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More Years, Less Yawns: Fresh Evidence on Tiredness by Age and Other Factors

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Objectives. It is commonplace for people to complain about being tired. There have been actually few studies of tiredness in large general population samples, and where studies do exist, the measures often rely on external assessments. We use a diary-based method to overcome these limitations in a representative sample of U.S. residents.

Methods. Data come from the 2010 American Time Use Survey. Around 13,000 respondents provided a diary about the prior day and rated how tired they felt during selected activities. Regression analysis is used to explain variance in tiredness by age.

Results. Regression analysis reveals that tiredness decreases with age. This relationship exists when we control for hours of sleep, gender, self-rated health, ethnic group, number of children, marital status, employment status, level of education, and the amount of time participants spent doing tiring activities.

Discussion. Contrary to much previous research, tiredness decreases with age. People who are more than 65 years of age are almost one point on a 0–6 scale less tired than people aged between 15 and 24. Clinical implications and methodological limitations are discussed.

Key Words: Age—Diary—Fatigue—Tiredness.

OVER the course of the last century, people in the United States appear to have become increasingly tired (Bliwise, 1996). Accordingly, complaints of tiredness and fatigue are now common among the general population, with one study in the United States estimating the prevalence of atypical fatigue to be 34%, and other studies in the United Kingdom putting it at about 18% (Cella, Lai, Chang, Peterman, & Slavin, 2002; Chou, 2013; Pawlikowska et al., 1994). Tiredness can also be indicative of many physical or mental disorders and is associated with impaired motor function and consequently injuries resulting from accidents while driving or at work (Avlund, 2010; Chan, 2011; Phillips & Sagberg, 2013).

Studies to date tend to show that tiredness is more common among certain groups, such as parents (Hagen, Mirer, Palta, & Peppard, 2013) and those of a low social position (Watt et al., 2000). The relationship between age and tiredness varies between studies. One suggested reason for the variation is that tiredness may decrease with age among those who are healthy and increase among those who are not; thus, sampling variation might explain why the majority of results show a positive or no association between age and tiredness and some a negative relationship (Watt et al., 2000). Much of what we know about tiredness is from small-sample studies on clinical populations with diagnoses such as sleep apnea or cancer that provide limited information about the wider population, with one exception being Danish population studies that may not generalize to other countries (Ekmann, Avlund, Osler, & Lund, 2012).

However, there is also no agreed upon definition of tiredness or fatigue (Egerton, 2013). Many of these studies rely on clinician reports or answers to standardized instruments such as the Multidimensional Fatigue Inventory (Hinz, Fleischer, Brähler, Wirtz, & Bosse-Henck, 2011). Yet tiredness, like pain, is a subjective experience. Where subjective reports are elicited, the results may be influenced by the recall and reporting process (Dockray et al., 2010). For example, people tend to recall feeling more tired over the last week than their aggregated daily tiredness scores suggest, especially when tiredness levels vary throughout the week (Schneider, Broderick, Junghaenel, Schwartz, & Stone, 2013).

The present study contributes to the evidence on the epidemiology of tiredness by exploring its relationship with age and other factors using diary-based information from a nationally representative sample of residents in the United States. By using diary-based reports of tiredness, the risk of reporting and recall biases is reduced because the recall duration period is minimal, and respondents are reminded of what activity they were doing before they report on how tired they felt during that activity.

Method

Sample and Variables

The data set analyzed in the present study is the 2010 American Time Use Survey (ATUS), a nationally

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representative cross-sectional sample drawn from the Census Population Survey of 12,829 U.S. residents in non-institutional settings who are aged 15 years and older. Each participant filled out a diary of the prior day's activities and reported it to a telephone interviewer. From each time-use diary, three activities were selected at random regarding which the respondent provided affect (emotion) ratings. The precise wording of the tiredness item was, "From 0 to 6, where a 0 means you were not tired at all and a 6 means you were very tired, how tired did you feel during this time?"

In addition to age, ATUS also contains demographic and background information on respondents that were included the analysis as explanatory variables because of a previously demonstrated association with tiredness: amount of time spent sleeping during the diary day, gender, self-rated health (to proxy for actual health and active lifestyle), ethnic group, number of children, marital status, labor force status, and education (to proxy social position) (Cordero, Loredo, Murray, & Dimsdale, 2012; Lewis & Wessely, 1992; Martikainen, Hasan, Urponen, Vuori, & Partinen, 1992; Song, Jason, & Taylor, 1999).

Statistical Analysis

The data were analyzed in STATA 12. Replicate sampling weights were applied using the successive difference replication method to using adjust for several aspects of the complex survey design: unit nonresponse, unequal reporting by respondents across different days of the week, stratified oversampling of certain demographic groups, unequal probability of activity selection for affect ratings due to differing numbers of activities in each respondent's diary, and differences in the amount of time respondents spent during affect-rated activities.

No demographic or background variables had missing values (more than a third of the sample did not have income information, and so education was used instead of income to proxy social standing and earnings). Less than 1% of the diary entries contained missing data on tiredness; as this is a relatively low number of observations with missing values, they were simply excluded from the analysis.

Population proportions, means, and standard deviations were calculated to provide descriptive statistics, and Rao-Scott χ^2 tests were conducted and used to calculate effect sizes (Cramer's V) in order to account for the complex survey design. One multiple linear regression was used to explore the relationship between tiredness and age, and a second to explore the relationship between tiredness and age when controlling for the other demographic and background characteristics of respondents. Standard errors (*SE*s) were clustered at the individual level. As a robustness check, a multinomial logistic regression was also run in order to ascertain whether the results were sensitive to assumptions made about the level of measurement of tiredness; no substantive differences were found, and thus, these results are not reported here.

Results

The unweighted and weighted results did not substantively differ and so the weighted results are reported. Sample characteristics of respondents are presented in Table 1. A total of 52.8% were men and 47.2% were women, with 62.8% employed, 7.93% unemployed, and 29.79% not in the labor force. The mean age was 44.27 years with a standard deviation of 18.07 years. Most of the sample did not have children (58.52%), were employed (62.28%), or were married (53.26%).

Tiredness generally decreased with age ($\chi^2 = 848.79$, $p < .001$, $\varphi_c = .07$), higher levels of education ($\chi^2 = 619.32$, $p < .001$, $\varphi_c = .05$), better self-rated health ($\chi^2 = 1990.36$, $p < .001$, $\varphi_c = .11$), and increasing hours slept ($\chi^2 = 549.3$, $p < .001$, $\varphi_c = .05$). Women were more tired than men ($\chi^2 = 527.9$, $p < .001$, $\varphi_c = .01$). Tiredness increased as the number of children increased, and nearly a quarter of people reporting no tiredness during their daily activities were not parents ($\chi^2 = 440.10$, $p < .001$, $\varphi_c = .05$).

The results of multiple linear regressions explaining variance in tiredness by age and other demographic and background characteristics are presented in Table 2. In the regression with age as the only explanatory variable, increasing age was associated with decreasing tiredness for most age groups. The age group 25–34 years was significantly less tired than the age group 15–24 years ($\beta = -0.19$, $SE = 0.09$, $p < .05$, $r^2 = .012$), the age group 55–64 years even less tired compared with the age group 15–24 years ($\beta = -0.40$, $SE = 0.09$, $p < .001$, $r^2 = .012$), and the age group 65–74 years was the least tired of all ($\beta = -0.70$, $SE = 0.1$, $p < .001$, $r^2 = .012$). The age group 75–85 years was the second least tired age group ($\beta = -0.65$, $SE = 0.12$, $p < .001$, $r^2 = .012$), and there were no statistically significant differences in tiredness between the age group 15–24 years and 35–44 years ($\beta = -0.17$, $SE = 0.09$, $p > .05$, $r^2 = .012$) or 45–54 years ($\beta = -0.13$, $SE = 0.09$, $p > .05$, $r^2 = .012$).

In the second regression controlling for the other demographic and background characteristics in addition to age, increasing age was again associated with decreasing tiredness. For example, the age group 25–34 years was a bit less tired than the age group 15–24 years ($\beta = -0.35$, $SE = 0.1$, $p < .001$, $r^2 = .082$), and the age group 75–85 years was much less tired than the age group 15–24 years ($\beta = -0.94$, $SE = -0.14$, $p < .001$, $r^2 = .082$). It is evident that adjusting for these other characteristics does not change the overall shape of the age profile.

Further Analysis

One possibility for the finding that tiredness decreases with age is that older people may start choosing to spend less time doing activities that they find tiring. To explore this, a longitudinal data set would be ideal, in order to separate age

Table 1. Descriptive Statistics (Weighted)

	%		%		%
Gender		No. of children		Hours of sleep	
Male	52.8	0	58.52	0 hr	0.13
Female	47.2	1	17.48	1–5 hr	8.13
Tiredness		2	14.83	6–7 hr	29.53
0 (less tired)	30.4	3	6.19	8–9 hr	38.41
1	9.1	4	2.09	10–11 hr	17.27
2	14.85	5+	0.89	12–13 hr	4.87
3	16.89	Self-rated health		13+ hr	1.66
4	13.26	Poor	4.11	Education	
5	9.14	Fair	12.65	<1st grade through 8th grade	4.4
6 (more tired)	6.35	Good	29.08	9–10th grade	7.62
Marital status		Very good	33.23	11th–12th grade	5.46
Never married	30.12	Excellent	20.93	High school diploma or equivalent	29.36
Married	53.26	Ethnic group		Some college but not degree	16.53
Widowed	5.39	White	81.88	Associate degree	8.07
Divorced	9.26	Black	11.85	BSc	18.28
Separated	1.97	American Indian/Alaskan Native	0.87	MSc/PhD	10.28
Age		Asian	3.7	Labor force status	
Mean	44.27	Other	1.71	Employed	62.28
Standard deviation	18.07			Unemployed	7.93
Min	15			Not in labor force	29.79
Max	85				

Table 2. Results of Multiple Linear Regressions Explaining Variance in Tiredness From Age, Without and With Controls for the Demographic and Background Variables Hours of Sleep, Gender, Self-Rated Health, Ethnic Group, Number of Children, Marital Status, Employment Status, and Level of Education (Weighted)

	Tiredness			
	Without controls		With controls	
	b	*SE*	*b*	*SE*
Age				
15–24	Ref		Ref	
25–34	−0.19*	0.09	−0.35***	0.1
35–44	−0.17	0.09	−0.44***	0.11
45–54	−0.13	0.09	−0.45***	0.11
55–64	−0.40***	0.09	−0.68***	0.12
65–74	−0.70***	0.1	−0.98***	0.12
75–85	−0.65***	0.12	−0.94***	0.14
Male			−0.39***	0.05
Constant	2.51***	0.07	4.25***	0.19
R^2	0.012		0.082	
N (activities)	38115		38115	

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

from period and cohort effects. In the absence of longitudinal data, however, the proportion of time that participants spent doing their least, second least, and most tiring activities was calculated. The variable ranged from 0.3% to 100% with a mean and standard deviation of 15%. This variable was then entered into the tiredness regression explaining variance in tiredness from age and the other factors in order to determine whether it has an effect on the age profile of tiredness.

The overall pattern of the age profile did not change substantively when adjusting for this factor (χ^2 (28) = 954.46, $p < .001$, $r^2 = .082$). In addition, the r^2 is identical in this regression compared with the regression without adjusting for this factor, implying that no additional variance in tiredness is explained when it is included. The unadjusted relationship between age and tiredness, along with the adjusted relationship including the sociodemographic and background variables in addition to proportion of day spent in tiring activities, is shown in Figure 1.

Discussion

The most surprising finding emerging from this study is that tiredness decreases with age in a recent, nationally representative, nonclinical U.S. sample when controlling for other background and demographic characteristics. People aged 65 years and older are almost one point on a 0–6 scale less tired than people 15–24 years of age. Although it has been suggested that the trajectory of tiredness across the life span may differ according to health status (Watt et al., 2000), our results contradict such an explanation by controlling for perceived health status. Our results suggest that tiredness is not an inevitable aspect of ageing regardless of health status, and further, that symptoms of tiredness even in older age may be indicative of an underlying physical or mental condition requiring treatment.

Although these results provide useful information on the incidence and correlates of tiredness in a general population sample, its cross-sample nature limits the extent to which any causal inferences can be made. Although it would be impossible for tiredness to cause age, it may certainly be the case that the observed relationship between tiredness and age is a cohort effect specific to the sample studied. Future longitudinal research into the etiology of

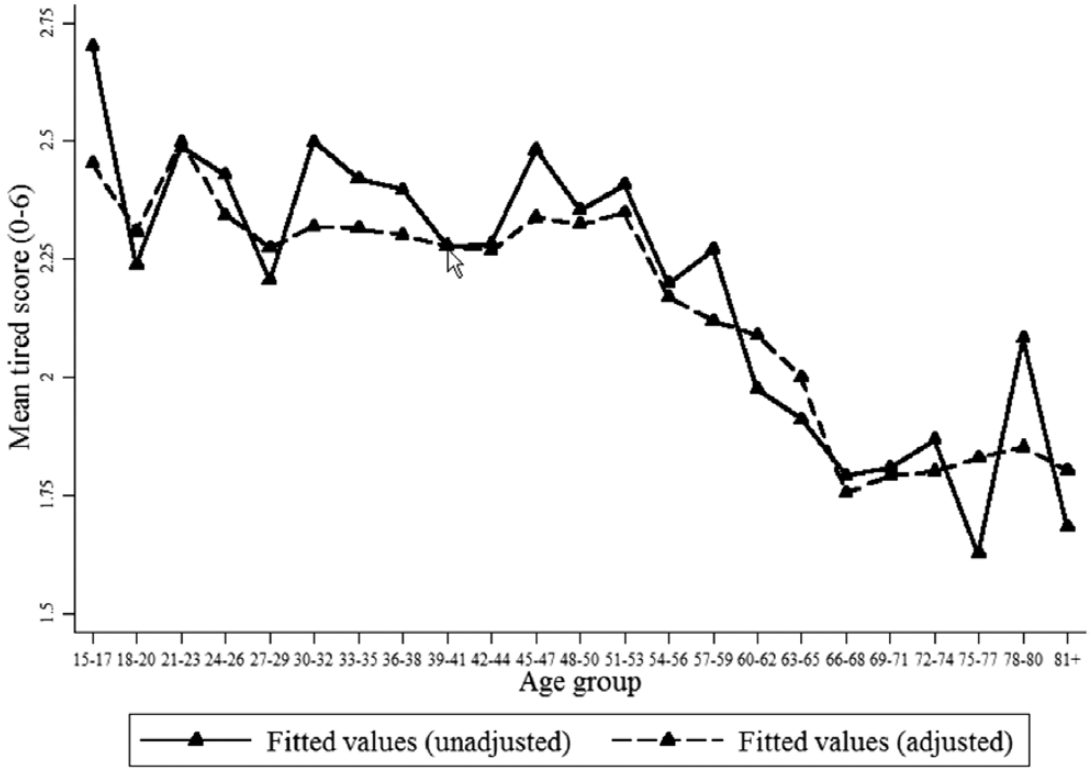

Figure 1. Fitted values of tired as a function of age, unadjusted and adjusted for hours of sleep, gender, self-rated health, ethnic group, number of children, marital status, employment status, level of education, and proportion of day spent in least, second least, and most tiring activity (weighted).

ageing could explore this possibility. It may also be that another factor not controlled for in the analysis, such as the presence of disease or lifestyle choices surrounding time or activity management, is responsible for the relationship between age and tiredness. Unfortunately neither the data on disease nor the longitudinal data were available, but it does not appear that self-rated health or the proportion of time participants spent engaged in more or less tiring activities according to age affect the tiredness age profile.

Finally, it is important to note that the concept of "tiredness" is measured in various ways in the literature and is sometimes even seen as an aspect of frailty (Schultz-Larsen & Avlund, 2007). A single-item indicator of tiredness as used presently may, therefore, only be capturing one aspect of a complex construct. Multiple indicators of tiredness are required for richer information on its prevalence and correlates.

Notwithstanding these issues, diary-based methods such as the one described here can be viewed as an additional means of gathering data on tiredness. The present study also establishes a standard of comparison for reports of tiredness. Future studies on smaller samples could use these findings as a benchmark to qualify the generalizability of their results, and physicians can better assess the typicality of patients' symptoms. In sum, these results highlight that the tiredness associated with activities of daily life decreases with age. This surprising finding should lead to further research efforts to understand it and discussion of the policy implications it raises.

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