



Longitudinal associations among the Big Five personality traits and healthcare utilization in the U.S.

Olivia E. Atherton^{a,b,*}, Emily C. Willroth^c, Sara J. Weston^d, Daniel K. Mroczek^{b,e}, Eileen K. Graham^b

^a Department of Psychology, University of Houston, Houston, TX, USA

^b Department of Medical Social Sciences, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA

^c Department of Psychological and Brain Sciences, Washington University in St. Louis, MO, USA

^d Department of Psychology, University of Oregon, Eugene, OR, USA

^e Department of Psychology, Northwestern University, Chicago, IL, USA

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ABSTRACT

Objective: One critical component of individual and public health is healthcare utilization, or the extent to which individuals have routine check-ups, schedule treatments, or use emergency services. However, we know little about *who* uses healthcare services and what types, the conditions that exacerbate utilization, or the factors that explain *why* people seek out services. The present study fills these gaps in the literature by investigating the role of personality factors in predicting various forms of healthcare utilization, how these associations vary by age, socioeconomic resources, and chronic conditions, as well as one potential psychological mediating mechanism (i. e., sense of control).

Methods: We use data from a large longitudinal sample of Americans (N = 7108), with three assessments spanning 20 years. Participants reported on their Big Five personality traits using the Midlife Development Inventory, healthcare utilization across three domains (routine visits, scheduled treatment, urgent care), age, income, insurance, chronic conditions, and sense of control.

Results: Multilevel models showed that people who were more agreeable and neurotic tended to use more healthcare services. Moreover, *on occasions* when people were more extraverted and open, they tended to use more healthcare services. There were several nuances in personality-healthcare utilization associations depending on the type of healthcare service, age, and socioeconomic resources. Longitudinal mediation analyses demonstrated sense of control as one mechanism linking personality traits to healthcare utilization in the U.S.

Conclusions: We discuss the theoretical and practical implications of interactions between individuals and structural systems for promoting the health of aging U.S. Americans.

1. Introduction

Healthcare utilization, or the extent to which individuals use routine (e.g., dentist, optometrist), scheduled (e.g., surgery), or emergency care services, is critical for health and longevity. Despite the U.S. spending more on healthcare than any other nation, Americans use fewer healthcare services and have worse health and shorter life expectancies compared to citizens of other highly developed nations (Anderson et al., 2003, 2019; Squires and Anderson, 2015), with even the most privileged White U.S. citizens tending to have worse health than the average person in other developed nations (Emanuel et al., 2021). Within the U.S.,

health disparities proliferate; individuals who have fewer socioeconomic resources or are racial-ethnic minority citizens have even worse health than highly resourced White U.S. citizens (Emanuel et al., 2021). As Anderson et al. (2003, 2019) note, healthcare in the U.S. is expensive. The U.S. adopts public- and privately-funded models of healthcare, such that the majority of Americans receive healthcare benefits through their employer's private insurance companies. But, this model is not universally-accessible to citizens or non-citizens; approximately 12% of Americans are uninsured (Cohen et al., 2020) and 45% of Americans are inadequately insured (Collins et al., 2019). Because adequate use of healthcare services, whether they are preventative or reactive, result in

* Corresponding author. Department of Psychology, University of Houston, Houston, TX, USA.

E-mail address: oeatherton@uh.edu (O.E. Atherton).

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decreased risk for morbidity and premature mortality (Kaplan and Milstein, 2019), it is critical to understand *who* uses healthcare services, under *what* conditions, and *why*.

To fill these gaps in the literature, we use data from a large study of U.S. adults, with three measurement occasions spanning two decades, to understand the role of personality traits and contexts in predicting healthcare utilization. Specifically, we address the following research questions: 1) To what extent are between- and within-person variations in the Big Five personality traits related to healthcare utilization?; 2) Do these associations vary by *type* of healthcare service, age, income, health insurance, and chronic conditions?; and 3) To what extent do the Big Five traits impact healthcare utilization via perceptions of control? Collectively, answering these research questions will have theoretical and practical implications for understanding Americans' interactions with the healthcare system.

1.1. Personality traits and healthcare utilization across the lifespan

Andersen's (1995) Behavioral Model posits that there are *predisposing*, *enabling*, and *need-based* characteristics that impact individuals' decisions to use healthcare services (Andersen, 1995; Von Lengerke et al., 2014). Personality traits (consistent patterns of thinking, feeling, and behaving) are one such *predisposing* characteristic, in that dispositional tendencies either promote or inhibit individuals' decisions to seek out healthcare services. Personality traits are generally organized into five broad domains: Extraversion (sociable, assertive, energetic), Agreeableness (warm, kind, cooperative), Conscientiousness (hard-working, responsible, organized), Neuroticism (anxious, depressed, emotionally unstable), and Openness (curious, creative, open-minded). A large body of literature that has shown that personality traits are important predictors of health behaviors (e.g., Turiano et al., 2018), adherence to medical regimens (e.g., Molloy et al., 2014), disease onset (e.g., Weston et al., 2015), and mortality risk (e.g., Graham et al., 2017).

Prior research has shown that Conscientiousness and Neuroticism are positively related to the number of times an individual uses healthcare services (Friedman et al., 2013; Hajek et al., 2020; Hallgren et al., 2016; Willroth et al., 2023). Individuals who are more conscientious are more likely to use healthcare services, presumably because their responsible, hard-working, and self-controlled nature allows them to effectively manage their health by seeking preventative care, responding appropriately to health changes, and engaging in more health-promoting behaviors. In contrast, individuals who are high in Neuroticism are more likely to use healthcare services, albeit for different reasons. Individuals who are more emotionally unstable, anxious, or depressive may be more likely to use healthcare services out of anxiety, fear, and vigilance for their health (e.g., Weston and Jackson, 2018) and may use healthcare services even when they are not needed. Additionally, it is well-established that individuals who are higher in Neuroticism have worse health (e.g., Weston et al., 2015); and thus, these individuals may simply need more healthcare services and seek out treatment as a result (but see Weston and Jackson, 2016).

The remaining Big Five traits – Extraversion, Agreeableness, and Openness – have been inconsistently related to healthcare utilization, both in terms of effect size and direction (Chapman et al., 2009; Friedman et al., 2013; Hajek et al., 2020; Hallgren et al., 2016). These discrepant findings may be due to the different *types* of health services that individuals can use (e.g., urgent care, routine appointments, surgery), which may have distinct associations with personality traits. For example, prior evidence suggests that Extraversion is positively related to hospital use, but not other forms of healthcare utilization (e.g., Chapman et al., 2009). In the case of Conscientiousness and Neuroticism, Conscientiousness may be particularly related to *preventative* healthcare utilization (e.g., routine physical check-ups, scheduled treatments), whereas Neuroticism may be particularly related to *reactive* healthcare utilization (e.g., emergency room/urgent visits). Thus, there may be nuanced associations between *predisposing* characteristics, like

personality traits, and specific types of healthcare services. Yet, prior research has not systematically explored these nuanced associations. Additionally, much work in this area has been cross-sectional or prospective with only two timepoints (e.g., Hajek et al., 2020), which hinders our understanding of how between- and within-person variations in personality traits are related to healthcare utilization over time. Although we might expect longitudinal associations to follow the same pattern as cross-sectional work, it is possible that between- and within-person processes play out differently due to biological, psychological, and social maturation. Separating between- and within-person associations of personality and healthcare utilization over time is critical because between-person associations characterize how personality differences *between* people are related to healthcare utilization, whereas within-person associations characterize how personality at a given occasion is related to healthcare utilization at a given occasion within persons over time.

1.2. Conditions in which personality-healthcare use associations are stronger (or weaker)

Aligned with Andersen's Behavioral Model (1995), it is critical to consider the broader contexts in which individuals are behaving, as *need-based* or *enabling* factors likely interact with personality traits to impact healthcare utilization. The present study examined four moderators: age, income, health insurance, and chronic conditions. Drawing on Andersen's Behavioral Model (1995) and the Life Course of Personality Model (Shanahan et al., 2014), there are several competing pathways by which contextual factors may exacerbate (or mitigate) the associations between personality and healthcare utilization.

1.2.1. Age

Aligned with the *age-as-leveler hypothesis* (Shanahan et al., 2014), individual differences may be less likely to be expressed among older adults because aging “levels the playing field” for seeking healthcare resources. In other words, individuals tend to seek out more health services with age (e.g., Andersen and Newman, 2005), in part, because declines in physical and cognitive function, and increases in health problems, are inevitable with age. Thus, we suspect that the associations among personality traits and healthcare utilization may be weaker among older adults than younger adults, though no prior work has investigated this question empirically.

1.2.2. Socioeconomic resources (SES)

Aligned with Andersen (1995)'s conceptualization of “access” as the presence of *enabling* resources, prior work has demonstrated that socioeconomic resources, such as higher income and stable health insurance, are significantly related to healthcare utilization (Adler and Newman, 2002). But, no prior work has examined the extent to which SES *moderates* the association among personality traits and healthcare utilization. On the one hand, according to Andersen's Behavioral Model of *enabling* factors and the *accumulation hypothesis* (Shanahan et al., 2014), it is possible that the associations among personality traits and healthcare utilization are stronger for high income and insured individuals because societal barriers and resources are not an issue. Therefore, individual differences are more likely to be expressed. For example, if an individual cannot afford healthcare services, then they may not use those services even if their trait propensity (of high Conscientiousness) would normally lead them to be proactive with their health. On the other hand, according to the *resource substitution hypothesis* (Shanahan et al., 2014), it is possible that the associations among personality traits and healthcare utilization are stronger for low income and uninsured/underinsured individuals because they do not have the resources to access healthcare. In other words, the difficulty of access allows for more self-selection in who uses health services, where individual differences “compensate” in the absence of socioeconomic resources (e.g., high Conscientiousness may be especially beneficial for

healthcare utilization in the absence of financial resources).

1.2.3. Chronic conditions

Based on Andersen's Behavioral Model of *need-based* factors and the *age-as-leveler* hypothesis (Shanahan et al., 2014), we suspect that the associations among personality traits and healthcare utilization will be weaker for individuals who have more chronic conditions because chronic conditions (which often increase with age) necessitate the use of healthcare resources (e.g., Andersen and Newman, 2005), leaving less – rather than more – room for individual differences to be expressed.

1.3. Perceptions of control as a mechanism linking personality to healthcare utilization

Leveraging longitudinal panel mediation models, we aimed to investigate perceptions of control as a potential mechanism for *why* personality traits are related to healthcare utilization. Generally, perceptions of control are comprised of personal mastery and perceived constraints, signifying the extent to which individuals feel they have a sense of control over their own actions and the environment (e.g., Lachman and Weaver, 1998; Pearlin and Schooler, 1978; Prenda and Lachman, 2001). Because of disparities in healthcare access in the U.S., it is possible that Americans may feel as though they are subject to external constraints outside of their control, and these perceptions of control may be one psychological mechanism that explains why personality traits promote (or inhibit) the use of healthcare services.

Prior work has documented associations among the Big Five and perceptions of control, such that Conscientiousness is positively related to sense of control whereas Neuroticism is negatively related to sense of control (e.g., Milad and Bogg, 2020). Intuitively, it seems that higher levels of sense of control will be more related to more healthcare use. However, some work has found that individuals who feel more in control are less likely to seek out healthcare resources (e.g., Kesavayuth et al., 2020). Given questions concerning the direction of the association between sense of control and healthcare utilization, it was unclear how sense of control would mediate the associations between the Big Five and healthcare utilization. We suspected that higher Conscientiousness might lead to higher sense of control and more healthcare utilization, whereas higher Neuroticism might lead to lower sense of control and more healthcare utilization.

2. Method

2.1. Transparency and openness

In this article, we report how we determined our sample sizes. Given the use of de-identified publicly-available data, the present work is exempt from institutional review board approval. Details regarding data collection, measures, and datasets are available at: <https://www.icpsr.umich.edu/web/ICPSR/series/203>. The pre-registrations, a list of pre-registration deviations, analytic code, and output are posted on the Open Science Framework (OSF): https://osf.io/8nxac/?view_only=a38fbff7a6e74408be76f05e0c6993b6. Most analyses were conducted using R (version 4.2.1; R Core Team, 2021) and the following packages: *tidyverse* (Wickham, 2019), *psych* (Revelle, 2022), *lme4* (Bates et al., 2015), *lmerTest* (Kuznetsova et al., 2017), *sjPlot* (Lüdtke, 2021), and *ggpubr* (Kassambara, 2020). To conduct longitudinal panel mediation, we used Mplus V.8 (Muthén and Muthén, 2017) in combination with the *MplusAutomation* package in R (Hallquist and Wiley, 2018) to enhance reproducibility. Prior researchers have used the same dataset to answer research questions about personality, sense of control, or healthcare utilization (e.g., Lachman et al., 2009; Milad and Bogg, 2020; Willroth et al., 2023); however, no prior work has used data from all three measurement occasions of MIDUS to answer the present study research questions.

2.2. Participants and procedures

We used longitudinal data from a large probability sample: Midlife in the United States (MIDUS). From 1995 to 1996 (Time 1), MIDUS collected data from 7108 Americans (52% female), who ranged in age from 20 to 75 years (Median = 45). Ninety percent of participants were White, 5% were Black/African-American, 3% were multiracial or other, 1% were Asian or Pacific Islander, and 1% were American Indian/Alaska Native. There were two follow-up assessments conducted from 2004 to 2006 ($N = 4963$) and 2013–2014 ($N = 3294$); the average retention rate across the three waves was 68%. We used all available data at each measurement occasion; we did not exclude any participants. To investigate the potential impact of attrition, we compared individuals who did and did not participate at Time 3 on study variables assessed at Time 1. Individuals who did not participate at follow-up tended to report lower levels of Conscientiousness ($M = 3.39$ vs. 3.45 , $p < .001$, $d = -0.15$), higher levels of Neuroticism ($M = 2.26$ vs. 2.22 , $p = .005$, $d = 0.07$), and made more routine visits to the doctor ($M = 2.94$ vs. 2.75 , $p = .01$, $d = 0.06$), at Time 1. Individuals who dropped out of the study also had lower household incomes ($M = \$63,384$ vs. $\$83,083$, $p < .001$, $d = -0.31$), were less likely to be insured ($\chi^2(2, 6179) = 284.58$, $p < .001$), were more likely to be men ($\chi^2(1, 6179) = 27.47$, $p < .001$), and were older ($M = 47.04$ vs. 45.61 , $p < .001$, $d = 0.11$) at Time 1. There were no significant differences for the remaining Big Five personality traits, forms of healthcare utilization, or chronic conditions, all $ps > .05$.

2.3. Measures

2.3.1. Big Five personality traits

At all three timepoints, participants self-reported on their personality traits using the Midlife Development Inventory, which contains a set of 25 adjectives scored into five broad personality domains (Lachman and Weaver, 1997). Participants responded to items on a 4-point Likert scale ranging from 1 (*a lot*) to 4 (*not at all*). Items were reverse-scored (when appropriate) and averaged together to create Big Five domain composite scores, where higher values represent higher levels of the trait.

2.3.2. Healthcare utilization

At all three timepoints, participants responded to 4–5 items about their healthcare utilization in the past 12 months. Specifically, they reported the number of times they went for: a routine physical check-up or gynecological exam, a routine dental check-up or exam, a routine optical check-up or exam (combined with dental item at Time 1 only), urgent care treatment, and scheduled treatment/surgery. From these items, we created several composites to assess the overall *quantity* and *type* of healthcare used. To assess the *quantity* of healthcare utilization, we summed participants' responses for all items into one score. To assess the *type* of healthcare used, we created three sub-composites: 1) routine exams (sum of routine physical check-up or gynecological exam, dental check-up or exam, and optical check-up or exam), 2) urgent care treatment, and 3) scheduled treatment/surgery.

2.3.3. Sense of control

At all three timepoints, participants responded to 12 items about the extent to which they felt capable to do what they set their mind to and felt constrained by external factors (Lachman and Weaver, 1998; Pearlin and Schooler, 1978). Participants responded on a 7-point Likert scale ranging from 1 (*strongly agree*) to 7 (*strongly disagree*). The perceived constraints items were reverse-coded and then averaged together with the personal mastery items to obtain an overall assessment of each participant's level of perceived control at each timepoint (e.g., Prenda and Lachman, 2001). Higher values indicate the participant believes they are more in control of their goals and environments, whereas lower values represent that the participant believes they are less in control, with more obstacles interfering with their goals.

2.3.4. Age

At all three timepoints, participants reported on their age. The mean age of the sample was 46.38 years at Time 1 (range = 20 to 75), 55.43 years at Time 2 (range = 28 to 84), and 63.64 years at Time 3 (range = 39 to 93).

2.3.5. Income

At all three timepoints, participants reported on their annual household income. The median income in the sample was \$55,000 at Time 1 ($M = \$73,379$, range = \$0 to \$300,000+), \$57,500 at Time 2 ($M = \$71,363$, range = \$0 to \$300,000+), and \$68,000 at Time 3 ($M = \$87,919$, range = \$0 to \$300,000+). We rescaled income to be on a 0–10 scale for analyses to facilitate interpretation and achieve model convergence.

2.3.6. Health insurance

At all three timepoints, participants used a series of eight dichotomous items to denote which type of health insurance they have. We compiled these items into one categorical variable at each timepoint, which was coded as 0 = no health insurance, 1 = public health insurance (comprised of national health coverage, Medicare, Medicaid), and 2 = private health insurance (comprised of employer-provided insurance, spouse's employer-provided insurance, directly from insurer, union health insurance, military health insurance). Across the three timepoints, 2–9% percent of the sample had no health insurance, 16–50% had public insurance, and 48–75% had private insurance.

2.3.7. Chronic health conditions

At all three timepoints, participants reported whether they had any chronic conditions (from a list of 29). Chronic health conditions were coded such that 0 = no chronic conditions in the past year and 1 = one or more chronic conditions in the past year. Across measurement occasions, 22–24% did not have any chronic conditions in the last year, whereas 76–78% had one or more chronic conditions.

2.4. Statistical analyses

For all analyses, we report standardized effect sizes and 99% confidence intervals. Given the large number of analyses conducted, we considered p -values less than or equal to 0.01, and 99% confidence intervals that do not contain zero, as statistically significant. The effective N s for the multilevel models ranged from 6072 to 6315. We used maximum likelihood estimation (ML) to account for missing data. ML is preferred over multiple imputation when using multilevel models that contain missing data at Levels 1 and 2, and cross-level interactions, because the procedure leads to less biased parameter estimates and standard errors (Grund et al., 2018, 2019). Although ML assumes that data are missing (completely) at random, research shows that the biasing effects of non-random missing data with ML can be reduced by the inclusion of auxiliary variables in the model (Graham, 2009). The MIDUS data do contain non-random missing data (e.g., ~19% attrited due to death), but we chose to use ML because it outperforms other missing data methods such as listwise deletion (Schafer and Graham, 2002) and our models contain relevant variables that correlate with mortality (e.g., personality, age) to help reduce bias (Graham, 2009). To understand the between- and within-person associations of the Big Five and healthcare utilization, we adopted a multilevel modeling (or mixed effects modeling) approach (Raudenbush and Bryk, 2002), where Level 1 (waves) is nested within Level 2 (persons). The models are expressed for each trait and outcome as follows:

$$\text{Level 1 : HCU}_{ij} = B_{0j} + B_{1j} (\text{Personality}_{ij}) + e_{ij}$$

$$\text{Level 2 : } B_{0j} = a_{00} + a_{01} (\text{Personality}) + u_{0j}$$

$$B_{1j} = a_{10} + u_{1j}$$

HCU_{ij} represents the amount of healthcare utilization on a given wave i for person j . It is a function of B_{0j} (the person's intercept), B_{1j} (the person's slope, or the association between personality and healthcare utilization for each person j), and e_{ij} (the within-person error, or residual term). The random effects of the Big Five scores were dropped to achieve model convergence. Within-person Big Five scores (i.e., Personality_{ij}) were computed by subtracting person-mean Big Five scores at each wave from the grand-mean centered Big Five score. Between-person Big Five scores (i.e., B_{0j}) were captured by computing the grand-mean centered Big Five score (across waves) for each individual. We repeated these analyses by type of healthcare utilization (i.e., routine visits, scheduled visits, urgent care).

To investigate moderators, we extended the above models by conducting a series of two multilevel models for each moderator at both the within- and between-person levels, as suggested by Preacher et al. (2016). For the within-person moderation models, we added the time-varying moderator as a main predictor (i.e., B_{2j} (Moderator $_{ij}$)), in addition to entering a term that represents the interaction between the time-varying moderator and the *person mean-centered* Big Five scores (i.e., B_{1j} (Personality $_{ij}$) * B_{2j} (Moderator $_{ij}$)). For the between-person moderation models, we added the time-varying moderator as a main predictor (i.e., B_{2j} (Moderator $_{ij}$)), in addition to a cross-level term that represents the interaction between the time-varying moderator and the *grand-mean centered* Big Five scores (i.e., B_{0j} (Personality) * B_{2j} (Moderator $_{ij}$)).

To understand whether the Big Five personality traits predict healthcare utilization via perceptions of control, we conducted longitudinal panel mediation analyses (see Fig. 1) within a structural equation modeling framework (e.g., Selig and Preacher, 2009). By employing this type of model, we accounted for the stabilities of the Big Five, sense of control, and healthcare utilization over time, as well as their concurrent associations at the initial assessment. We conducted separate models for each Big Five trait and healthcare utilization, with sense of control variable as the mediating factor in each ($X \rightarrow M \rightarrow Y$). X (personality), M (sense of control), and Y (healthcare utilization) are expressed by the following three equations:

$$X_{[t]} = \beta_{X,[t-1]} X_{[t-1]} + \zeta_{X,[t]}$$

$$M_{[t]} = \beta_{M,[t-1]} M_{[t-1]} + \beta_{X,[t-1]} X_{[t-1]} + \zeta_{M,[t]}$$

$$Y_{[t]} = \beta_{Y,[t-1]} Y_{[t-1]} + \beta_{M,[t-1]} M_{[t-1]} + \beta_{X,[t-2]} X_{[t-2]} + \zeta_{Y,[t]}$$

$X_{[t]}$ represents the value of X (personality) at wave t , and $\beta_{X,[t-1]}$ represents the association between X (personality) at wave t and X (personality) measured at the previous wave $t-1$. Last, $\zeta_{X,[t]}$ represents the random disturbance (or error) for X at each wave t . The same interpretations hold for the M (sense of control) and Y (healthcare utilization) terms. Of note, these mediation models do not disambiguate between- and within-person effects, and they rely on the assumptions that: a) there are no unobserved confounders and b) the causal mechanisms linking the Big Five, sense of control, and healthcare utilization do not start earlier in lifespan than study baseline (Rohrer et al., 2022).

3. Results

Table S1 (supplemental material) shows descriptive statistics for the Big Five personality traits, perceived control, and healthcare utilization at all waves. Table S2 shows a correlation matrix of all study variables at Time 1.

3.1. Between- and within-person variations in the Big Five and healthcare utilization

Fig. 2 contains forest plots of the between- and within-person associations (see Tables S3–S7 for full results). In terms of between-person

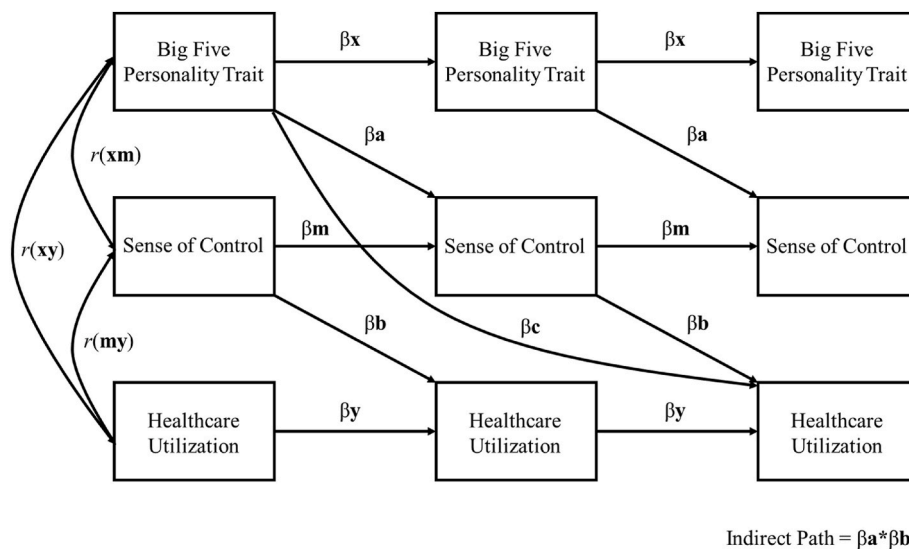


Fig. 1. Visual depiction of longitudinal panel mediation model.

effects, we observed that people who were more agreeable and neurotic tended to use more healthcare services overall, but there were no between-person effects of Extraversion, Conscientiousness, and Openness on overall healthcare utilization. In terms of within-person effects, we found that *on occasions* when people were more extraverted and open they tended to use fewer healthcare services on those occasions. There were no within-person associations among the remaining Big Five traits and healthcare utilization.

3.2. Variation by type of healthcare service

When we re-ran the analyses by *type* of healthcare utilization (see Fig. 2 and Tables S3–S7), we observed that between-person variations in Agreeableness and Neuroticism replicated in predicting all three healthcare service types. People who were more agreeable and neurotic tended to have more routine visits, scheduled treatments/surgeries, and urgent care/emergency visits. There was also one statistically significant between-person effect for Conscientiousness and urgent care use, such that people who were more conscientious tended to use fewer urgent care services. There were no between-person effects for Conscientiousness and routine or scheduled visits, nor for Extraversion and Openness with any type of healthcare service.

The within-person associations observed for Extraversion and Openness with overall healthcare utilization replicated for routine services, but not scheduled treatments or urgent care. On occasions when people were more extraverted and open, they tended to report fewer routine visits to their primary care doctor, dentist, and optometrist. Contrary to our findings with overall healthcare utilization, we found that on occasions when people were more agreeable they tended to report fewer routine visits, but there were no associations with scheduled treatments or urgent care. Likewise, we did not find any within-person associations between Neuroticism and overall healthcare utilization, but this may have been due to opposite-direction effects for each of the three types of services. On occasions when people were more neurotic they tended to report fewer routine visits, more urgent care visits, and there were no associations with scheduled treatments. Consistent with the overall healthcare utilization results, there were no within-person associations between Conscientiousness and any type of healthcare utilization. We conducted sensitivity analyses with between- and within-person computations of the Big Five as simultaneous predictors of all types of healthcare utilization. The majority of results remained the same in terms of direction, magnitude, and statistical significance, with a couple of exceptions (see OSF project page for full

results).

3.3. Moderation by age, socioeconomic resources, and chronic conditions

3.3.1. Main effects

People who were older tended to use more healthcare services over time (see Tables S8 and S12). In terms of socioeconomic resources, income was not significantly associated with healthcare utilization (see Tables S9 and S13), but people who had public or private insurance tended to use more healthcare services than people with no insurance (see Tables S10 and S14). Chronic conditions were positively associated with healthcare utilization such that people with more chronic conditions tended to use more healthcare services (see Tables S11 and S15).

3.3.2. Within-person moderation

Age was a statistically significant moderator of within-person associations between healthcare utilization and Extraversion, Agreeableness, and Openness (see Tables S8–12). As shown in Figure A1 (appendix), the associations between personality traits and healthcare utilization were stronger for older adults compared to younger adults. On occasions when older adults were less extraverted, agreeable, and open, they tended to use more healthcare services compared to older adults who were more extraverted, agreeable, and open. Whereas, for younger adults, there were small-to-null associations between personality traits and healthcare utilization. Further, there were no differences in healthcare utilization for younger versus older adults on occasions when they are more extraverted, agreeable, and open; healthcare utilization differences across age groups were only evident at low trait levels.

In terms of socioeconomic resources, there were two statistically significant within-person moderation effects (see Figure A2). First, there was an interaction between Extraversion and income on healthcare utilization (Figure A2, panel A), such that there was no association between Extraversion and healthcare utilization for individuals with higher incomes. There was a strong association between Extraversion and healthcare utilization for individuals with lower incomes where, on occasions when individuals were less extraverted and had lower incomes, they were likely to use the most healthcare services compared to more extraverted individuals with lower incomes. There were no healthcare utilization differences across income groups at the high end of Extraversion.

Second, there was an interaction between Extraversion and insurance status on healthcare utilization (Figure A2, panel B). In this case, the association between Extraversion and healthcare utilization was

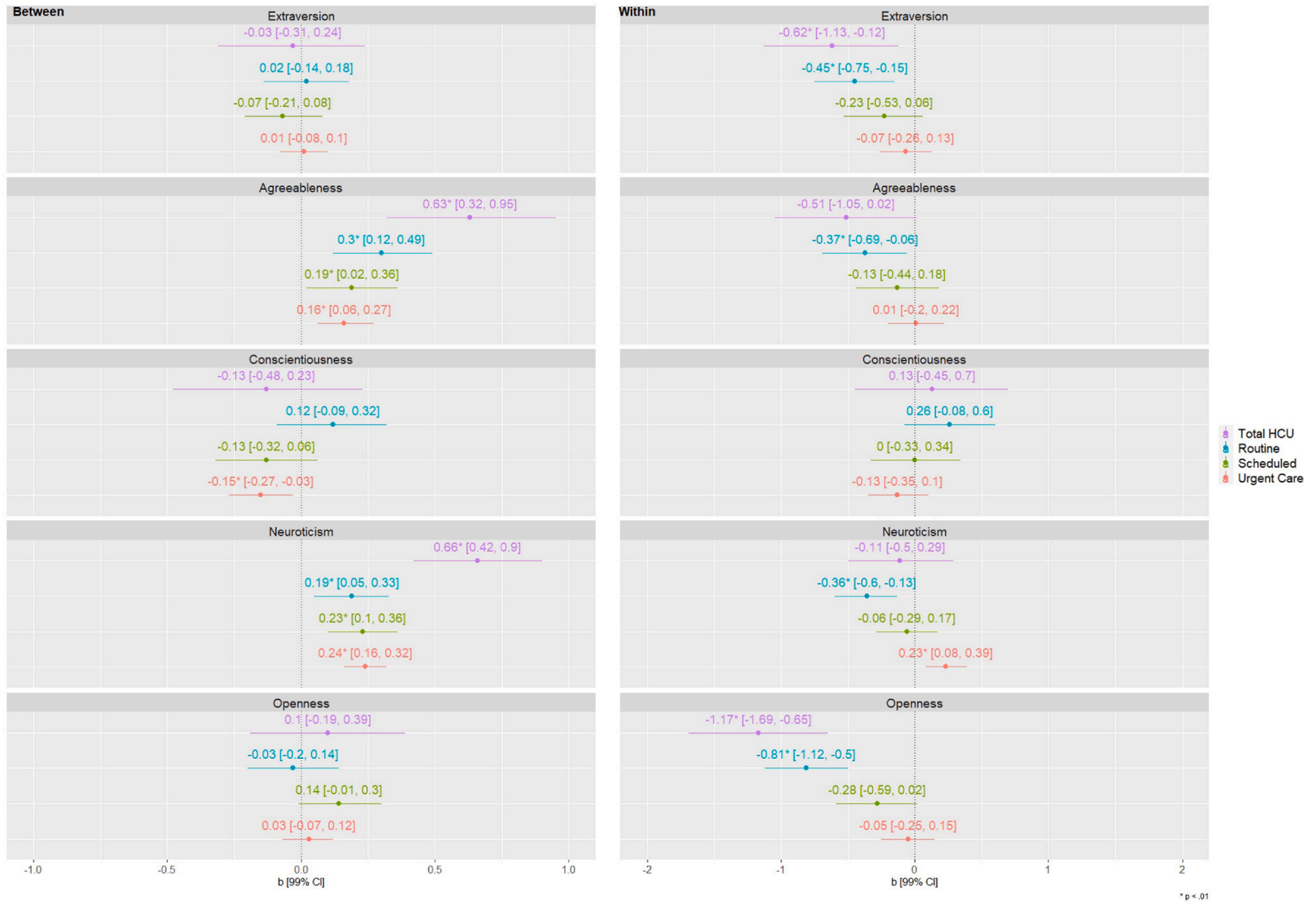


Fig. 2. Forest plots of between- and within-person effects.

stronger for individuals with no insurance or public insurance. There was no association between Extraversion and healthcare utilization for individuals with private insurance. For individuals with no insurance or public insurance, on occasions when they were more extraverted, they tended to use fewer healthcare services than individuals who were less extraverted. In terms of overall levels, there were few healthcare utilization differences across insurance groups at the low end of Extraversion; differences were evident at the high end of Extraversion. There were no statistically significant within-person moderation effects for chronic conditions (all $ps > .01$).

3.3.3. *Between-person moderation*

Most between-person moderation effects were $p > .01$ (see Tables S13–17); there was only one statistically significant interaction effect: Neuroticism and age on healthcare utilization (Figure A3). At all ages, there was a positive association between Neuroticism and healthcare utilization, with the strongest association for individuals who were younger. Younger individuals who were more emotionally stable tended to use the fewest healthcare services, whereas older individuals who were more emotionally stable tended to use the most healthcare services.

3.4. *Perceived control as mediator of the links among the big five and healthcare utilization*

Table 1 shows the mediation results. Perceived control did not mediate the link between Agreeableness and healthcare use; however, perceived control was one indirect path linking the remaining Big Five traits to healthcare utilization. Individuals who were more extraverted, conscientious, and open tended to feel more in control, and higher perceptions of control were related to using fewer healthcare services. Conversely, individuals who were more neurotic tended to feel less in control, and lower perceptions of control were related to using healthcare services more often.

We conducted two sets of analyses to examine whether three confounders (age, sex, income) affected the effect sizes and/or statistical significance of the direct and indirect lagged pathways. In the first set of analyses, we regressed the mediator (sense of control) at Time 2 and Time 3, as well as the dependent variable (healthcare utilization) at Time 2 and Time 3 on the confounder. In the second set of analyses, we included correlations between the confounder (i.e., age, sex, income) and Time 1 variables (i.e., trait, sense of control, healthcare utilization). For all mediation models, the direct and indirect pathways in Table 1 hold, in terms of effect size and statistical significance when accounting for age, sex, and income.

3.5. *Unregistered analyses*

We conducted unplanned analyses to examine the main and moderating effects of sex (full results are on the OSF project page). In sum, men used fewer healthcare services than women and all sex moderation effects were null, except sex moderated the associations among between-person Openness and healthcare utilization, as well as within-person Openness and healthcare utilization. Additionally, we

conducted unregistered analyses to control for chronic conditions and insurance in the mediation models, taking the same approach as was done for age, sex, and income. For all mediation models, the direct and indirect pathways in Table 1 hold, in terms of effect size and statistical significance when accounting for chronic conditions and insurance.

4. Discussion

The present study used data from a large longitudinal study of U.S. adults to better understand who uses healthcare services, what types of healthcare services they use, under what conditions, and why. Generally, aligned with Andersen’s Behavioral Model, we found that personality traits were related to healthcare utilization, albeit in nuanced ways depending on between- (vs. within-) person variations, type of healthcare service, age, and socioeconomic resources. Further, findings suggest that perceived control was one indirect path linking the Big Five personality traits (except for Agreeableness) to healthcare utilization. Below, we describe the findings in more detail and speculate on broader theoretical and practical implications for Americans within the U.S. healthcare system.

4.1. *Who uses healthcare services, when, and why?*

There are five takeaways from the present research. First, consistent with the Behavioral Model (Andersen, 1995), prior empirical research (e.g., Friedman et al., 2013; Hajek et al., 2020; Hallgren et al., 2016; Willroth et al., 2023), and our pre-registered hypotheses, we found that people who were more neurotic tended to use more healthcare services overall and across various types of healthcare services (i.e., routine visits, scheduled treatments, urgent care). Moreover, on occasions when people were more neurotic, they tended to have fewer routine visits, but more urgent care visits. This pattern of results suggests that on occasions when people are more neurotic they tend to engage less with *preventative* forms of healthcare utilization, like going to their primary care doctor, dentist, or optometrist, but they engage more with *reactive* forms of healthcare utilization such as urgent care or emergency services. This may be because when Neuroticism is high, individuals either perceive, or objectively have, health conditions that lead them to seek emergent care and to fall short on keeping up with routine check-ups. Alternatively, as we observed in the longitudinal mediation models, individuals who were more neurotic tended to feel less in control, and lower perceptions of control were related to using healthcare services more often, suggesting that individuals who are more anxious, depressed, or emotionally unstable may experience unique external constraints on their behavior that lead them to use urgent services (as opposed to routine services).

Second, contrary to prior empirical research and our pre-registered hypotheses, we were surprised to find that between- and within-person variations in Conscientiousness were largely unrelated to quantity or type of healthcare utilization. Out of all possible between- and within-person effects, there was only one statistically significant finding: people who were more conscientious tended to use fewer urgent care and emergency services compared to people who were less hard-working, irresponsible, and disorganized, which is consistent with

Table 1
Results from longitudinal panel mediation models.

	$r(xy)$	$r(xm)$	$r(my)$	β_x	β_m	β_y	β_a	β_b	β_c	Indirect ($\beta_a^* \beta_b$)
Extraversion (X)	.00	.32*	-.09*	.71*	.61*	.18*	.04*	-.05*	.04	-.002*
Agreeableness (X)	.05*	.13*	-.09*	.64*	.63*	.18*	.002	-.05*	.08*	.00
Conscientiousness (X)	-.01	.33*	-.09*	.63*	.59*	.18*	.10*	-.05*	.04	-.01*
Neuroticism (X)	.09*	-.42*	-.09*	.66*	.59*	.18*	-.07*	-.04*	.01	.003*
Openness (X)	.02	.33*	-.09*	.70*	.60*	.18*	.08*	-.05*	.06*	-.004*

Note. Column labels correspond to the notation in Fig. 1. M = sense of control. Y = total healthcare utilization. Values in the table are standardized coefficients. * $p < .01$.

recent personality research in the emergency room setting (Atherton et al., 2021). Therefore, Conscientiousness served a protective effect in that it reduced the risk of emergency or urgent care visits, which may be because people who are more conscientious do not engage in risky health behaviors (e.g., binge drinking) that increase the likelihood of needing emergency services, or because people who are more conscientious generally tend to have better health overall. Moreover, although the effect sizes were small, the mediation models suggested there was full mediation by sense of control. In other words, there was a significant indirect effect in the absence of a direct effect, suggesting an unmeasured competing pathway (e.g., MacKinnon et al., 2002). Conscientiousness was not directly related to healthcare utilization, but people who were more conscientious tended to feel more in control, and higher perceptions of control were related to using fewer healthcare services. At present, it is unclear whether these perceptions of control are indicative of conscientious people being more likely to have better health because they are controlling their behaviors more effectively and thus do not need as many healthcare services as a result. Or, it is possible that these perceptions of control are a false sense of security that lead more conscientious people to not use healthcare services, even when they should be. These various possibilities should be explored in future research.

Third, although prior research has shown inconsistent associations among Extraversion, Agreeableness, Openness and healthcare utilization (Chapman et al., 2009; Friedman et al., 2013; Hajek et al., 2020; Hallgren et al., 2016), we found several notable patterns among these personality traits and healthcare utilization. Specifically, people who were more agreeable tended to use more healthcare services overall and across the three types of healthcare services (i.e., routine visits, scheduled treatments, urgent care), compared to people who were less agreeable. Further, on occasions when people were more extraverted, agreeable, and open, they tended to use fewer healthcare services (specifically routine services). One explanation for these results might be that on occasions when individuals are more outgoing and friendly, warm and caring, and creative and curious, they are spending their time with friends, family members, and at art museums instead of spending time at the doctor's office. This may be an instance when the socially desirable ends of personality traits, like Extraversion, Agreeableness, and Openness, may have positive effects on interpersonal functioning and feelings of communion, but are detrimental for one's physical health given that preventative forms of healthcare are often a means to screening and diagnosing health conditions before they become too severe. Alternatively, as was shown in the mediation models for Extraversion and Openness, individuals who were more extraverted and open tended to feel more in control, and higher perceptions of control were related to using fewer healthcare services. Moreover, it is important to point out that the associations between Extraversion, Agreeableness, Openness, and healthcare utilization were further qualified by age. Contrary to our predictions and the *age-as-leveler hypothesis* (Shanahan et al., 2014), we consistently found that personality-healthcare utilization associations were stronger among older adults rather than younger adults. On occasions when older adults were lower on Extraversion, Agreeableness, and Openness, they tended to use the most healthcare services compared to older adults who were more extraverted, agreeable, and open. In this case, age does not necessarily seem to level the playing field, but rather, healthcare utilization becomes more heavily dependent on one's personality characteristics with age, pointing to the possibility of an *age-as-amplifier* effect for the associations among personality traits and healthcare utilization.

Fourth, in terms of socioeconomic resources and chronic conditions, there were surprisingly few moderation effects, with only two for socioeconomic resources that were specific to Extraversion. Aligned with Andersen (1995)'s conceptualization of access as the presence of enabling resources, we found that there was no association between Extraversion and healthcare utilization on occasions when individuals had higher incomes or private insurance. By contrast, there was a strong association between Extraversion and healthcare utilization on

occasions when individuals had lower incomes, were uninsured, or had public insurance. In this case, it seems as though having more socioeconomic resources (and presumably better access to healthcare services) essentially breaks the association between Extraversion and healthcare utilization. This pattern of findings is aligned with the idea that difficulty of access leads to more self-selection in who uses health services, whereas easy access to healthcare services permits all individuals, regardless of their extraverted tendencies, to use healthcare services. The present results were also mixed with regards to whether Extraversion is a resource substitute among uninsured and publicly insured individuals. We observed that in some cases higher Extraversion was protective, aligned with Shanahan's model (2014), whereas in other cases it put uninsured and publicly insured individuals at risk.

Finally, it is worth noting that there were relatively few moderating effects of age, income, insurance status, and chronic conditions overall, especially given the number of analyses that were conducted. Moreover, some sociodemographic factors, that tend to be correlated with one another (e.g., age and chronic conditions), showed discrepant results as moderators. For example, we observed that age was a significant moderator whereas chronic conditions were not. Theoretically, it is plausible that age moderates whereas chronic conditions do not because as people get older, there are many reasons for using healthcare services beyond chronic conditions. For example, as people get older, they are more likely to experience falls, have surgeries for hip replacements, and get infections like pneumonia more easily, all of which become more likely with age, are not considered chronic conditions, are likely correlated with personality traits like risk-taking, sociability, and activity levels, and increase their use of healthcare. Further, because we know that chronic conditions are often managed for longer periods of time, it is possible that chronic conditions do not change the association between personality and healthcare utilization because people have learned how to manage their condition(s), making healthcare utilization less dependent on individual differences in personality traits. Methodologically, as shown in Table S2, age and chronic conditions were only weakly correlated with one another ($r = .17$); and thus, they do seem to be capturing unique constructs and are not redundant with one another.

Another example of the complicated nature of studying processes underlying healthcare utilization is, within the U.S. healthcare system, most older adults (65+) will have public insurance through Medicare or Medicaid; in which case, age and insurance systematically co-occur after a certain point in the lifespan. These complex interactions among exacerbating (and mitigating) factors complicate our understanding of personality-healthcare utilization associations and the theoretical and practical inferences we might draw. It would be beneficial for future researchers to obtain larger sample sizes to be able to explore three-way interactions directly, or to use personalized prediction models to unpack the need-based, enabling, and predisposing factors that lead to healthcare utilization at an individual level. Likewise, the present findings hint at the necessity of investigating non-linear or threshold effects – e.g., does age amplify personality-healthcare utilization associations to a certain point such as when individuals reach age 65, have numerous health conditions, and have public insurance? Finally, the present study highlights the need to not only consider the complex intertwining effects of socio-demographic moderating factors in predicting healthcare use, but also many theoretically-relevant variables that we did not examine. For example, strong social support networks become critically important for older adults in using healthcare services, as family, friends, and caretakers help to facilitate healthcare use through arranging and managing appointments, as well as providing transportation.

4.2. Theoretical and practical implications

The present findings have several theoretical implications. Aligned with Andersen's Behavioral Model, we observed that predisposing, enabling, and need-based factors influenced healthcare utilization in the long-term. Although preliminary, it seems as though there is less

evidence for the *age-as-leveler* and *resource substitution* hypotheses, and more evidence for the *accumulation* hypothesis of Shanahan et al. (2014) Life Course Personality Model. Individuals who have more socioeconomic resources use healthcare services regardless of their dispositional tendencies, whereas individuals who face structural and systemic barriers to healthcare also experience further disparities due to their personality tendencies. Future researchers should continue to test Andersen's Behavioral Model and Shanahan's Life Course Personality Model to fine-tune the theoretical bounds of how individuals use healthcare services.

More practically, the present study has several implications. Although just the beginning of research in this area, studying individual-level characteristics and healthcare utilization longitudinally is important for developing future interventions and health policy. Between-person effects and moderation analyses help us to understand *who* might be at risk and particularly benefit from intervention and changes in health policy, whereas within-person effects and mediation analyses help us to understand the ways in which we might tailor future interventions and health policies to certain individuals over time. Further, it is important to consider the many contexts in which these experiences are taking place – the type of healthcare service (whether it be preventative or reactive), whether a healthcare professional recommended the service (e.g., adherence), the barriers a person faces, and the structural systems in which Americans are living.

At face value, one could argue that a practical implication of the present study is to promote effective use of healthcare services by increasing the sense of control that people feel over their environments. On the one hand, one way to increase sense of control within the current healthcare system might be to increase health literacy, by making U.S. adults more aware of the resources available to them (e.g., sliding scales, free clinics). Increasing health literacy may promote feelings of control over one's environment and health; and thus, lead to appropriate use of healthcare services. On the other hand, increasing individuals' sense of control may prove to be a daunting (or potentially harmful) endeavor given the U.S. does not have an accessible or freely available healthcare system. Feelings of lack of control are likely an intuitive and appropriate response to structural barriers to healthcare. In an American utopia, access to healthcare services would not be dependent on one's personality characteristics; all Americans should be able to access and receive healthcare regardless of their dispositional tendencies. In which case, researchers and policy-makers should work towards changing the *structural* systems that impact healthcare access and affordability, rather than trying to change the individuals within those systems. This could also include changing the healthcare system so that it caters to the wide range of personality differences that exist – extraverted and non-extraverted individuals alike. Ultimately, improving health likely involves complex interactions among individuals within structural systems, where both top-down and bottom-up approaches may be most effective for improving individual health and reducing public health costs of healthcare under- and over-use.

4.3. Limitations

There are several limitations of the present study. First, participants self-reported on their Big Five personality traits and healthcare utilization, which inflated effect sizes due to shared method variance. Future research should examine whether the results hold with informant-reports of personality traits and objective measures of healthcare utilization from electronic medical records, for example.

Relatedly, the direct and indirect effect sizes in the mediation models are rather small in magnitude, which is not surprising given that the mediation models are rather strict tests due to controlling for the stability of all constructs across 20 years as well as simultaneous estimation of all lagged pathways. Second, the Conscientiousness measure had noticeably poor reliability (range = 0.56-0.58), which may have led to biased effect size estimates for its associations with healthcare

utilization. Future research should use a better measure of Conscientiousness to determine if the present patterns of results still hold when psychometrically sound. Moreover, the MIDI does not permit examinations of personality facets in relation to healthcare utilization, which may show nuanced results that help to explain why personality is related to healthcare utilization (e.g., if assertiveness facet of Extraversion is related to doctor use, but the gregariousness facet is not). Third, some variables had very high (e.g., chronic conditions) or very low (e.g., urgent care use) endorsement, and this lack of variance impacts the extent to which moderators and/or personality traits can account for variance in the outcome(s). Currently, it is unclear whether high (or low) endorsement of healthcare utilization items is substantively meaningful (e.g., not many people use certain services) or methodological artifacts (e.g., an item was worded too narrow to capture variance). Fourth, the participants are notably homogeneous in terms of race and ethnicity (90–94% White). To the extent that the personality-healthcare utilization associations reflect a “universal” psychological process in humans (e.g., via sense of control), we might expect that the present results are generalizable across Americans regardless of sociodemographic background. On the other hand, well-known disparities in healthcare access and socioeconomic resources across racial/ethnic groups in the U.S. marginalize minoritized communities in ways that are not shared by White Americans, and the psychological processes that underlie personality-healthcare associations may be different across sociodemographic groups. Thus, there is reason to believe that we may observe different longitudinal, moderation, and mediation effects with greater sample diversity and future research should explore these various possibilities for (non-)generalizability. Fifth, the present study focused on parsing the between- and within-person longitudinal associations between personality traits and healthcare utilization, but this modeling approach does not speak to the directionality of effects (i.e., does personality lead to healthcare utilization, or does healthcare utilization change personality, or both?). Based on the present results, the within-person associations between personality traits and healthcare utilization suggest that future research may consider using random-intercept cross-lagged panel models to tease apart directionality. Finally, in the present study, we focused on how and why personality factors are related to healthcare utilization. However, it is important to acknowledge that personality traits, sense of control, and socio-demographic moderators are a limited set of contributors to healthcare utilization. Future research should simultaneously model a wider range of theoretically-motivated variables (e.g., based on Andersen's Behavioral Model) to fully understand healthcare utilization in the U.S.

5. Conclusions

The present study found that people who were more agreeable and neurotic tended to use more healthcare services. Moreover, on occasions when people were more extraverted and open, they tended to report using more healthcare services. Yet, healthcare utilization became more heavily dependent on one's personality characteristics with increasing age. Further, difficulty in access to services (due to socioeconomic resources) led to more self-selection in who uses health services, whereas easy access permitted all individuals, regardless of their personality tendencies, to use healthcare services. Finally, sense of control was one mechanism linking personality traits to healthcare utilization in the U.S. such that people with certain personality characteristics tend to feel more (or less) in control, which subsequently shapes their healthcare utilization across 20 years. Theoretically, these results contribute to our understanding of the longitudinal, moderation, and mediation pathways that underlie predisposing, enabling, and need-based characteristics in Anderson's Behavioral Model. Practically, the present findings have intervention and policy implications; namely, the between-person and moderation effects we identified point to who might be at risk and particularly benefit from intervention and changes in health policy. At the same time, the within-person and mediation effects we identified can

help to develop future interventions and health policies that are tailored (or personalized) to certain individuals. Ultimately, the main contribution of this work is that we show that some people are more or less likely to interact with healthcare systems based on their personality tendencies, underscoring the pressing need to identify ways to change U.S. healthcare systems to cater to all citizens regardless of their dispositional tendencies.

Author note

OEA, ECW, SJW, DKM, and EKG conceptualized the study. DKM acquired financial support. OEA curated the data, conducted the statistical analyses, visualized the results, and drafted the manuscript. All co-authors reviewed and provided critical feedback on the manuscript. All co-authors approved the final manuscript for submission.

OEA and ECW conducted the majority of this work while at Northwestern University, but they are now at the University of Houston and Washington University St. Louis, respectively.

The data is publicly available and can be downloaded at: <https://www.icpsr.umich.edu/web/ICPSR/series/203>. The pre-registrations and code are posted on the Open Science Framework: https://osf.io/8nxac/view_only=a38fbff7a6e74408be76f05e0c6993b6. This research was supported by grants from the National Institute of Aging awarded to Daniel K. Mroczek (AG018436; AG064006). We have no conflicts of interest to disclose.

CRedit authorship contribution statement

Olivia E. Atherton: Conceptualization, Data curation, Formal analysis, Project administration, Visualization, Writing - original draft, Writing - review & editing. **Emily C. Willroth:** Conceptualization, Formal analysis, Writing - review & editing. **Sara J. Weston:** Conceptualization, Writing - review & editing. **Daniel K. Mroczek:** Conceptualization, Funding acquisition, Writing - review & editing. **Eileen K. Graham:** Conceptualization, Writing - review & editing.

Data availability

The MIDUS data are publicly available for download at <https://www.icpsr.umich.edu/web/ICPSR/series/203>.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2023.116494>.

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