Adults Older Than Age 55 Engage in Less Diverse Activities Than Those 18 Years Ago

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Abstract

Objectives: Lifespan perspectives have long acknowledged that individual functioning is shaped by historical and socio-cultural contexts. Secular increases favoring recent cohorts are widely documented. However, little is known about secular trends in day-to-day activities and whether historical changes have occurred in younger and older adults alike.

Methods: We compared data from two independent cohort samples of the daily diary portion of the Midlife in the United States Study obtained 18 years apart (1995/1996 cohort: *n*=1,499 vs. 2013/2014 cohort: *n*=782) and identified case-matched cohorts (*n*=757 per cohort) based on age, gender, education, and race. An activity diversity score was calculated based on seven common daily activities, using Shannon's entropy method. We additionally examined the roles of age and other sociodemographic and health characteristics in cohort differences in activity diversity.

Results: Results revealed that the 2013/2014 cohort experienced lower daily activity diversity than the 1995/1996 cohort. Age was positively associated with activity diversity in the 1995/1996 cohort, whereas age was negatively associated with activity diversity in the 2013/2014 cohort. These associations were significant for those who were older than age 55. Cohorts also differed in the types of most dominant activities and average time spent in those activities.

Discussion: Findings show changes in the lifestyles and daily activities of US adults across two decades. Contrasting to the common belief that today's adults may be healthier and more active, they seem engaging in less diverse daily activities, which can be a risk for future health outcomes.

Keywords: activity diversity, daily activities, cohort differences, lifestyles, age differences, historical change

Introduction

Daily activities play an important role in gauging adults' health and well-being, including functional independence, social interactions, and cognitive stimulation. Daily activities could thus be used as effective means to identify those who are at risk for health problems and to promote healthy aging. However, little is known about how today's adults engage in daily activities compared to those in the past. Historical and socio-cultural contextual changes have been identified for many domains, including cognitive functioning, health, and well-being (Canizares et al., 2018; Flynn, 1999; Marshall et al., 2015; Twenge, 2015), all of which may be closely related to how people go about their day and engage in specific activities. However, over and above the type of activities that adults engage in (e.g., social activities, volunteering; Han et al., 2020), more recent research has highlighted the importance of how activities are spread across various domains (i.e., "activity diversity"). Activity diversity is defined as the variety and evenness of engagement across various daily activities (Lee et al., 2018). To illustrate, person A who engages in paid work, leisure, physical activity, social events, and volunteering with a similar frequency may have a higher activity diversity score than person B who spend most of their time in paid work. Greater activity diversity has been found to be associated with higher psychological well-being, better cognitive functioning, larger hippocampal volume, and rich and balanced emotional experiences (Jeon et al., 2022; Lee, Charles, et al., 2021; Lee et al., 2018; Lee, Urban-Wojcik, et al., 2021; Urban-Wojcik et al., 2022).

Historical Trends in Daily Activities

Lifespan psychology has long acknowledged the historical embedding of developmental processes (Baltes et al., 1980; Elder, 1974; Riley, 1973; Ryder, 1965; Schaie, 1965). While numerous studies have examined historical change in adult development across macro time scales such as years and decades (for an overview, see: Drewelies et al., 2019), only very few studies have zoomed into daily lives of different cohorts (for an exception see: Almeida et al., 2020). However, it seems reasonable to assume that daily activities have changed over historical time. Drawing from the HIDECO (HIstorical changes in

DEvelopmental COntexts) theoretical model (Drewelies et al., 2019), several factors might have contributed to changes in daily activity types and patterns across adulthood. First, the Great Economic Recession of 2008 had severe economic and psychological consequences, such as loss of financial resources and financial insecurity, which could have affected not only the types of activities but also the diversity of activities. For example, the opportunity to engage in work-related activities might have become more limited after the recession, or alternatively become more dominant in one's daily life due to increased pressure to maintain employment (Kirsch & Ryff, 2016; Wiley & Manstead, 2018). With regards to activity diversity, one could assume that activity diversity may be decreased in the more recent cohort due to fewer resources and greater financial constraints.

Second, technological advancements over the last century have affected daily life in almost every way. Today, a larger number of activities can be done within the same amount of time due to technological advances (e.g., online shopping, texting, remote working) (Berner et al., 2019; Wang & Wellman, 2010; Wright, 2012). It is much more common these days to write an email instead of sending a letter via mail or to order a book online rather than going to the bookstore. This may contribute to reducing the frequency and the amount of time spent in daily activities necessary to perform social and professional roles as compared to earlier historical times.

Third, modernization theory indicates that life today is less societally structured and more fluid than in the past (Allan, 2008; Beck, 1992). For example, social relations that people once relied on to master daily life challenges have changed in their structure (e.g., later age of marriage, later age of childbearing, and smaller family size). This may have led to both increases in flexibility in the construction of daily life and decreases in social roles and accompanying activities in today's adults. Lastly, how people work has changed dramatically, with, for example, increased perception of time pressure in later-born cohorts (Löckenhoff et al., 2022). This may increase daily stress (Almeida et al., 2020), which may degrade one's motivation or opportunities to explore novel activities or engage in more diverse daily activities. Together, the HIDECO model guides us to expect that overall activity diversity

may decrease over historical time, potentially due to increased financial constraints, reliance on technology, decreased structure in daily life, and increased daily stress.

Age Differences in Historical Trends in Daily Activities

The general empirical patterns suggest that today's older adults living in the community are physically and cognitive fitter, happier and perceive less constraints over their lives than those in earlier cohorts (Flynn, 1999; Gerstorf et al., 2015; Hülür et al., 2016; König et al., 2018). For activity diversity, this could mean the maintenance of a higher level of functioning up until older age would lead to greater activity diversity today compared to earlier cohort. Being cognitively fitter, having less limitations, and feeling younger might allow older adults to not only enjoy a more active lifestyle but also engage in varying activities across different domains.

On the contrary, the "bucket list" effect suggests that older adults may postpone important leisure and social goals to the postretirement period (Freund, 2020). This could lead older adults today to engage specifically in more leisure activities relative to other types of activities and thus to have lower activity diversity. Further, while overall life expectancy and disease treatment has improved in many ways over historical time, certain diseases (e.g., lifestyle related diseases such as adiposity), have also increased historically (Canizares et al., 2018; Marshall et al., 2015; Twenge, 2015). If extended life years in today's older adults include more years with morbidity (Fries et al., 2011), it may limit their ability to engage in more diverse activities. Taken together, while we have seen historical improvements in many domains of life in older age that may support activity diversity, there are also other factors (i.e., leisure concentration, lifestyle related diseases) that may undermine activity diversity in older adults today. Because of these opposing possibilities, we explored whether and how the presumed historical shift toward lower activity diversity differs by age.

The Present Study

This study examined whether and how daily activities have changed. Calculating an index of activity diversity in two independent cohorts of adults sampled 18 years apart, we expected to observe lower activity diversity in the later-born cohort compared to the earlier-born cohort. In a second step, we explored whether the presumed historical shift toward lower activity diversity differs by age. We also considered potential differences by other sociodemographic and health characteristics (i.e., gender, race, education, income, and chronic conditions) to elucidate the role of age in historical changes in activity diversity independent of the roles of other confounding factors. For example, education has been shown to increase in both quality and quantity over historical time (Schaie et al., 2011). Similarly, gender roles have changed and could potentially drive cohort differences in activity patters. Women's daily activity patterns today may be more similar to men's because of more engagement in the work force and more equal gender roles (e.g., household chores; Bianchi & Milkie, 2010).

Methods

We used data from the two cohorts of the Midlife in the United States Study (MIDUS) who participated in the National Survey of Daily Experiences (NSDE). Detailed descriptions of participants, variables, and procedures can be found elsewhere (Ryff & Krueger, 2018). Selected details relevant to this report are given below.

Participants and Procedure

Two independent MIDUS samples were used for the current analyses: the MIDUS I (M1) sample and the MIDUS Refresher (MR) sample. The M1 sample was collected between 1995 and 1996. The MR sample was collected between 2013 and 2014 to refresh and expand the MIDUS study by recruiting a new set of participants (Kirsch & Ryff, 2016; Surachman et al., 2019). For the purposes of the present study, we used sub samples of M1 and MR who participated in the NSDE as well as the main survey.

At M1, 1,499 adults responded to the NSDE-1 ("1995/1996 cohort", hereafter). Participants were between ages 20 to 74 years (M = 46.21, SD = 12.87). At MR, 782 adults responded to the NSDE-R ("2013/2014 cohort", hereafter). Participants were between ages 25 to 75 years (M = 47.91, SD = 12.67). Table 1 shows the comparison of sample characteristics between the two cohorts. Compared to the 1995/1996 cohort, the 2013/2014 cohort was older, included more racial minorities, and had higher education and higher household income, and more chronic conditions. Overall, compared to the general population in the US, the NSDE cohort samples were more educated, has higher median household income, and is less racially heterogeneous (U.S. Census Bureau, 2014).

Participants were contacted on 8 consecutive evenings for a 15-min semi-structured telephone interview during which they were asked to report on activities they had engaged that day. Participants were compensated $25 for completing the NSDE protocol. In total, the 1995/1996 cohort provided 7 days of data (SD = 1.41), with 98% providing 6 or more daily reports and 51% providing all 8 daily reports. The 2013/2014 cohort provided 7.5 days of data (SD = 1.43), with 96% providing 6 or more daily reports and 80% providing all 8 daily reports. Sociodemographic and health characteristics were assessed during the main survey at each M1 and MR.

Measures

Daily Activities. During each end-of-day interview, participants reported daily activities, answering, "Since this time yesterday, how much time did you spend _____," with the hours and minutes they spent in seven activities: paid work, with children, doing chores, on leisure, in physical activities, on formal volunteering, and giving informal help to people who do not live with respondents (e.g., friends, neighbor, parent, other relatives, etc.). To calculate

whether individuals had (=1) or had not (=0) participated in an activity on a given day, times were converted to a set of daily binary variables.

Activity Diversity. The number (i.e., variety) and proportion (i.e., evenness) of each binary variable across all days were calculated and then used to measure activity diversity, using Shannon's (1948) entropy method:

$$Activity\ Diversity_i = -\left(\frac{1}{\ln(m)}\right)\sum_{j=1}^{m} p_{ij}\ln p_{ij}$$

where $m = 7$ is the number of activity types, and p_{ij} is the proportion of individual i's engagement of each activity type to their total activity engagement, $j = 1$ to m. Using the binary indicators of activity engagement ensures that different normative hours spent in each activity (e.g., paid work required to be 8 hours on weekdays, which limits the number of hours left for other activities) do not affect the measure of activity diversity across days. Resulting activity diversity scores (transformed to %) can range from 0 (*no diversity*—all daily activity in a single category) to 100 (*complete diversity*—daily activity spread evenly across all seven categories). Activity diversity scores were normally distributed in both cohorts ($1.45 \leq |\text{skewness}| \leq 1.46$, $4.30 \leq \text{kurtosis} \leq 6.12$).

Total Activity Engagement and Modal Activity. To examine daily activity engagement from multiple angles, we also used total activity engagement and modal activity. Total activity engagement was calculated as mean total time spent in the seven activities (in hours). The modal (i.e., most dominant) activity type for each individual, i, was determined by the activity with the largest proportion of individual i's total activities (i.e., maximum p_{ij}). In cases of ties, the two activity types were considered joint modes (Berger & Parker, 1970). Using the proportion instead of the number of modal activities corrects for differences in total number of observations and allows for comparisons across individuals with differing total activity engagement (Magurran & McGill, 2011).

Age. Age was calculated as the difference between the date of the first daily interview and a given participant's date of birth and scaled in years.

Sociodemographic and Health Characteristics. Gender (0=*female*, 1=*male*), race (0=*non-White*, 1=*White*), education (1=*no school/some grade school* to 12=*Ph.D. or other professional degree*), and household income (in dollars) were considered as covariates as well as potential moderators. Number of chronic conditions experienced or treated by a medical doctor in the past 12 months was also considered.

Statistical Analyses

First, we used descriptive statistics to describe the characteristics of the two cohort samples. Second, we used t-tests to compare differences between the cohorts in activity diversity and total activity engagement. Third, we used general linear regression models with PROC GLM in SAS (Fitzmaurice et al., 2004) to test our hypotheses regarding differences between the 1995/1996 and 2013/2014 cohorts in activity diversity, in fully adjusted models. In Model 1, we included main effect of cohort (2013/2014=1 vs. 1995/1996=0) in addition to total activity engagement as well as sociodemographic and health characteristics. In Model 2, we added an interaction between cohort and age (measured as a continuous variable). Significant interactions ($p < .05$) were probed to understand the nature of the interactions. Simple slope tests were conducted using estimates commands in PROC GLM to illustratively compare differences by age in the cohort effects. For this follow up analysis, we conducted the regions of significance test to determine a specific age range that the cohort effect was significant (Preacher et al., 2006). Model 2 also included all interaction terms between cohort and other sociodemographic and health characteristics (i.e., gender, race, education, household income, and chronic conditions) simultaneously. We used unstandardized regression coefficients to interpret the

effect of each variable on its own measurement scale (but also see Supplemental Table 4 for standardized regression coefficients).

Follow-Up Analysis. To minimize possible confounds and equate the cohort samples as closely as possible on relevant background variables, we conducted a follow-up analysis using propensity score matching (Foster, 2010; Thoemmes & Kim, 2011). Calculating a logistic regression, we used 1:1 matching to select for each participant from the 1995/1996 cohort (n = 1,499) a "twin" participant from the 2013/2014 cohort (n = 782) who was the same or as similar as possible on age, gender, education, and race. We followed the procedure recommended in the matching literature (Austin, 2013; Rosenbaum & Rubin, 1985). A suitable neighbor in the 2013/2014 cohort could be identified for 757 participants in the 1995/1996 cohort. While the matching procedure is considered as a rigorous test of cohort differences, it considerably reduces the sample size and statistical power. Also, the selection of matching variables only represents a fraction of possible important covariates. Due to these reasons, we present results using matched cohorts only in supplemental materials.

Results

Descriptive Statistics

Supplemental Table 1 shows intercorrelations for the variables under study, separately for the two cohort samples. Commonalities and differences between the cohorts are of note. Beginning with similarities, in both cohorts, activity diversity was correlated with total activity engagement (rs = .35, .53 for the 1995/1996, 2013/2014, respectively; ps < .001), such that greater activity diversity was associated with more time spent in the activities. There were some differences between the cohorts in terms of the correlations among time spent in individual activities. For example, time spent in paid work was negatively associated with time spent with children in the 1995/1996 cohort (r = –.12; p < .001), yet this association was not found in the 2013/2014 cohort (r = –.05; p = .141). Overall, the magnitude of the correlations among individual activities was weak ($.01 \leq |r| \leq .34$).

Cohort Differences in Activity Diversity

Our analyses revealed cohort differences in activity diversity and total activity engagement (Table 2). The 2013/2014 cohort reported lower activity diversity (M = 0.73, SD = 0.13) than the 1995/1996 cohort (M = 0.77, SD = 0.11), $t(1362.5) = 7.57$, $p < .001$. The 2013/2014 cohort also reported less time spent in the seven daily activities (M = 12.40, SD = 4.21) than the 1995/1996 cohort (M = 14.67, SD = 4.91), $t(1808.2) = 11.55$, $p < .001$. This pattern of results was consistent when we used matched cohort samples (Supplemental Table 2). These results remained significant after adjusting for total activity engagement as well as sociodemographic characteristics (Table 3 and Supplemental Table 3, Model 1). The effect size of cohort difference in activity diversity corresponded to the effect size of chronic conditions (Supplemental Table 4). That is, the historical decrease in activity diversity was the same as having three additional chronic conditions (1 SD higher).

The Roles of Age and Sociodemographic Characteristics. There was a significant interactive association of age and cohort with activity diversity (Table 3, Model 2; B = –0.24, SE = 0.04, $p < .001$). The nature of this interaction is depicted in Figure 1. For the 1995/1996 cohort, age was positively associated with activity diversity (*Slope Estimate* = 0.08, SE = 0.02, $p < .001$). For the 2013/2014 cohort, however, age was negatively associated with activity diversity (*Slope Estimate* = –0.16, SE = 0.03, $p < .001$). Regions of significance test further showed that these slopes were significant for those who were older than age 55. This difference by age was independent of possible moderations by other sociodemographic characteristics, which were non-significant. Results were also consistent when we used matched cohort samples (Supplemental Table 3, Model 2).

Supplemental Analyses

We further tested whether the two birth cohorts differed in mean time spent in each activity and the type of modal activity (Table 4). Beginning with mean time spent in each activity, the 2013/2014 cohort reported spending less time in paid work, with children, and doing chores, but spending more time volunteering and giving emotional help, compared to the 1995/1996 cohort. There were no cohort differences in time spent in leisure or in physical activities. Turning to modal activity, compared to the 1995/1996 cohort, a lower proportion of the 2013/2014 cohort had paid work and doing chores as their most dominant activities among the seven daily activities. In contrast, a higher proportion of the 2013/2014 cohort had leisure and volunteering as their most dominant activities. In the matched cohort samples (Supplemental Table 5), the pattern of these differences remained consistent, although some significance levels changed.

Using the four activities that showed significant cohort differences in modality (i.e., paid work, doing chores, leisure, and volunteering), we tested cohort differences in mean time spent in the activities after adjusting for covariates. The 2013/2014 cohort spent less time in paid work, doing chores, and leisure than the 1995/1996 cohort (Supplemental Tables 6-8, Model 1). However, the two cohorts did not differ in time spent in volunteering in fully adjusted model (Supplemental Table 9, Model 1).

There were no interactive association of age and cohort with the four modal activities (Supplemental Tables 6-9, Model 2). However, there was a significant interactive association of gender and cohort with time spent in doing chores (Supplemental Table 7, Model 2; $B = 0.37$, $SE = 0.11$, $p < .001$). The nature of this interaction is depicted in Supplemental Figure 1. The association between female gender and more time spent in doing chores was stronger for the

1995/1996 cohort (*Slope Estimate* = –0.87, *SE* = 0.06, $p < .001$) than for the 2013/2014 cohort (*Slope Estimate* = –0.50, *SE* = 0.09, $p < .001$). Moreover, there was a significant interactive association of race and cohort with time spent in doing chores (Supplemental Table 7, Model 2; *B* = 0.41, *SE* = 0.17, $p = .016$). Supplemental Figure 2 shows this interaction. For the 1995/1996 cohort, the difference between whites and non-whites in time spent doing chores was not significant (*Slope Estimate* = –0.15, *SE* = 0.11, $p = .192$). For the 2013/2014 cohort, being white was associated with more time spent in doing chores (*Slope Estimate* = 0.26, *SE* = 0.12, $p = .038$).

Lastly, we tested differences by retirement status (14% were retirees in both cohorts). Although retirees had significantly lower activity diversity compared to non-retirees, the cohort difference in activity diversity did not differ by retirement status and our results remained consistent after controlling for retirement status (Supplemental Table 10).

Discussion

The aim of the present study was to examine secular trends in daily activity patterns in two independent cohorts of midlife adults 18 years apart. In line with the HIDECO (Historical changes in Developmental Contexts) theoretical model (Drewelies et al., 2019), we found that the 2013/2014 cohort reported lower activity diversity in daily life than the 1995/1996 cohort. This historical shift may relate to financial constraints (Kirsch et al., 2019; Kirsch & Ryff, 2016; Wiley & Manstead, 2018), reliance on technology (Berner et al., 2019; Wang & Wellman, 2010; Wright, 2012), decreased structure in daily life (Allan, 2008; Beck, 1992), and increased daily stress (Almeida et al., 2020) over time. While the literature suggested two competing scenarios regarding age differences in historical trends in daily activity diversity, our data supported only

one scenario. That is, the historical shift towards lower daily activity diversity was more apparent in those who were older than age 55. Below, we speculate potential reasons for this.

Overall, our findings suggest that positive changes in contemporary adults' health and functioning are not reflected in their daily activities. Although there have been historical improvements in adults' physical and cognitive functions (Flynn, 1999; Gerstorf et al., 2015; Hülür et al., 2016; König et al., 2018), lifestyle related diseases have also increased over time (Canizares et al., 2018; Marshall et al., 2015; Twenge, 2015). Moreover, the "bucket list" effect that brings about more concentration on leisure activities after retirement (Freund, 2020) may have narrowed the range of daily activities that adults engage in. While our findings point to a reduction in activity diversity in adulthood, particularly in those in the second half of midlife, there may be other factors that potentially affected the results.

One possibility is that the activities per se are no longer comparable between cohorts. In this study, we assessed seven broad daily activity categories that an average adult may engage in over a week – paid work, time with children, doing chores, leisure, physical activity, volunteering, and giving emotional help to close ones. It is possible that some activities that today's adults engage in are not part of those categories. For example, time spent on the phone, laptop or iPad might not be categorized as leisure time per se but can, in many cases, also not be considered paid work or chores. Indeed, the 2013/2014 cohort also reported they spent less time in the seven activities compared to the 1995/1996 cohort (Table 2), supporting this possibility. This might have limited our ability to capture true age-related differences in daily activities and activity diversity. Relatedly, with changes in family structure and decreases in birth rate, adults today might spend less time with their own children, but more time with extended family,

partners, or friends (Drewelies et al., 2019). Although the result was consistent with our hypothesis, the overall historical shift towards lower activity diversity found in this study might have been affected by lack of consideration of other activity categories. It would be important for future studies to further examine what activities today's adults engage in and eventually adapt categories to sociohistorical changes in daily activities patterns (Allan, 2008; Berner et al., 2019; Wang & Wellman, 2010; Wright, 2012).

Another reason for reduced activity diversity may be the data collection period of the 2013/2014 cohort, which was 5-6 years after the Great Economic Recession of 2008. This means that adults in the 2013/2014 cohort might have been more negatively influenced by the Recession (Kirsch & Ryff, 2016), thus they were not able to enjoy historical improvements in many domains of life (Flynn, 1999; Gerstorf et al., 2015; Hülür et al., 2016; König et al., 2018). Financial constraints and stress from the Recession might have increased chronic conditions (Canizares et al., 2018; Marshall et al., 2015; Twenge, 2015) and limited adults' ability to enjoy an active lifestyle. In our study, however, the historical decrease in activity diversity was found even after adjusting for household income and chronic conditions. This is concerning, as lower activity diversity is associated with an array of adverse health and well-being outcomes (Jeon et al., 2022; Lee, Charles, et al., 2021; Lee et al., 2018; Lee, Urban-Wojcik, et al., 2021; Urban-Wojcik et al., 2022). If this is a true phenomenon, future research may need to focus on improving activity diversity in adults.

Additionally, we found that the relative dominance among the seven daily activities ("modal activity") has also changed historically. Compared to the 1995/1996 cohort, significantly lower proportion of the 2013/2014 cohort had paid work and doing chores as their

most dominant daily activities. Further, gender difference in time spent in doing chores was reduced in the 2013/2014 cohort. These are in line with the potential effects of technological advancements (Wright, 2012). In contrast, higher proportion of the 2013/2014 cohort had leisure and volunteering as the most dominant daily activities. This may reflect that life today is less structured around traditional social roles (e.g., paid worker, parents) and may involve a wider array of possible activities than in the past (Allan, 2008; Beck, 1992). The value of leisure and volunteering activities might have also increased after the Great recession because many people experienced job insecurity and job losses and thus were perhaps more motivated to invest in their own development and helping others. Future studies need to further examine the dynamic interplay of daily activities with societal changes.

Strengths of this study include the comparison of daily lives between two different historical cohorts of adults sampled 18 years apart and the calculation of activity diversity based on the same set of daily activities between the cohorts. Examining daily activity engagement from multiple angles (activity diversity, total activity engagement, modal activity, mean time spent in each activity) advances our knowledge on how today's adults engage in varying activities compared to those in the past. To the best of our knowledge, this is the first study that examines historical changes in daily activities and activity diversity. Moreover, testing differences by age and other sociodemographic and health characteristics deepens our understanding of historical trends and helps identify sub-groups that may be more vulnerable to restricted or polarized lifestyles.

Limitations and future directions

We note several limitations of our study. First, our results are based on a US sample (Ryff & Krueger, 2018), and thus need to be corroborated and replicated in other samples. Relatedly, it is necessary to test whether and how our results generalize to less positively selected and more diverse segments of the population, such as less educated or less healthy adults (e.g., clinical populations such as older patients living in nursing homes) and racial/ethnic minorities. While we have included older adults in our sample, only few people were older than age 65, and it is thus an open question whether and how cohorts differ in daily activity patterns in older ages or the end of life. Our age moderation result showed that aging in midlife is related to decreased activity diversity. However, given that many people in midlife may still function well, we may underestimate cohort differences in activity diversity. For example, previous conceptual work (Baltes et al., 2006) and empirical findings focusing on the end of life (Hülür et al., 2013, 2015, 2017) suggest that cohort differences do not necessarily emerge in the last phase of life towards death. Additionally, in both cohorts, there were only 14% who were retired, and we found no difference by retirement status in the cohort effect on activity diversity; it would be important to examine how retirement is associated with activity diversity over time in a sample that includes more older people. We also acknowledge several measurement and design issues which could have implications for our findings. In NSDE, activities were assessed at the end of the day over the course of seven days with a pre-specified set of activities. We addressed differences in activity engagement across days, but future work using a more intense ecological momentary assessment design could examine potential within-day activity diversity differences among cohorts. Moreover, potential changes in daily activities especially since COVID (e.g., time spend online, with phone, computer, emailing) have not captured in this study. Future studies may need to replicate this study based on an up-to-date and more extensive list of daily activities. Lastly, our study design does not allow temporal or causal inferences about cohort differences in activity diversity. To better understand the underlying mechanisms of how daily activities are linked to key indicators of successful aging, more mechanism-oriented research is needed.

Conclusion

This study shows that activity diversity, the variety and evenness of engagement across daily activities, have decreased over 18 years, particularly among those who were older than age 55. This raises concern as lower activity diversity reflects a less active and restricted lifestyle that does not support health and well-being. Future studies may need to continue to examine historical changes in activity diversity in different samples and consider ways to promote activity diversity particularly in the second half of middle adulthood.

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Table 1. Comparison of sample characteristics between the two (***unmatched***) cohorts

	1995/1996 cohort (*n* = 1,499)		**2013/2014 cohort** (*n* = 782)		**Diff Tests**[1]	**p-value**
	M or %	*SD*	*M or %*	*SD*		
Age	46.21	12.87	47.91	12.67	-3.01	.003
Age groups, %						
Younger (<35y)	22		20		6.50	.039
Middle-aged (35-65y)	69		68			
Older (>65y)	9		12			
Gender, %					0.88	.349
Male	46		44			
Female	54		56			
Race, %					27.33	<.001
White	92		85			

Non-white	8		15			
Education	6.81	2.36	8.02	2.44	-11.46	<.001
Household income	72814.6	63441.8	85285.5	80702.0	-4.38	<.001
Number of chronic conditions	2.37	2.56	2.81	3.11	-3.36	<.001

[1] For continuous variables, t-tests were used. For categorical variables, chi-squared tests were used.

Table 2. Descriptives and differences between ***unmatched*** cohorts

	1995/1996 cohort (*n* = 1,499)		**2013/2014 cohort** (*n* = 782)		**t-value**	**p-value**
	M	*SD*	*M*	*SD*		
Activity diversity	77.37	10.75	73.32	12.83	7.57	<.001
Total activity engagement	14.67	4.91	12.40	4.21	11.55	<.001

Table 3. Results of general linear models testing cohort difference in activity diversity and moderations by sociodemographic characteristics.

	Activity diversity (0 to 100)					
	Model 1			Model 2		
	B	*SE*	*P-Value*	*B*	*SE*	*P-Value*
Intercept	77.30	0.74	<.001	77.16	0.97	<.001
Total activity engagement	0.96	0.05	<.001	0.98	0.05	<.001
Age	0.0002	0.02	.992	0.08	0.02	<.001
Gender, Male (vs. Female)	–1.57	0.45	<.001	–1.56	0.55	.004
Race, White (vs. non-White)	–0.01	0.73	.990	0.19	0.98	.844
Education	0.50	0.10	<.001	0.005	0.001	<.001
Household income	0.0000	0.0000	.003	0.0000	0.0000	.053
Number of chronic conditions	–0.29	0.08	<.001	–0.24	0.11	.025
Cohort, 2013/2014 (vs. 1995/1996)	–1.71	0.48	<.001	–1.08	1.41	.445
Cohort × Age				–0.24	0.04	<.001
Cohort × Gender				–0.05	0.94	.954
Cohort × Race				–0.51	1.45	.723
Cohort × Education				–0.03	0.21	.887

Cohort × Household Income	0.0000	0.0000	.340
Cohort × Number of Chronic Conditions	–0.12	0.17	.490

Note. N = 2,281 participants from both cohorts. 2,193 observations were used due to missingness in sociodemographic variables. Unstandardized regression coefficients are presented.

Table 4. Differences in individual activities between ***unmatched*** cohorts

	Mean time spent in each activity						**Modal activity**					
	1995/1996 cohort (*n* = 1,499)		**2013/2014 cohort** (*n* = 782)		**t-value**	**p-value**	**1995/1996 cohort** (*n* = 1,499)		**2013/2014 cohort** (*n* = 782)		**χ2**	**p-value**
	M	SD	M	SD			*n*	%	*n*	%		
Paid work	4.73	3.39	3.87	3.2	5.85	<.001	816	54.44	387	49.49	4.85	.028
With children	2.18	2.89	1.88	2.64	2.51	.012	175	11.67	85	10.87	0.25	.614
Doing chores	1.99	1.35	1.42	1.04	11.15	<.001	106	13.55	29	3.71	9.84	.002
Leisure	3.14	2.05	2.98	2.07	1.76	.079	262	17.48	196	25.06	17.96	<.001
Physical activities	0.82	1.17	0.73	1.12	1.79	.073	11	0.73	8	1.02	0.23	.632
Volunteering	0.54	1.16	0.67	1.35	–2.25	.025	23	1.53	27	3.45	7.95	.005
Giving emotional help	1.27	2.62	0.85	1.9	4.42	<.001	93	6.20	41	5.24	0.69	.405

Note. Jointly modal activities included the 1995/1996 cohort: Chores and leisure (*n*=4); paid work, doing chores, and leisure (*n*=1); paid work and leisure (*n*=3); with children and giving emotional help (*n*=1); leisure and giving emotional help (*n*=1); volunteering and giving emotional help (*n*=1); paid work and physical activities (*n*=2). 2013/2014 cohort: With children and leisure (*n*=1); chores and leisure (*n*=1); leisure and volunteering (*n*=1); volunteering and giving emotional help (*n*=3); paid work and with children (*n*=2); paid work, doing chores, leisure, and physical activities (*n*=1).

Figure Captions

Figure 1. The role of age in the cohort difference in activity diversity.

Note. There was a significant interactive association of age and cohort with activity diversity (B = –0.24, SE = 0.04, p < .001). For the 1995/1996 cohort, age was positively associated with activity diversity (*Slope Estimate* = 0.08, SE = 0.02, p < .001). For the 2013/2014 cohort, age was negatively associated with activity diversity (*Slope Estimate* = –0.16, SE = 0.03, p < .001). Regions of significance of test further showed that these slopes were significant for those who were older than age 55.

Figure 1