflect reductions in arts funding in the US over the last 20 years,³² with fewer resources available to support community-based arts venues and run performing arts events. The COVID-19 pandemic is another important factor. By far the lowest rates of receptive engagement were in 2021, following pandemic lockdowns. There were also substantial dips in activities done with others or outside the home in 2021. Engagement had somewhat recovered by 2022, but it did not reach pre-pandemic levels, potentially reflecting consequences of the COVID-19 pandemic, including the closure of many arts venues, additional barriers such as having to book in advance, and changes in behavioural norms. However, in ATUS, examples of performing arts did not explicitly include digital engagement (e.g. watching a recording of a play), meaning some engagement may have been missed. It was previously shown that the majority of those participating in the arts in 2022 did so through electronic or digital media.¹⁹ The apparent decline in engagement may thus be a result of shifts to more digital engagement, with overall rates remaining stable or even increasing. This could also explain the decline in activities done with others and outside the home.

Our findings suggest that males, working age adults, those living in non-metropolitan areas, and those with a disability have the lowest daily participation rates. These groups may experience the most systemic barriers to arts participation. Although our findings on sex, urbanicity, and disability status are consistent with previous evidence, we did not find the expected large disparities according to education or income.^{18,33–36} In fact, there was some evidence for increases in engagement just for people with an annual family income under \$60,000. Those earning \$30,000-\$59,999 had a participation rate of 4.8% in 2003, which then peaked at 6.9% in 2021. Despite being small absolute differences, these changes are meaningful when considered in relation to the low engagement rates, representing a 44% relative increase. Additionally, despite working age adults having the lowest participation rates, engagement did increase in this group over time. These reductions in income- and age-related disparities are promising, and could indicate that strategies to improve access to the arts may have had some success, helping people to overcome barriers such as cost, difficulty of getting to a venue, and lack of time.^{37,38} Despite this, our findings indicate that increasing sex differences and sustained disparities according to residential area and disability status require further attention. Research should explore the underlying drivers of these inequities, particularly as they may result from unjust systems, practices, or norms.

In addition to highlighting specific individual-level disparities to address, our findings demonstrate the need for initiatives to increase arts engagement at the population level, particularly targeting receptive activities that are done with others outside the home. According to the INNATE framework, the arts include numerous 'active ingredients' that may lead to improvements in health and wellbeing.³⁹ Activities done outside the home and with others may provide exposure to additional beneficial ingredients (over and above activities done alone at home), such as opportunities for social interactions, developing social identities and social support, physical activity, and exposure to nature. Yet, an individual's arts engagement is determined by many interconnected factors.⁴⁰ Changing

engagement is complex and requires simultaneous intervention at multiple levels. Monitoring is vital to understand the impact of interventions to increase engagement. Fortunately, the recently established Arts Indicators Project, led by the National Arts Statistics and Evidence-based Reporting Center (NASERC), began doing so in 2024.⁴¹ The project aims to provide regular statistics on the arts in the US, using data from robust, publicly accessible, and nationally representative sources (e.g. Annual Business Survey, American Community Survey, ATUS, Current Population Survey, SPPA). In addition, five arts behaviour questions were added to the US Census Bureau's Household Pulse Survey in spring 2024.⁴² Analyses are planned to explore trends over time, the role of individual characteristics, and regional variations in arts participation, cultural assets, and art education, which will further extend our findings and be valuable for those working in public health.⁴¹

This study has several strengths. We included over 236,000 people, with weights making estimates nationally representative of an average day in the US. Although response rates declined over time, ATUS measured all daily activities, so there may be less selection bias than surveys explicitly focussed on the arts. Time use surveys are also less susceptible to recall bias than other surveys that require reporting over longer periods. ATUS allowed us to use a broader definition of arts than previous surveys. Whilst overarching categories remained consistent over time, specific examples of activities within these domains were updated, which is important to keep up with emerging ways of participating in the arts. In contrast, previous research has not been able to compare changes in participatory engagement over time due to changes in measures.¹⁹ We also provide the first population-level data on trends in social context and location of everyday arts engagement.

However, there are some limitations of the ATUS activity classifications. Participation in many art forms is infrequent when measured daily, so ATUS had to group specific activities into larger categories such as "attending performing arts" or "arts and crafts as a hobby" to gain reliable estimates. This prevented more detailed investigation of some engagement types, including the separation of listening to and making music into its receptive and participatory elements. We chose to focus on overall engagement because, despite the large sample size, many types of engagement were still rare. This also meant we could not explore the social context or location of activities separately. Engagement on the average day cannot be compared with monthly or annual prevalence rates. We excluded some activity categories as they included non-arts activities (e.g. arts and entertainment not elsewhere classified), but this could mean we missed some forms of engagement. We could not separate some digital/virtual consumption of arts from other activities, which may mean we further underestimated overall rates of engagement, as this is the most popular mode of arts participation.¹⁹ Despite this, our approach was consistent with UNESCO's framework for measuring cultural participation, which recommends focussing on conscious participation in the arts and using broad activity categories that encompass diverse cultural practices.⁴³ Additionally, our measures of sex (male, female; due to availability in ATUS) and race (White, Black, Asian, Other; due to small numbers in non-White groups) were overly simplistic. This approach conflates experiences across diverse sex, racial, and ethnic groups, which might be problematic as these groups may not have equal access to the arts.¹⁸ Future research should collect more nuanced data on sex and further explore the role of race and ethnicity in arts participation.

Overall, we found small increases in average daily rates of participatory arts engagement and small declines in receptive arts engagement over the last 20 years in the US. People have become less likely to do arts activities with others or outside the home. This is concerning given that arts engagement is

increasingly being recognised as a health behaviour, with the arts providing an opportunity for expanding individual choice in health promotion decision-making. Ultimately, arts engagement should be integrated into national and international surveillance systems, alongside other health behaviours. The NASERC Arts Indicators Project will be key for monitoring arts behaviours in the US. Our findings indicate that tracking different arts activities separately is crucial, and it will be equally important to measure where activities are done and who with, as well as the demographic and socioeconomic characteristics influencing participation.

Methods

Sample

The American Time Use Survey (ATUS) is a continuous cross-sectional survey, covering all residents of private households in the US aged 15 and over.²⁵ Individuals are randomly selected from a subset of households that have completed their eighth month of interviews for the Current Population Survey (CPS). One individual per household is invited to ATUS two months after completing this CPS interview.

Data collection began in 2003, with data currently available to 2023. We excluded 2020 due to complications during the COVID-19 pandemic (data collection was paused for part of the year, so weights for 2020 cannot be combined with other years). Approximately 26,400 people were eligible per year, but response rates declined over time (57.8%-35.8%).²⁵ Each participant was interviewed once. ATUS excluded participants with incomplete responses. This left a total of 236,357 participants. Following UCL Centre for Time Use Research's recommendations, we excluded participants who did not report: spending time on sleep/rest/personal care/eating /drinking (n=15); at least one change in location (n=59); and at least one change in the presence of others (n=13). This left a final analytical sample of 236,270 participants.

Ethical approval

This study has Institutional Review Board approval from the University of Florida (IRB202401080) and ethical approval from University College London Research Ethics Committee (project 18839/001). All participants gave informed consent.

Measures

ATUS asked participants to recall their activities over 24 hours, beginning at 4am on the day prior to the interview and ending at 4am on the day of the interview. Participants were randomly assigned a day of the week on which to complete the survey, with 10% of the sample allocated to each weekday and 25% to each weekend day. Weights then account for this non-uniform distribution and differing response rates across days of the week, so that measures can be estimated for an average day. Information on secondary activities (activities that are done at the same time as the primary activity) was not collected, except for childcare. Participants reported every activity they took part in during the 24-hour period, including where they were and whom they were with. Activities were coded using a standard lexicon,

verified by two coders, and classified within a three-tiered system, from broad to detailed categories including examples.

Arts and cultural engagement

Arts activities were: dancing, performing (including extracurricular music and performance activities), arts and crafts as a hobby, arts and crafts with children (including household and non-household children), writing for personal interest, listening to or making music (not the radio), attending performing arts, attending museums, and watching dancing (Table S1). We measured whether participants engaged and total time (minutes) spent 1) overall, 2) for each art domain, and 3) for each specific activity (Figure 1). Engagement in each activity was indicated by spending ≥ 1 minute on it during the diary day. Art domains were participatory (dancing, performing, arts and crafts, writing) and receptive (attending performing arts, museums, watching dancing) activities. Listening to/making music was examined separately as it included both participatory and receptive elements.

We categorised whom arts were done with into six social contexts: alone, with partner or spouse, with child or grandchild, with other family member, with a friend/colleague/neighbour/acquaintance, and with multiple people. Finally, we categorised where arts were done into seven locations: own home, other's home, workplace, library, school, other community location (e.g. outdoors, place of worship, whilst travelling, other), or multiple locations. Arts and cultural venues (e.g. theatre, music venue, museum, historic site) were not included in the list of potential locations, so these were likely recorded in the "other" category.

Reading was excluded as it can be done passively, without critical engagement, or be approached as a functional task, leading to debate around whether it is an arts behaviour. Reading was also far more common than other arts activities. Other related but excluded activities were arts and entertainment not elsewhere classified (included non-arts activities), income-generating activities and travel related to arts and entertainment (not strictly leisure), and serving at volunteer events and cultural activities (the main activity was serving rather than the arts).

Individual characteristics

Demographic, socioeconomic, and health-related information was collected either during the ATUS interview or from earlier CPS interviews. We included sex (male, female), age group (15-24 years, 25-65 years, 66 years and over), race (White, Black, Asian, Other [including American Indian, Alaskan Native, Hawaiian/Pacific Islander, multiple racial groups]), education (high school or less, college, undergraduate, postgraduate), annual family income (quartiles: less than \$30,000, \$30,000 - \$59,999, \$60,000 - \$99,999, \$150,000 and over), metropolitan status (non-metropolitan area, metropolitan area), and disability status (no disability, disability that prevents work). Sex, age, metropolitan, and disability status were measured in the ATUS interview. Race, education, and income were measured in the CPS interview, 2-5 months before the ATUS interview (mean=3.04, standard deviation [SD]=0.57). Further sociodemographic characteristics were included just in Table 1.

Statistical analysis

We aimed to test whether arts engagement has changed from 2003 to 2023. First, we explored the proportion who did arts activities (participation rate), the average time spent on arts overall (total

mean), and the average time spent on arts just for participants who undertook these activities (participation mean).⁴⁴ We used a series of regression models to examine time trends. Poisson regression with robust standard errors estimated prevalence ratios, testing whether participation rates changed over time, for arts overall and each domain and activity separately. Linear regression tested whether the amount of time spent on arts activities (total mean, participation mean) changed over time, overall and for each domain and activity.

Next, we explored social context and activity location. Given the low frequency of arts activities done with different people, we tested whether the proportion of participants who did activities alone (vs with others) changed over time using Poisson regression with robust standard errors. Similarly, as arts activities were mostly done at home, we tested whether the proportion of participants who did activities only in the home (own home/others' homes vs outside home) differed over time using Poisson regression with robust standard errors. Finally, we examined whether time trends differed across population groups. We added interactions between participation year and individual characteristics for overall participation rate and participation mean in separate models. We then repeated analyses stratified by individual characteristics.

In all models, time (year) was treated as a linear exposure. We ran two additional sets of models for each outcome to test this assumption: 1) including a quadratic effect of time, and 2) treating time as categorical (the most complex model possible). We compared models using fit statistics (Akaike Information Criterion, Bayesian Information Criterion), Wald tests (quadratic vs linear model), and likelihood-ratio tests (categorical vs continuous model). Wald tests indicated that including quadratic terms did not improve model fit ($p > 0.05$), except for activity location. Although likelihood-ratio tests indicated that treating time as categorical did improve model fit over including it as a continuous linear exposure for most outcomes, likelihood-ratio tests may not be valid for models with probability weights or robust standard errors as assumptions are violated. Given this, and to avoid overfitting and aid interpretation, time was treated as linear in all models.

ATUS generated weights to account for complex sampling, day of the week, and response rates across demographics and days. We used these weights to generate estimates for an average day representative of the US civilian non-institutionalised population aged 15 and over. Missingness was generally low (<6%; Table S2), although ATUS replaced missing income data using values from previous CPS waves for 9% of participants. To account for data that were still missing, we used multiple imputation by chained equations (MICE).⁴⁵ We generated 20 imputed data sets using ordered logistic and logistic regression according to variable type. The imputation model included all variables used in analyses, sampling weights, and auxiliary variables (Table S2). Separate imputation models were used for overall arts indices and individual activities due to collinearity. Findings from imputed analyses did not differ to complete case analyses (Table S8-S13), so imputed results are reported. All analyses were performed using Stata 18.⁴⁶

In sensitivity analyses, we tested whether outliers in the number of minutes spent on art activities (participation mean) influenced findings. Top-coding outliers at three standard deviations above the mean (416 minutes) or at the 99th percentile (513 minutes) did not alter the results, so analyses are reported without outliers removed or recoded.

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References

1. Sonke J, Rodriguez AK, Colverson A, et al. Defining “Arts Participation” for Public Health Research. *Health Promot Pract*. Epub ahead of print 17 July 2023. DOI: 10.1177/15248399231183388.
2. Fancourt D, Finn S. *What is the evidence on the role of the arts in improving health and well-being? A scoping review*. Copenhagen, <https://europepmc.org/article/NBK/nbk553773> (2019).
3. Fancourt D, Bone JK, Bu F, et al. *The Impact of Arts and Cultural Engagement on Population Health: Findings from Major Cohort Studies in the UK and USA 2017 - 2022*. London, <https://sbbresearch.org/wp-content/uploads/2023/03/Arts-and-population-health-FINAL-March-2023.pdf> (March 2023, accessed 13 November 2024).
4. Fancourt D, Tymoszuk U. Cultural engagement and incident depression in older adults: Evidence from the English Longitudinal Study of Ageing. *British Journal of Psychiatry* 2019; 214: 225–229.
5. Fancourt D, Steptoe A. Physical activity and social and cultural engagement as risk-reducing factors in the prevention of chronic pain in older age: findings from a longitudinal cohort study. *The Lancet* 2018; 392: S34.
6. Fancourt D, Steptoe A. Cultural engagement predicts changes in cognitive function in older adults over a 10 year period: Findings from the English Longitudinal Study of Ageing. *Sci Rep* 2018; 8: 10226.
7. Bone JK, Bu F, Sonke JK, et al. Leisure engagement in older age is related to objective and subjective experiences of aging. *Nat Commun* 2024; 15: 1499.
8. Bone JK, Bu F, Sonke JK, et al. Longitudinal associations between arts engagement and flourishing in late adolescents and young adults: a fixed effects analysis of the panel study of income dynamics. *Affect Sci* 2023; 4: 131–142.
9. Tymoszuk U, Perkins R, Fancourt D, et al. Cross-sectional and longitudinal associations between receptive arts engagement and loneliness among older adults. *Soc Psychiatry Psychiatr Epidemiol* 2020; 55: 891–900.
10. Rodriguez AK, Akram S, Colverson AJ, et al. Arts Engagement as a Health Behavior: An Opportunity to Address Mental Health Inequities. *Community Health Equity Research & Policy* 2023; 2752535X2311750.
11. Sajnani N, Fietje N. The Jameel Arts & Health Lab in collaboration with the WHO–Lancet Global Series on the Health Benefits of the Arts. *The Lancet*. Epub ahead of print September 2023. DOI: 10.1016/s0140-6736(23)01959-1.

12. Dow R, Warran K, Letrondo P, et al. The arts in public health policy: progress and opportunities. *The Lancet Public Health* 2023; 8: e155–e160.
13. Galea S. The Arts and Public Health: Changing the Conversation on Health. *Health Promot Pract* 2021; 22: 8S-11S.
14. World Health Organization. The Global Health Observatory, <https://www.who.int/data/gho> (accessed 13 November 2024).
15. Guthold R, Stevens GA, Riley LM, et al. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. *Lancet Glob Health* 2018; 6: e1077–e1086.
16. Bauman A, Phongsavan P. *Epidemiology of substance use in adolescence: prevalence, trends and policy implications*. 1999.
17. Wang DD, Leung CW, Li Y, et al. Trends in dietary quality among adults in the United States, 1999 through 2010. *JAMA Intern Med* 2014; 174: 1587–1595.
18. Bone JK, Bu F, Fluharty ME, et al. Who engages in the arts in the United States? A comparison of several types of engagement using data from the General Social Survey. *BMC Public Health* 2021; 21: 1349.
19. National Endowment for the Arts. *Arts Participation Patterns in 2022: Highlights from the Survey of Public Participation in the Arts*, <https://www.arts.gov/sites/default/files/2022-SPPA-final.pdf> (2023, accessed 13 November 2024).
20. Americans for the Arts. *Americans Speak Out About the Arts in 2023: An In-Depth Look at Public Perceptions and Attitudes About Arts & Culture in 2023*, <https://www.americansforthearts.org/by-program/reports-and-data/research-studies-publications/public-opinion-poll> (2024, accessed 14 February 2025).
21. National Endowment for the Arts. An Average Day in the Arts: State Participation Patterns from the American Time Use Survey for 2006-2010. 2012; 1–41.
22. National Endowment for the Arts. *Time and Money: Using Federal Data to Measure the Value of Performing Arts Activities*. 2011.
23. Bu F, Mak HW, Bone JK, et al. Longitudinal changes in home-based arts engagement during and following the first national lockdown due to the COVID-19 pandemic in the UK. *Perspectives in Public Health* 2022; 142: 117–126.
24. Bone JK, Mak HW, Fluharty ME, et al. Who engaged in home-based arts activities during the COVID-19 pandemic? A cross-sectional analysis of data from 4,731 adults in the United States. *Health Promot Pract* 2022; 1–10.
25. Bureau of Labor Statistics. *American Time Use Survey User's Guide: Understanding ATUS 2003 to 2023*, <https://www.bls.gov/tus/atususersguide.pdf> (2024, accessed 1 August 2024).
26. Rabkin N, Hedberg EC. *Arts education in America: What the declines mean for arts participation*, <https://www.arts.gov/sites/default/files/2008-SPPA-ArtsLearning.pdf> (2012).
27. Biden JR. Executive order on promoting the arts, humanities, museum, and library services in America. *The White House*, <https://www.whitehouse.gov/briefing-room/presidential-actions/2022/09/30/executive-order-on-promoting-the-arts-the-humanities-and-museum-and-library-services/> (2022, accessed 15 November 2024).
28. National Endowment for the Arts. *National Endowment for the Arts Strategic Plan FY 2022-2026*, <https://www.arts.gov/sites/default/files/2022-2026-Strategic-Plan-Feb2022.pdf> (2022, accessed 15 November 2024).
29. Woods RA. Spotlight on Statistics: Sports and Exercise. *Bureau of Labour Statistics* 2017; 1–16.

30. American Lung Association. Tobacco Trends Brief: Overall Smoking Trends, <https://www.lung.org/research/trends-in-lung-disease/tobacco-trends-brief/overall-smoking-trends> (2024, accessed 13 December 2024).
31. Frontier Economics. *Culture and Heritage Capital: Monetising the Impact of Culture and Heritage on Health and Wellbeing*, https://assets.publishing.service.gov.uk/media/678e2ecf432c55fe2988f615/rpt_-_Frontier_Health_and_Wellbeing_Final_Report_09_12_24_accessible_final.pdf (2024, accessed 14 February 2025).
32. Lawrence S. Arts Funding at Twenty-Five: What Data and Analysis Continue to Tell Funders about the Field. *Grantmakers in the Arts Reader*; 29, <https://www.giarts.org/sites/default/files/29-1-arts-funding-at-twenty-five.pdf> (2018, accessed 15 November 2024).
33. Lamont M, Beljean S, Clair M. What is missing? Cultural processes and causal pathways to inequality. *Socioecon Rev* 2014; 12: 573–608.
34. National Endowment for the Arts. *How a Nation Engages With Art: Highlights from the 2012 Survey of Public Participation in the Arts*. Washington, DC, <https://www.arts.gov/sites/default/files/highlights-from-2012-sppa-revised-oct-2015.pdf> (2013).
35. National Endowment for the Arts. *U.S. Patterns of Arts Participation: A Full Report from the 2017 Survey of Public Participation in the Arts*. Washington, DC, https://www.arts.gov/sites/default/files/US_Patterns_of_Arts_ParticipationRevised.pdf (2019).
36. Stallings SN, Mauldin B. *Public Engagement in the Arts: A Review of Recent Literature*, https://www.lacountyarts.org/sites/default/files/pdfs/lacac_pubenglitrev.pdf (2016).
37. Dwyer C, Weston-Sementelli J, Lewis CK, et al. *Why we engage: Attending, creating, and performing art*, https://www.arts.gov/sites/default/files/Why-We-Engage-0920_0.pdf (2020).
38. Blume-Kohout M, Leonard SR, Novak-Leonard JL. *When Going Gets Tough: Barriers and Motivations Affecting Arts Attendance*, <https://www.arts.gov/sites/default/files/when-going-gets-tough-revised2.pdf> (2015).
39. Warran K, Burton A, Fancourt D. What are the active ingredients of ‘arts in health’ activities? Development of the INGredients iN ArTs in hEalth (INNATE) Framework. *Wellcome Open Res* 2022; 7: 10.
40. Fancourt D, Warran K. A fRAMework of the DetermInants of Arts aNd Cultural Engagement (RADIANCE): integrated insights from ecological, behavioural and complex adaptive systems theories. *Wellcome Open Res* 2024; 9: 356.
41. Roberts A, Snyder T, Spingler L, et al. *The Arts in the United States: Developing Key National Indicators of Arts Activity*, https://www.arts.gov/sites/default/files/naserc-techrprt-508_0.pdf (2024, accessed 15 November 2024).
42. National Endowment for the Arts. *Arts Attendance, Art-Making, and Social Connectedness: Spring/Summer 2024*, <https://www.arts.gov/impact/research/publications/us-patterns-arts-participation-full-report-2017-survey-public-participation-arts>. (2024).
43. UNESCO Institute for Statistics. *Measuring cultural participation*.
44. United Nations Statistical Commission. *Guide to Producing Statistics on Time Use*, https://unstats.un.org/UNSDWebsite/statcom/session_55/documents/BG-3k-Guide_to_Producing_Statistics_on_Time_Use-55UNSC_background-E.pdf (2024, accessed 28 August 2024).
45. White IR, Royston P, Wood AM. Multiple imputation using chained equations: Issues and guidance for practice. *Stat Med* 2011; 30: 377–399.

46. StataCorp. Stata Statistical Software: Release 18.

Tables and figures

Figure 1. Dataset characterisation and measures of arts engagement.

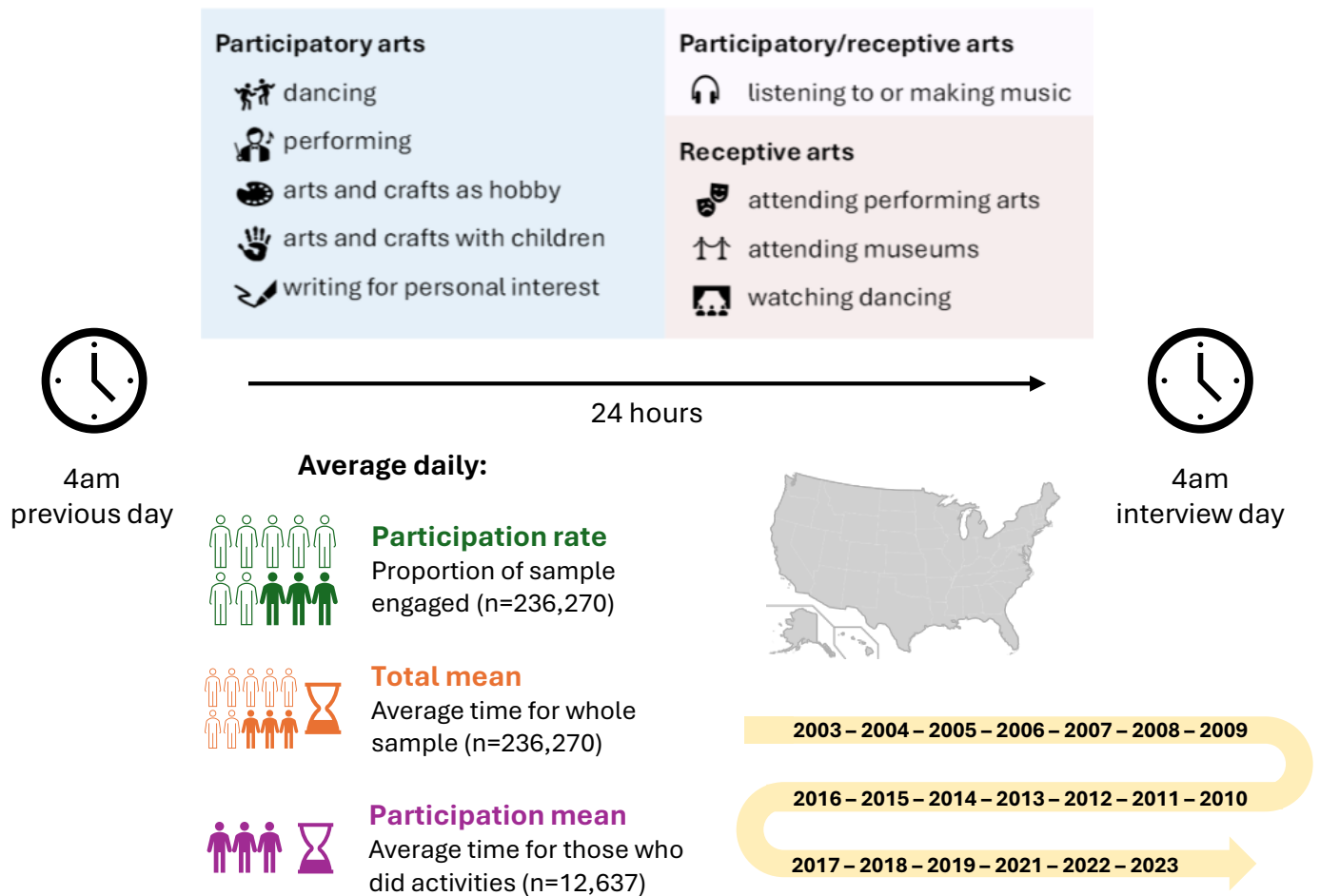


Figure 2. Overall engagement in arts activities from 2003 to 2023 (excluding 2020 due to the COVID-19 pandemic). A) Participation rate: proportion of sample who engaged in the arts. B) Total mean: average time spent on the arts in the full sample. C) Participation mean: average time spent on arts just for participants who undertook these activities. D) Proportion of participants who did arts activities with others. E) Proportion of participants who did arts activities outside the home.

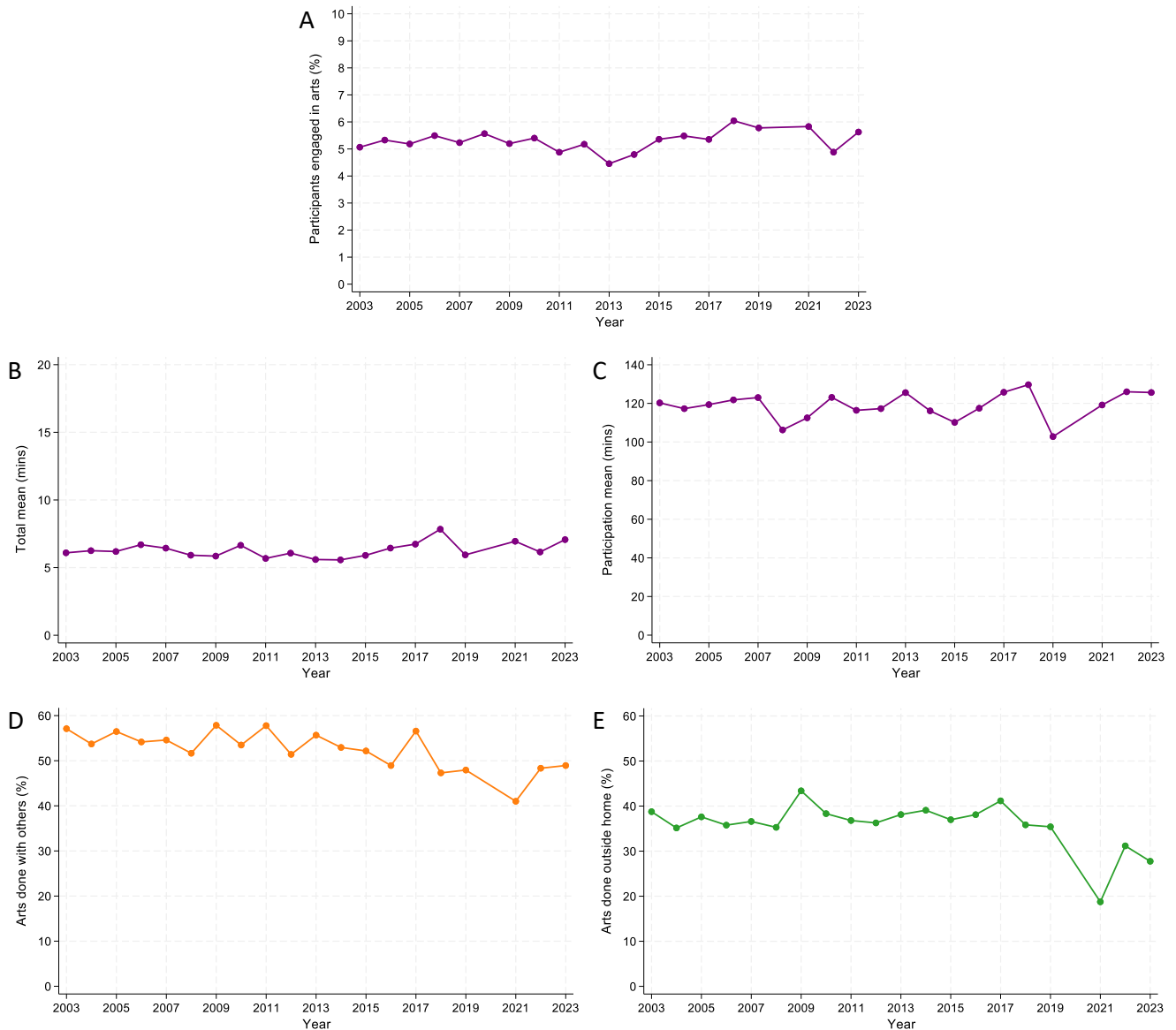


Figure 3. Overall engagement by domain and activity participation rates from 2003 to 2023 (excluding 2020). A) Participation rates (proportion of sample who engaged) for participatory activities, receptive activities, and listening to/making music. B) Total means (average time spent in the full sample) for participatory activities, receptive activities, and listening to/making music. C) Participation means (average time spent just for those who engaged) for participatory activities, receptive activities, and listening to/making music. D) Participation rates for specific participatory activities. E) Participation rates for specific receptive activities.

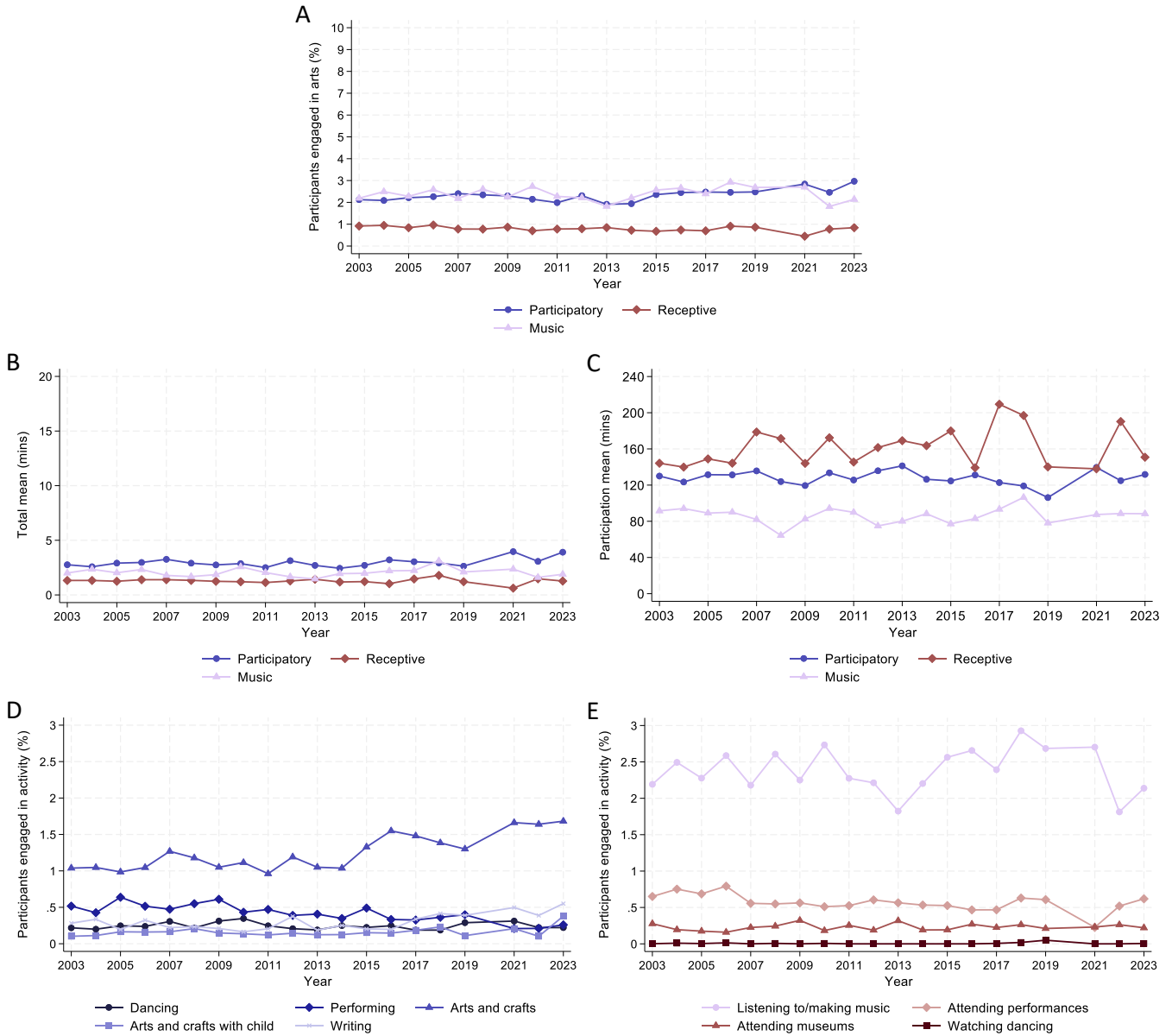


Figure 4. Proportion of total engagement spent on specific arts activities from 2003 to 2023 (excluding 2020).

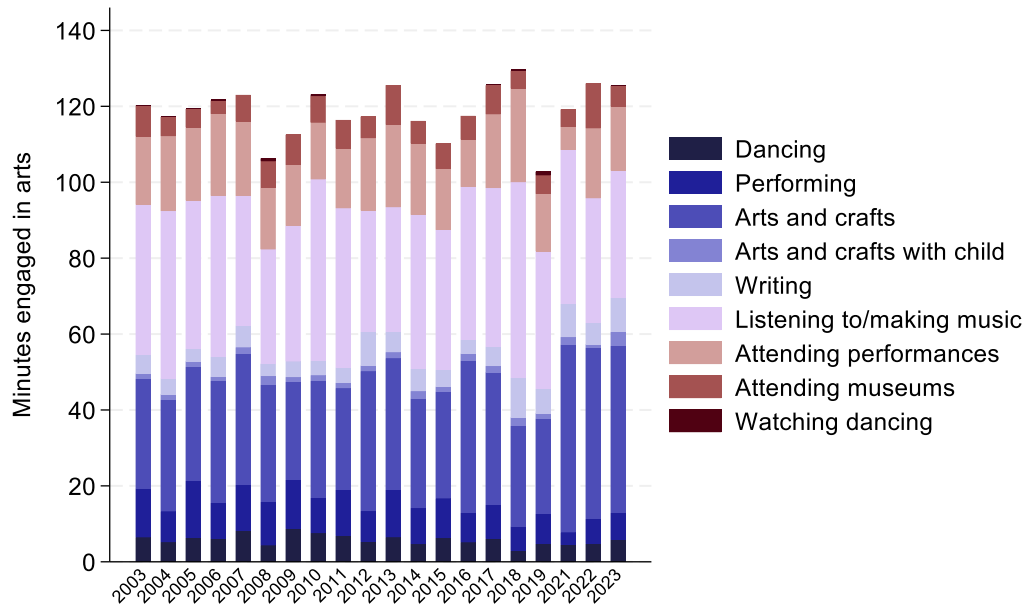


Figure 5. Differential trends in participation rates from 2003 to 2023 (excluding 2020) stratified by individual characteristics. A) Sex: male, female. B) Age group: 15-24 years, 25-65 years, 66 years and over. C) Race: White, Black, Asian, Other (including American Indian, Alaskan Native, Hawaiian/Pacific Islander, mixed race). D) Education: high school or less, college, undergraduate, postgraduate. E) Annual family income quartiles: less than \$30,000, \$30,000 - \$59,999, \$60,000 - \$99,999, \$150,000 and over. F) Metropolitan status: non-metropolitan area, metropolitan area. G) Disability status: no disability, disability that prevents work.

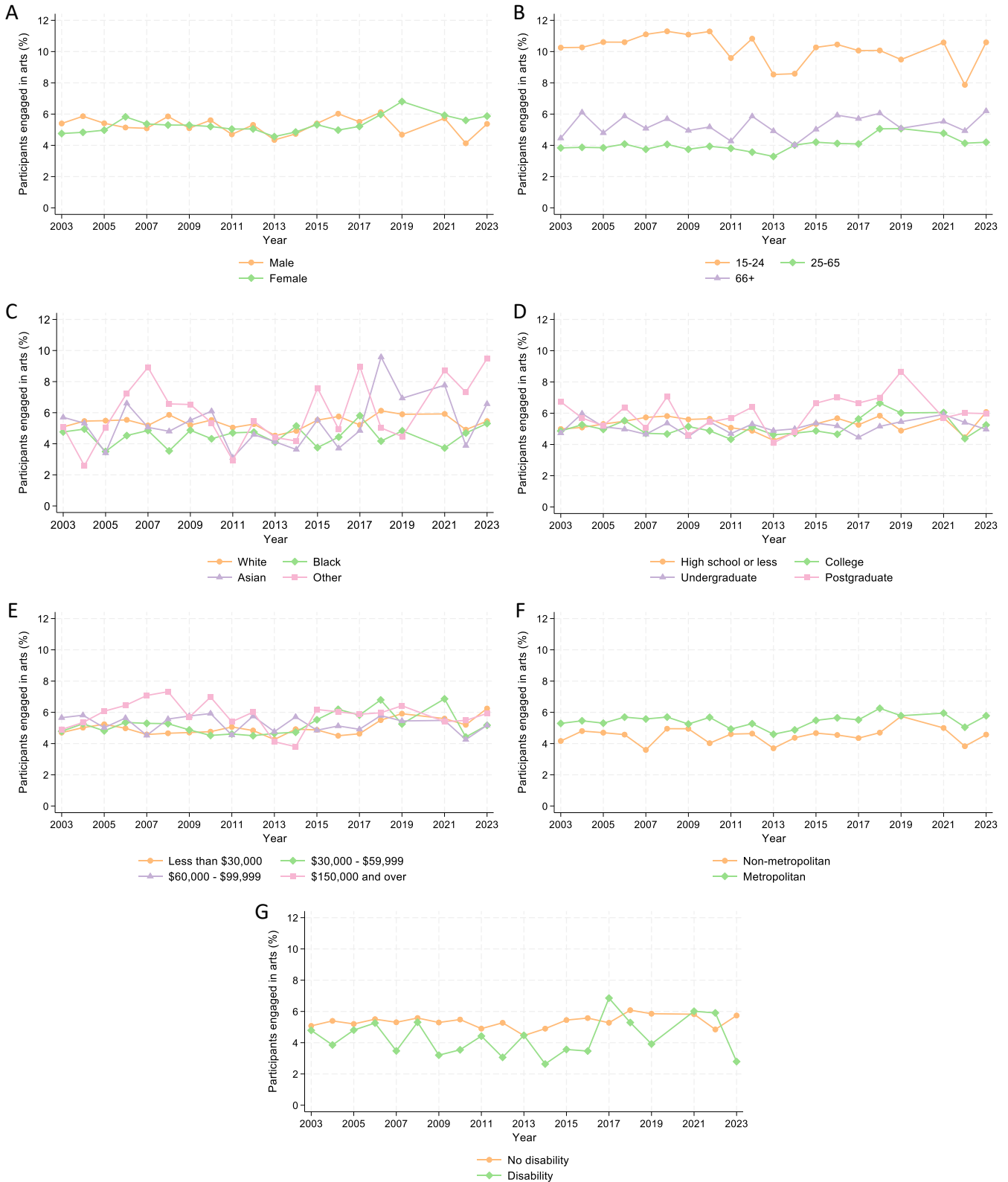


Figure 6. Differential trends in participation means (time spent on activities by those who participated) from 2003 to 2023 (excluding 2020) stratified by individual characteristics. A) Sex: male, female. B) Age group: 15-24 years, 25-65 years, 66 years and over. C) Race: White, Black, Asian, Other (including American Indian, Alaskan Native, Hawaiian/Pacific Islander, mixed race). D) Education: high school or less, college, undergraduate, postgraduate. E) Annual family income quartiles: less than \$30,000, \$30,000 - \$59,999, \$60,000 - \$99,999, \$150,000 and over. F) Metropolitan status: non-metropolitan area, metropolitan area. G) Disability status: no disability, disability that prevents work.

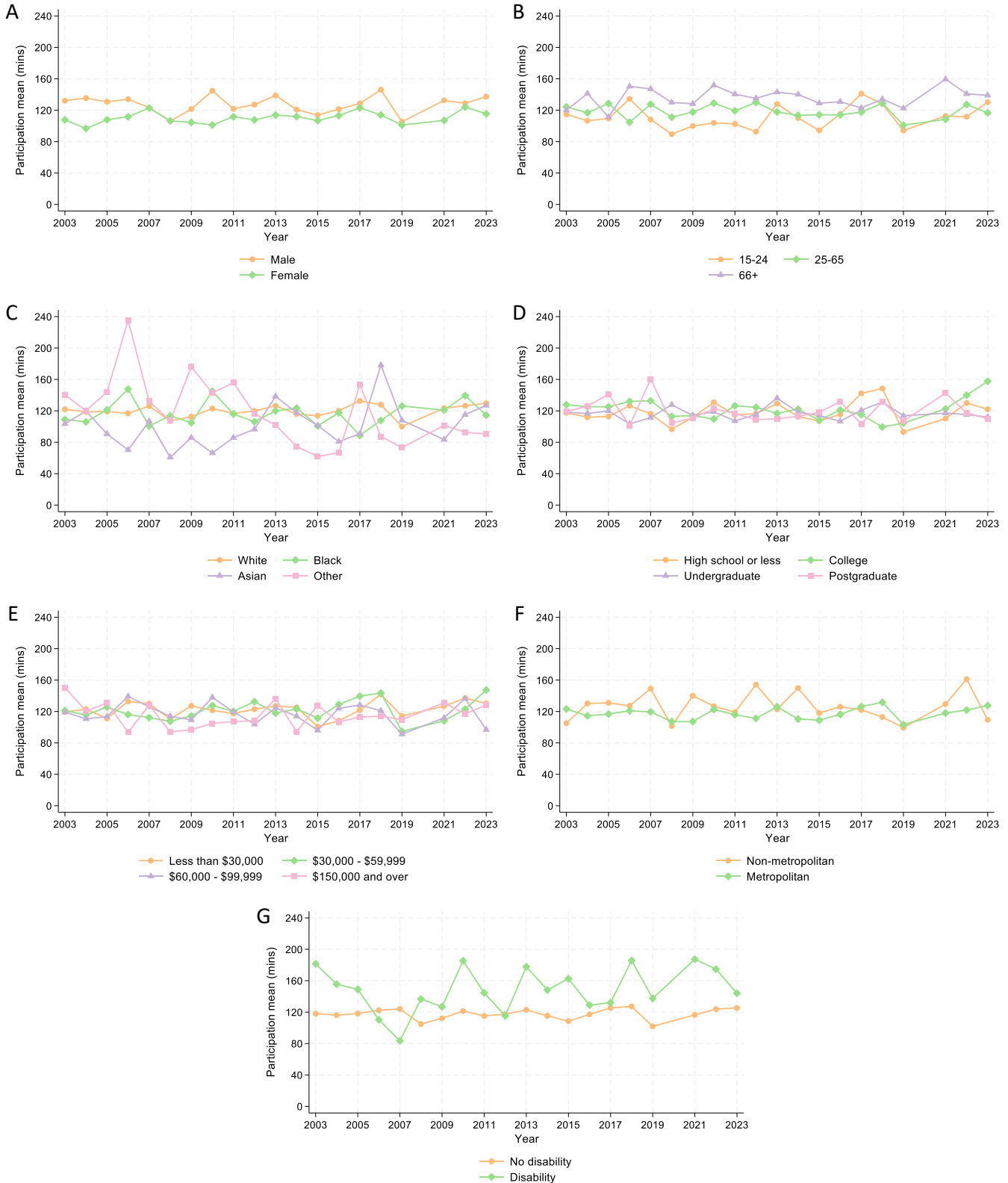


Table 1. Characteristics of the sample.

Characteristic	Proportion
Sex	
Male	48%
Female	52%
Age	
15-24 years	17%
25-65 years	67%
66 years and over	16%
Race	
White	81%
Black	12%
Asian	4%
Other	2%
Marital status	
Married	53%
Widowed/divorced/separated	17%
Never married	30%
Child under 18 in household	39%
Education	
High school or less	45%
College	25%
Undergraduate	19%
Postgraduate	11%
Employment status	
Employed	63%
Unemployed	5%
Not in labour force	16%
Retired	16%
Annual family income	
Less than \$30,000	25%
\$30,000 - \$59,999	28%
\$60,000 - \$99,999	24%
\$150,000 and over	23%
Metropolitan status	
Non-metropolitan area	16%
Metropolitan area	84%
Disability prevents work	4%
	Mean (SD)
Household size	2.98 (1.56)
Number of children in household	0.75 (1.13)

Note. N=236,270. Results are weighted and based on 20 imputed datasets.