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## Grit is associated with psychological health among older sexual minority men

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### Abstract

Studies have shown that grit—defined as perseverance and passion for achieving one’s long-term goals—is associated with improved health outcomes, including lower levels of psychological distress. However, the psychometric properties of the original Grit Scale (Grit-O Scale) has not been validated among sexual minority men (SMM). The present study aimed to validate the Grit-O Scale among a sample of older SMM and assess the relationships between the Grit-O Scale factors and symptoms of psychological distress. We used data from a single visit of participants in the Multicenter AIDS Cohort Study (MACS) Healthy Aging longitudinal study. The sample included

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981 older SMM (mean age = 61, SD = 8.5) with and without HIV. We conducted confirmatory factor analysis (CFA) to identify the two factors of the Grit-O Scale: consistency of interest and perseverance of effort. We also conducted a latent profile analysis (LPA) to identify distinct profiles of psychological distress from self-reported scales of depression, anxiety, and perceived stress. The Grit-O Scale showed acceptable reliability estimates for the items with Cronbach's alpha reliability coefficients ranging from 0.77 to 0.82. The CFA identified the two factors of the Grit-O Scale with acceptable model fit (root mean square error of approximation = 0.058 [95% CI = 0.050, 0.067], comparative fit index = 0.95, Tucker-Lewis Index = 0.93, standardized root mean square residual = 0.07). The LPA yielded three mutually exclusive profiles of psychological distress (profile 1: low stress, anxiety, and depression; profile 2: high stress and depression and low anxiety; and profile 3: high stress, anxiety, and depression). In adjusted multinomial logistic regression analysis, we found that both higher levels of consistency of interest and perseverance of effort factors of the Grit-O Scale were significantly associated with decreased odds of being in profiles 2 and 3 compared with being in profile 1. Our findings support the use of the Grit-O Scale among older SMM. Grit factors could explain variability in the negative psychological symptoms among older SMM and warrant further investigation.

### Keywords

Consistency of interests; Perseverance; Gay men; Aging; HIV; Mental Health

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### Introduction

Sexual minority men (SMM), including gay and bisexual men, experience higher levels of depression and anxiety symptoms compared with heterosexual men (Cochran & Mays, 2009; King et al., 2008; Pachankis, 2014). For SMM living with HIV, elevated symptoms of depression and anxiety have been associated with reduced adherence to antiretroviral therapy (Langebeek et al., 2014; Smith & Cook, 2019) and lower odds of HIV viral suppression (Aralis et al., 2018; Beer et al., 2016). Among SMM at risk for HIV, depression and anxiety symptoms negatively impact uptake and adherence to preexposure prophylaxis for HIV (Colson et al., 2020). Prior studies have focused on determining risk factors for depression and anxiety symptoms among SMM as an approach to inform development of preventive interventions (Hatzenbuehler et al., 2011; Mustanski et al., 2011). However, there is a need to explore innovative approaches to studying depression and anxiety outcomes among SMM that tap into existing strengths that protect against the development of depression and anxiety symptoms among SMM (Herrick et al., 2011, 2014). Therefore, research that identifies protective factors against depression and anxiety symptoms may inform interventions for improving the health and well-being of SMM with and without HIV.

Recently, there has been growing interest in how various personality traits influence health outcomes (Friedman & Kern, 2014; Huang et al., 2017; Stieger et al., 2021; Turiano et al., 2012). Grit is one personality trait that has continued to receive attention in the literature. Duckworth et al. defined *grit* as perseverance and passion for long-term goals (Duckworth et al., 2007a). Individuals with high grit demonstrate consistency of interests in future goals

and with sustained effort over many years towards achieving those goals. In other words, individuals with high grit levels will approach life goals as a marathon, maintaining stamina in effort and interest in achieving life goals despite adversity (Duckworth et al., 2007a; Duckworth & Quinn, 2009). Grit has been closely linked to resilience, perseverance, and self-control. However, Duckworth et al. (2007) contended that grit is distinct from resilience—which entails an individual’s ability to “bounce back” after experiencing setbacks or adversity—by its emphasis on long-term commitment of interests. Moreover, resilience is described as a process of overcoming adversity (Herrick et al., 2014). Similarly, Duckworth et al. argued that grit differs from self-control in its emphasis on long-term stamina rather than short-term intensity, such that an individual can demonstrate self-control, but lack the stamina to maintain interest and perseverance toward achieving a long-term goal (Duckworth et al., 2007a).

Initial studies on grit found positive associations between high grit levels and various measures of success and performance (Duckworth et al., 2011; Duckworth & Quinn, 2009; Eskreis-Winkler et al., 2014; Maddi et al., 2012; Von Culin et al., 2014). Moreover, there has been growing interest in studying the impact of grit on psychological health outcomes. For instance, high levels of grit have been associated with lower depression and anxiety symptoms (Datu et al., 2019; Musumari et al., 2018; Sharkey et al., 2018; Zhang et al., 2018), as well as lower levels of perceived stress (Kannangara et al., 2018; Lee, 2017; Meriac et al., 2015; Mullen & Crowe, 2018; Saunders-Scott et al., 2018). However, most of these studies on grit have focused on adolescents, young adults, and middle-aged samples, with few studies conducted among older adults and older SMM in particular. Grit could be a significant factor in how well SMM successfully age and maintain optimal psychological health outcomes. Older individuals in general experience age-related challenges in their physical, emotional, and psychological health because of age-related chronic disease conditions (Divo et al., 2014). SMM individuals experience health disparities in large part due to social stressors such as homophobic victimization, prejudice and discrimination because of their sexual minority status as proposed by the Minority Stress Theory (Meyer, 2003). Like other older adult groups, older SMM experience social isolation and reduced social support because of loss of family and friends (Mayer et al., 2021). In addition, older SMM face unique challenges from social stressors including long-term stigma and discrimination from family, friends, health care providers, and the community related to their age, sexual orientation, HIV serostatus, and race/ethnicity (Batchelder et al., 2017). These stressors, some of which have persisted over many years, have negative impacts on the psychological health outcomes of SMM. Despite this, research continues to show that not all older SMM experience negative outcomes (e.g., psychological health outcomes) as they age (Akhtar-Khaleel et al., 2015; Okafor et al., 2016; Pines et al., 2014; Wight et al., 2015, 2016). Therefore, it is important to study grit among older SMM who have faced persistent stigma and discrimination because such research can provide a means to understand why some SMM are able to overcome these adverse experiences and flourish, while some do not.

Grit has been most frequently measured using the self-reported 12-item original Grit Scale (Grit-O Scale), developed by Duckworth et al. (2007). The factor structure of the Grit-O Scale comprised two dimensions: consistency of interest and perseverance of effort.

*Consistency of interest* refers to a person's tendency to pursue the same goals and interests over time, whereas *perseverance of effort* is a person's predisposition to sustain effort over time despite facing challenges. The Grit-O Scale was developed and validated among samples that were either predominantly middle age (mean age = 45 years) and female (73%–80 %) or military cadets (Duckworth et al., 2007a). Moreover, there have been inconsistencies in the dimensionality of the Grit-O Scale across samples. While some studies have found evidence for the two-factor solution, such as Duckworth et al. (2007) (Mullen & Crowe, 2018; Rhodes & Giovannetti, 2021), others have found a three-factor solution that included industriousness (i.e., the tendency for an individual to work very hard and diligently) (Kim & Lee, 2015). Furthermore, consistency of interest and perseverance of effort, though related, seem to have distinct associations with psychological health outcomes (Datu et al., 2016; Von Culin et al., 2014). For example, Datu and colleagues (Datu et al., 2016) found that perseverance of effort was negatively associated with negative affect, whereas, consistency of interest was positively associated with negative affect. To our knowledge, the Grit-O Scale has not been previously validated among SMM and whether the different factors of grit are associated with psychological health outcomes among SMM has not been explored.

The objectives of this analysis were to (1) validate the Grit Scale among a sample of older SMM and (2) assess the relationship between identified constructs from the Grit-O Scale with symptoms of psychological distress. We hypothesized that the Grit Scale would demonstrate a two-factor solution comprising consistency of interest and perseverance of effort and that both factors would be associated with lower levels of psychological health symptoms.

## Methods

### Study population

The Multicenter AIDS Cohort Study (MACS) is a longitudinal study that examines the natural and treated history of HIV/AIDS among men who have sex with men (MSM) in Baltimore, Maryland/Washington, DC; Chicago, Illinois; Los Angeles, California; and Pittsburgh, Pennsylvania. Since 1984, 7,352 HIV-positive and HIV-negative participants have enrolled over four time periods: 4,954 in 1984–1985, 668 in 1987–1991, 1,350 in 2001–2003, and 380 in 2011–2019. MACS participants attend semiannual visits that involve an audio computer-assisted self-interview, a standardized clinic examination, and blood and urine collections for laboratory measurements. Further details on the study design can be found elsewhere (Dudley et al., 1995; Kaslow et al., 1987). Study instruments can be found at <http://www.mwccs.org>.

### Healthy Aging study

The Patterns of Healthy Aging Among Men Who Have Sex with Men Sub-study (hereafter, MACS Healthy Aging), was conducted to identify and understand psychosocial resiliency factors that contribute to healthy aging among older MSM with and without HIV infection (Egan et al., 2021). The sub-study was conducted over six semiannual waves (MACS visits 65–70), from April 2016 to March 2019. Participant inclusion criteria included being at least

40 years old on April 2016, reporting at least one sexual intercourse encounter with another man since enrolling in the MACS, and completing at least one MACS visit in the two years prior to April 2016. Current analyses used data collected from 981 MACS Healthy Aging participants at the wave 6 (i.e., MACS visit 70) visit (occurring between October 2018 and March 2019) who completed questions from the Grit Scale. Institutional review boards at each study site approved the MACS and Healthy Aging protocols, and informed consent was obtained from all participants (Egan et al., In Press). The analytic sample comprised 981 participants. The median age was 62 years (lower quartile=56; upper quartile=68). Most participants were non-Hispanic White (68.5%) and 42.7% completed some graduate work/graduate degree. Approximately one-third of the sample earned \$60,000 or more per year (39.4%), were employed full-time (36.6%), and used marijuana in the past six months (33.4%). Half of the sample were living with HIV (49.5%) (Table 1).

## Measures

### Grit

We measured grit using the 12-item Grit-O Scale that measures the degree to which individuals can persevere in effort and maintain focus in the pursuit of long-term goals (Duckworth et al., 2007a). The Grit Scale includes items such as “I have achieved a goal that took years of work” and “I have overcome setbacks to conquer an important challenge,” which measure perseverance of effort. Examples of items that measure consistency of interest include “I often set a goal but later choose to pursue a different one” and “my interests change from year to year.” Response options were on a 5-point Likert-type scale ranging from 1 = very much like me to 5 = not like me at all. All items for the consistency of interest subscale were reverse-coded.

### Symptoms of psychological distress

**Depression symptoms**—Depression symptoms were assessed using the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). The CES-D is a 20-item measure that asks participants to rate how often over the past two weeks they experienced symptoms associated with depression. Response options range from 0 to 3 for each item (0 = rarely or none of the time, 1 = some or little of the time, 2 = moderately or much of the time, and 3 = most or almost all the time). Responses for the 20 items are summed, with scores ranging from 0 to 60 and higher scores indicating greater depression symptoms. Cronbach’s alpha for the CES-D was 0.82.

**Anxiety symptoms**—Anxiety symptoms were assessed using the General Anxiety Disorder–7 (GAD-7) scale (Spitzer et al., 2006). The GAD-7 is a 7-item measure that asks participants how often over the past two weeks they experienced anxiety symptoms. Response options range from 0 = not at all; 1 = several days; 2 = more than half the days; and 3 = nearly every day. Responses for the 7 items are summed, with scores ranging from 0 to 21 and higher scores indicating greater anxiety symptoms. Cronbach’s alpha for the GAD-7 was 0.92.

**Perceived stress**—The Perceived Stress Scale (PSS) was used to measure the degree in which situations in a participant’s life are appraised as stressful (Cohen et al., 1983). The 10-item PSS (PSS-10) was used in this study. Response options range from 0 = never; 1 = almost never; 2 = sometimes; 3 = fairly often; and 4 = very often. Responses for the 7 items are summed (some items were reverse coded), with total scores ranging from 0 to 40 and higher scores indicating greater perceived stress. Cronbach’s alpha for the PSS-10 was 0.86.

### **Covariates of symptoms of psychological distress**

To minimize potential confounding, our models included several sociodemographic, clinical, physical, and psychosocial factors that have been previously identified as important drivers of psychological health symptoms among older adults and SMM, including sociodemographic factors, HIV serostatus (Batchelder et al., 2017), substance use particularly stimulant use (Javanbakht et al., 2020), frailty phenotype (Desquilbet et al., 2009), internalized homophobia (Newcomb & Mustanski, 2010), and stigma (Marti-Pastor et al., 2020).

**Sociodemographic characteristics**—Race/ethnicity was self-reported and categorized into (1) non-Hispanic White; (2) non-Hispanic Black; (3) Hispanic; and (4) other (American Indian, Asian, and Pacific Islander). Education was self-reported and categorized into (1) high school or less; (2) some college; (3) college degree; and (4) some or completed graduate education. Participants reporting any part-time, full-time, or self-employment were classified as being employed, otherwise participants were considered not employed. Income was self-reported and categorized into (1) less than \$19,999; (2) \$20,000-\$59,999; and (3) \$60,000 or more.

**HIV serostatus**—HIV status (HIV-positive/HIV-negative) was assessed using enzyme-linked immunosorbent assay and a confirmatory Western blot on all MACS participants at their baseline visit and at every visit for HIV-negative participants. HIV-positive participants include those who tested as such at baseline or seroconverted during study observation (S. P. Meanley et al., 2020).

**Substance use**—The Alcohol Use Disorders Identification Test–Consumption questionnaire (AUDIT-C) was used to measure alcohol misuse. The AUDIT-C has three questions with answer choices from 0 points to 4 points. Scores for all three questions are summed. Alcohol misuse was defined as an AUDIT-C score  $\geq 4$  which indicates patients with hazardous drinking or who have active alcohol use disorders (Bush et al., 1998). Smoking status was self-reported, and current (i.e., past six months) smoking status was categorized into three groups: never smoked, former smoker, and current smoker. Frequency of marijuana use was self-reported and categorized as no use, less than daily, and daily use. Illicit drug use was measured as a positive (i.e., yes response) to any use of cocaine/crack, uppers, heroin, downers, ethyl, PCP, and GHB in the past six months.

**Frailty phenotype**—Frailty was defined in the MACS as the presence of three or more of the following components: (1) weakness (present if grip strength measured using a dynamometer is less than 20th percentile of HIV-negative men); (2) slowness (present if

time to walk 4 m is more than 80th percentile of HIV-negative men); (3) unintentional weight loss (present if participant answers yes to the question “Since your last visit, have you had unintentional weight loss of at least 10 lbs?”); (4) exhaustion (present if participant answers yes to the question “During the past 4 weeks, as a result of your physical health, have you had difficulty performing your work or other activities [for example, it took extra effort]?”); and (5) low physical activity (present if participant answers yes, limited a lot to the question “Does your health now limit you in vigorous activities, such as running, lifting heavy objects, participating in strenuous sports?”) (Althoff et al., 2014; Desquilbet et al., 2009; Fried et al., 2001).

## Psychosocial characteristics

**Internalized homophobia**—Internalized homophobia was measured using the Internalized Homophobia Scale (Herek et al., 1998). Participants were asked to retrospectively “think about the period of time when you first realized you were attracted to other men” and subsequently answer 9 statements about sexuality and indicate their level of agreement. Example statements include: “*I would like to get professional help in order to change my sexual orientation from gay/bisexual to straight*”. Items were scored using a five-point Likert scale (strongly disagree to strongly agree). We created a binary (yes/no) variable of internalized homophobia by assigning a yes to participants who responded with agree or strongly agree with any of the 9 items similar to previous published reports (Herrick et al., 2013; Meanley et al., 2020).

**Perceived stigma**—Perceived stigma related to being a sexual minority individual was assessed with four questions, developed by the Healthy Aging Study team, that asked perceptions of stigma from people, family, gay community, and health care providers (Egan et al., 2021). Sample questions asked included “I feel that health care providers treat me with [response options] respect because I have sex with men.” Response options ranged from a lot more, a little more, not applicable, about the same, a little less, and a lot less, with scores for each item assigned as  $-2$ ,  $-1$ ,  $0$ ,  $1$ ,  $2$ , and  $3$ , respectively. We created a composite summary score by summing all items, with higher scores reflecting more perceptions of stigma.

## Data analysis

To validate the grit scale among a sample of older SMM, we conducted confirmatory factor analysis (CFA) using responses from the Grit-O Scale. In their study, Duckworth et al. (2007) compared a unidimensional model with a two-factor model, with correlated factors, and found better model fit indices for a two-factor model. Thus, in this study, we considered a two-correlated factor model composed of the two Grit subscales: consistency of interest and perseverance of effort. We specified items to load onto their a priori constructs outlined in the original study by Duckworth and colleagues (2007). Due to the sufficiently large sample size and the grit items having five response categories, we assumed the responses to be normally distributed (Gunzler & Morris, 2015; Rhemtulla et al., 2012). Therefore, grit items were treated as continuous, and we used robust maximum likelihood estimation in the CFA modeling strategy. We used root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and Tucker-



Lewis Index (TLI) to assess model fit. We assessed good model fit as RMSEA < 0.06 (with upper limit of the confidence value <0.08), CFI/TLI > 0.90, and SRMR < 0.08 (Browne & Cudeck, 1992; Hu & Bentler, 1999).

Next, we assessed the relationship between identified factors from the Grit-O Scale with psychological health symptoms. To address this, we first conducted a latent profile analysis (LPA) to identify mutually exclusive profiles of psychological distress based on participants' responses to the CES-D, GAD-7, and PSS-10. LPA is an analytic approach analogous to latent class analysis that allows for the identification of categorical latent factors from continuous observed variables (Collins & Lanza, 2009). To identify the optimal number of latent profiles, we conducted sequential models testing whether 2, 3, and 4 latent profiles of psychological distress best fit the data. We used the Akaike information criterion (AIC), Bayesian information criterion (BIC), sample size-adjusted BIC (SABIC), Lo-Mendell-Rubin Likelihood Ratio Test (LMR LRT), adjusted LMR LRT, and entropy to assess model fit. Lower AIC, BIC, and SABIC scores indicate better model fit. The LMR LRT and adjusted LMR LRT compare a model with  $k$  profiles vs another with  $k-1$  profiles, with a statistically nonsignificant  $p$ -value indicating that the  $k-1$  model fits the data better than the  $k$  model. Entropy—a measure of classification uncertainty—values > 0.70 indicate model fit (Jung & Wickrama, 2008). In addition, we examined the prevalence of each latent profile (retaining models where the smallest class contained more than 5% of the sample) and interpretability of the identified latent profiles. After the optimal number of latent profiles were selected, we used  $\chi^2$  statistics, independent  $t$  tests, and Wilcoxon tests to compare sociodemographic, clinical, physical, and psychosocial factors of the latent profiles of psychological distress. We then used a multinomial logistic regression model to assess associations of the identified grit constructs from the CFA and the latent profile of psychological distress. The primary independent variable in these models was the identified grit constructs and the dependent variable was the latent profile of psychological distress. For this analysis, we selected the profile with the lowest symptoms of psychological distress as the referent group. Covariates were selected for inclusion in the adjusted models if their  $p$ -values for their association with latent profile of psychological distress were < 0.10. Unadjusted and adjusted odds ratio, with 95% CIs are reported. Missing data on specific covariates ranged from 2% to 16%. We addressed missing data with multiple imputation using chained equations (White et al., 2011). Ten imputed datasets were generated for missing data, multinomial logistic regression models were conducted on each imputed data set, and odds ratios were pooled (Toutenburg, 1990). We used Mplus version 8.5 to conduct the CFA and LPA. We used SAS version 9.4 (SAS Institute Inc., Cary, North Carolina, USA) to conduct the multinomial multiple imputation and logistic regression.

## Results

### Results from the CFA measurement model of the Grit-O Scale

The overall Cronbach's alpha reliability coefficients of each factor yielded the following results:  $\alpha = 0.82$  for consistency of interest and 0.83 for the perseverance of effort. Cronbach's alpha reliability coefficients for items ranged from 0.77 to 0.80 for consistency of interest and 0.77 to 0.82 for perseverance of effort. The initial CFA with correlated factors

fit the data moderately well (RMSEA = 0.079 [95% CI = 0.072, 0.087], CFI = 0.89, TLI = 0.87, SRMR = 0.08). Because the two factors were allowed to correlate in the initial CFA model, in subsequent CFA models, we allowed correlation of item error variances (see Figure 1 for measurement model of Grit Scale). The final CFA model with correlated factors and item variances produced an acceptable fit to the data (RMSEA = 0.058 [95% CI = 0.050, 0.067]), CFI = 0.95, TLI = 0.93, SRMR = 0.07). All factor loadings were >0.5 (ranging from 0.52 to 0.85) and statistically significant (Table 2).

### Results from LPA of symptoms of psychological distress

Supplemental Table S1 shows model fit information for 1 to 4 profiles of psychological distress from the CES-D, GAD-7, and PSS-10. The three-class solution was selected because the LMR LRT and adjusted LMR LRT comparing the four-class with the three-class solution was statistically insignificant ( $p = 0.241$  and  $0.251$  for LMR LRT and adjusted LMR LRT, respectively) indicating that the four-class was not a better fit than the three-class solution. Entropy for the three-class was 0.90. The classification probabilities for the most likely latent profile are displayed in Supplemental Table S2. The three mutually exclusive latent profiles emerging from this solution comprise profile 1 ( $n = 706$ ; 67%) characterized by participants with mean GAD-7, PSS-10, and CES-D scores of 1.22, 9.43, and 4.47; profile 2 ( $n = 89$ ; 9%) participants with mean GAD-7, PSS-10, and CES-D scores of 15.78, 23.24, and 31.80; and profile 3 ( $n = 256$ ; 24%) participants with mean GAD-7, PSS-10, and CES-D of 6.43, 22.18, and 39.55, respectively (Supplemental Table S3). Thus, we describe participants in profile 1 as having no/low psychological distress, participants in profile 2 as experiencing significant psychological distress (i.e., high scores on CES-D, GAD-7, and PSS-10), and participants in profile 3 as having significant depression and stress symptoms but low anxiety symptoms (i.e., high scores on CES-D and PSS-10, but low scores on GAD-7).

### Characteristics of sample by latent profile of symptoms of psychological distress

The mean age was lowest among those in profile 2 (mean age = 57 years). Compared with participants with profile 1, those with profiles 2 and 3 had higher proportions of frailty phenotypes (8.6% vs 17.7% and 20.7%), current smokers (12.6% vs 23.8% and 19.3%), daily marijuana use (9.4% vs 20.5% and 13.3%), self-reported internalized homophobia (20.8% vs 50.7% and 43.5%), and positive HIV status (46.7% vs 64.3% and 52.0%; supplemental Table S4). Overall, age, race/ethnicity, education status, annual income, frailty phenotype, stigma, smoking status, frequency of marijuana use, illicit drug use, internalized homophobia, and HIV status were statistically significantly associated with latent profile of psychological distress (all  $p$  values  $\leq 0.05$ ) and were considered for inclusion in the multivariable model.

### Multivariable multinomial logistic regression of associations between Grit-O subscales and latent profile of symptoms of psychological distress

We selected profile 1 as the referent group for the multinomial logistic regression analysis because it comprised participants with the lowest symptoms of psychological distress. We did not include education in the final model because of multicollinearity with income. Each unit increase in the consistency of interest factor was associated with decreased odds of

being in profile 2 (adjusted odds ratio [AOR] = 0.64; 95% CI = 0.49, 0.84) and profile 3 (AOR = 0.65; 95% CI = 0.55, 0.79) compared with being in profile 1 (Table 3). Similarly, each additional unit increase in the perseverance of effort factor was associated with lower odds of a being in profile 2 (AOR = 0.52; 95% CI = 0.40, 0.69) and profile 3 (AOR = 0.62; 95% CI = 0.52, 0.75) compared with being in profile 1. These findings were in the context of other significant covariates of latent profiles of psychological distress including older age, internalized homophobia, perceived stigma, and frailty phenotype (all p-values=<0.01; Table 3).

## Discussion

The aims of this study were to assess the psychometric validity of the grit scale in a sample of older SMM with and without HIV and to explore relationships between identified subscales from the Grit-O Scale with psychological health symptoms. Consistent with our hypothesis, a CFA produced a two-factor solution in which items loaded onto respective factors: consistency of interest and perseverance of effort with acceptable model fit statistics. Furthermore, we found that both higher consistency of interest and perseverance of effort were associated with reduced odds of having symptoms of psychological distress, independent of other important correlates of psychological distress including age, internalized homophobia, perceived stigma, and frailty phenotype.

To our knowledge, our study is among the first to assess the psychometric properties of the Grit-O Scale in older SMM with and without HIV. The internal consistency measures of the items of the Grit-O scale in this study of SMM were acceptable and were consistent with the values produced in the Grit-O Scale in the Duckworth et al. study (Duckworth et al., 2007a) and comparable with other studies in diverse populations (Arco-Tirado et al., 2018; van Zyl et al., 2020) including those conducted among older adults (Kim & Lee, 2015; Rhodes & Giovannetti, 2021). For example, Kim and Lee (2015) used the Grit-O Scale among older individuals in Korea and produced a three-factor solution with comparable reliability estimates: consistency of interest (0.79), perseverance of effort (0.76), and industriousness (0.84). As such, reliability estimates from our study indicated the stability of the items from the Grit-O Scale among this sample of older SMM. Regarding the component structure of the Grit-O Scale in this sample of older SMM, our CFA model indicated that the data fit a two-factor solution that map to the two constructs identified by Duckworth and colleagues in the original validation of the Grit-O Scale, with acceptable model fit statistics. Our study findings were also consistent with another study among older adults in the United States that found a two-factor solution using the short grit scale comprising 10 items (5 items loading on each factor) (Rhodes & Giovannetti, 2021). However, our study findings are inconsistent with one study among older adults in Korea using the Grit-O Scale to produce a three-factor solution consisting of an additional factor of industriousness (Kim & Lee, 2015). Cultural differences between older adults in Korea and North America could explain the different model solutions. The result of our analysis supports the use of the Grit-O Scale to produce separate scores for the two grit factors: consistency of interest and perseverance of effort among older SMM.

For the second aim of this study, we found that both consistency of interest and perseverance of effort were associated with decreased odds of having a profile of elevated psychological distress. These findings are independent of other covariates of psychological distress, particularly older age, internalized homophobia, perceived stigma, and frailty phenotype which were all statistically significant in the multivariable models. Our findings added to the growing literature demonstrating the protective associations between measures of grit and psychological well-being (Laird et al., 2019; Sharkey et al., 2018). Our findings were consistent with previous studies among SMM and persons with HIV. Those studies showed that higher levels of grit were associated with lower depression symptoms (Winiker et al., 2019) and prevalence of current major depressive disorder (Moore et al., 2018), although these studies did not explore the psychometric properties of the Grit-O Scale, but scored the grit scale by summing the grit items. Our findings expanded the literature by demonstrating a protective association between the two grit factors and symptoms of psychological distress among this sample of older SMM.

Our finding that both grit factors were associated with lower odds of psychological distress are particularly noteworthy among SMM. SMM often experience persistent stigma and discrimination, which results in significant symptoms of psychological distress that have negative downstream impact on other health domains (Smit et al., 2012; Valdiserri et al., 2019; Wight et al., 2012). Our finding suggested that a high grit personality trait characterized by passion and perseverance for long-term goals could be a strength that some older SMM in this sample use to mitigate psychological distress. As such, grit could be a factor that explains variability in the negative psychological impact of stigma, discrimination, and other traumatic experiences among older SMM. Findings from our study should serve as a foundation for future research on grit among older SMM towards facilitating intervention development. However, additional investigations are needed to replicate these findings among other samples of older SMM. It will also be important to document whether the protective associations of grit on psychological distress will be observed in other relevant domains of successful aging (e.g., physical, and cognitive health) and HIV-related health outcomes (e.g., antiretroviral therapy adherence). Moreover, studies that identify the mediational process whereby grit leads to protective psychological health are warranted. Although a growing number of studies have demonstrated that other personality trait types, such as neuroticism, extraversion, conscientiousness, and agreeableness can be changed through intervention (Magidson et al., 2014; Roberts et al., 2017; Stieger et al., 2021). For instance, one systematic review found increases in extraversion, conscientiousness as well as reduction in neuroticism of small to medium effect sizes via a broad range of intervention types (Roberts et al., 2017). However, relatively few studies have assessed strategies to promote grit via grit-focused interventions (Hwang & Nam, 2021). Cognitive behavioral strategies that focus on interest discovery and maintenance, facilitating goal setting, deliberate practice, and cultivating a growth mindset—i.e., the belief that one's abilities can improve with effort (Hwang & Nam, 2021)—could serve to increase grit in older SMM groups.

Our study had some limitations. Our analysis was cross-sectional, and we were not able to make definitive conclusions about the direction of the grit-psychological distress association. The measures used in our study were obtained via self-report, creating the potential for

reporting bias from participants. This issue is particularly relevant for the Grit Scale because items from the Grit Scale represent positive traits; it is possible participants may not have provided accurate responses due to the socially desirable nature of having positive traits. Additionally, we used a convenience sample of older SMM from the MACS. As such, our sample was predominantly non-Hispanic White with a higher degree of education. Thus, it is unclear how generalizable our findings will be in other SMM groups.

Despite these limitations, our results showed acceptable psychometric properties of the grit scale among this sample of older SMM with and without HIV. Further, the two factors of grit—consistency of interest and perseverance of effort—demonstrated protective associations with psychological distress. Our findings support the use of the Grit-O Scale for the assessment of the two grit factors among older SMM. This study did not measure the Big Five personality traits, precluding assessment of correlation between the Grit-O subscales with Big Five personality traits. Additional studies are needed to replicate these findings. Furthermore, future research that explores mediational pathways linking grit to better psychological health among older SMM with and without HIV is warranted. Investigations that use a longitudinal design and demographically diverse sample would be useful for these investigations.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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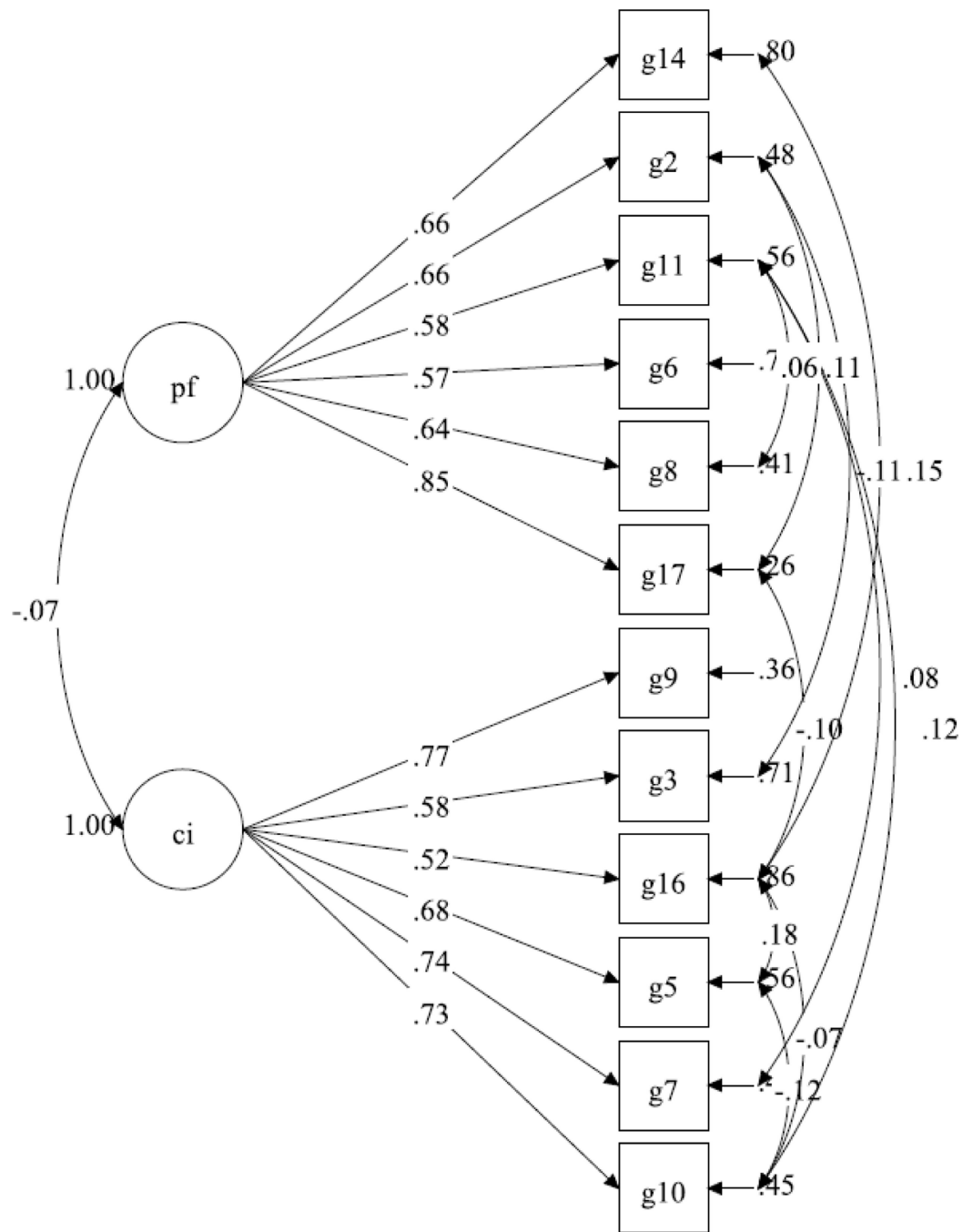
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**Figure 1.** Confirmatory factor analysis of the Grit Scale. Standardized coefficients are displayed. All coefficients were significant at  $p < 0.05$ . Model fit information: root mean square error of approximation = 0.058, comparative fit index = 0.95, Tucker-Lewis Index = 0.93, standardized root mean square residual = 0.07. Abbreviations= pf=Perseverance of effort; ci= consistency of interest

**Table 1.**

Characteristics of MACS participants by HIV status

	Overall		HIV status				P-value
	N	%	Positive (n = 486)		Negative (n = 495)		
Age, median (IQR), years <sup>†</sup>	62 (56, 68))		59 (54, 65)		65 (58, 70)		<.0001
<b>Race/ethnicity</b>							
Non-Hispanic White	672	68.5	271	55.8	401	81.0	<.0001
Non-Hispanic Black	199	20.3	139	28.6	60	12.1	
Hispanic	91	9.3	65	13.4	26	5.3	
Other	19	1.9	11	2.3	8	1.6	
<b>Education</b>							
High school or less	117	12.0	74	15.3	43	8.7	<.0001
Some college	147	15.0	94	19.4	53	10.8	
College degree	296	30.3	147	30.4	149	30.2	
Some graduate work/graduate degree	417	42.7	169	34.9	248	50.3	
<b>Income</b>							
<\$19,999	204	22.1	139	29.9	65	14.2	<.0001
\$20,000-\$59,999	356	38.5	189	40.6	167	36.4	
>\$60,000	364	39.4	137	29.5	227	49.5	
<b>Site</b>							
Baltimore, MD/Washington, DC	264	26.9	131	27.0	133	26.9	0.0005
Chicago, IL	234	23.9	142	29.2	92	18.6	
Pittsburgh, PA	243	24.8	103	21.2	140	28.3	
Los Angeles, CA	240	24.5	110	22.6	130	26.3	
<b>Full-time employment</b>							
No	616	63.4	310	64.2	306	62.6	0.6572
Yes	356	36.6	173	35.8	183	37.4	
<b>Frailty phenotype</b>							

	Overall				HIV status				P-value
	Positive (n = 486)		Negative (n = 495)		Positive (n = 486)		Negative (n = 495)		
	N	%	n	%	n	%	n	%	
No	811	87.7	399	87.7	412	87.7	412	87.7	0.9879
Yes	114	12.3	56	12.3	58	12.3	58	12.3	
<b>Alcohol misuse (AUDIT-C)</b>									
No	668	68.6	335	69.8	333	67.4	333	67.4	0.4232
Yes	306	31.4	145	30.2	161	32.6	161	32.6	
<b>Smoking</b>									
Never smoked	336	34.6	155	32.2	181	36.9	181	36.9	<.0001
Former smoker	488	50.2	227	47.2	261	53.2	261	53.2	
Current smoker	148	15.2	99	20.6	49	10.0	49	10.0	
<b>Marijuana frequency</b>									
Never	642	66.6	287	60.3	355	72.7	355	72.7	0.0002
Less than daily	213	22.1	123	25.8	90	18.4	90	18.4	
Daily	109	11.3	66	13.9	43	8.8	43	8.8	
<b>Drug use</b>									
No	851	88.8	394	83.5	457	94.0	457	94.0	<.0001
Yes	107	11.2	78	16.5	29	6.0	29	6.0	
<b>Internalized homophobia</b>									
No	585	71.3	277	67.9	308	74.6	308	74.6	0.0343
Yes	236	28.7	131	32.1	105	25.4	105	25.4	
<b>Stigma, mean (SD)</b> <sup>‡</sup>	0.11 (0.90)		0.16 (1.00)		0.06 (0.80)		0.06 (0.80)		0.0982

Abbreviations: AUDIT-C, Alcohol Use Disorders Identification Test–Consumption; MACS, Multicenter AIDS Cohort Study.

<sup>‡</sup>P-value from t test as distribution of scores was reasonably symmetric; all other p-values were from a  $\chi^2$  test.

**Table 2.**

Factor loadings and Cronbach's  $\alpha$  from the two-factor solution of the grit scale

Items	Factor loadings		Cronbach's $\alpha$
	Perseverance of effort	Consistency of interest	
G14. I have achieved a goal that took years of work.	0.66		0.82
G2. I have overcome setbacks to conquer an important challenge.	0.66		0.81
G11. I finish whatever I begin.	0.59		0.81
G6. Setbacks don't discourage me.	0.57		0.82
G8. I am a hard worker.	0.64		0.80
G17. I am diligent.	0.85		0.78
G9. I often set a goal but later choose to pursue a different one.		0.77	0.78
G3. New ideas and projects sometimes distract me from previous ones.		0.58	0.81
G16. I become interested in new pursuits every few months.		0.52	0.82
G5. My interests change from year to year.		0.68	0.79
G7. I have been obsessed with a certain idea or project for a short time but later lost interest.		0.74	0.79
G10. I have difficulty maintaining my focus on projects that take more than a few months to complete.		0.73	0.79

**Note:** All factor loadings were statistically significant ( $p < 0.05$ )

**Table 3.** Adjusted odds ratios from multinomial logistic regression association of grit factors with latent profile of distress

	Profile 2 (vs profile 1)		Profile 3 (vs profile 1)	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value
<b>Age</b>	0.92 (0.89, 0.95)	<0.001	0.95 (0.92, 0.96)	<0.001
<b>Race/ethnicity</b>				
Non-Hispanic White	Reference		Reference	
Non-Hispanic Black	0.42 (0.22, 0.80)	0.007	0.63 (0.42, 0.96)	0.032
Hispanic	1.18 (0.61, 2.31)	0.611	0.74 (0.45, 1.23)	0.250
Other	1.26 (0.37, 4.31)	0.708	1.65 (0.74, 3.68)	0.217
<b>Income</b>				
<\$19,999	Reference		Reference	
\$20,000-\$59,999	1.17 (0.83, 1.66)	0.368	0.83 (0.66, 1.07)	0.153
>\$60,000	0.61 (0.40, 0.94)	0.023	0.90 (0.70, 1.18)	0.449
<b>Internalized homophobia</b>				
No	Reference		Reference	
Yes	1.84 (1.33, 2.55)	<0.001	1.67 (1.38, 2.02)	<0.001
<b>Stigma</b>	1.42 (1.09, 1.85)	0.008	1.21 (1.01, 1.45)	0.036
<b>Frailty phenotype</b>				
No	Reference		Reference	
Yes	1.71 (1.17, 2.51)	0.005	1.85 (1.45, 2.38)	<0.001
<b>HIV status</b>				
Negative	Reference		Reference	
Positive	1.09 (0.83, 1.43)	0.517	0.95 (0.80, 1.13)	0.593
<b>Factors</b>				
Consistency of interest	0.64 (0.49, 0.84)	0.001	0.65 (0.55, 0.79)	<0.001
Perseverance of effort	0.52 (0.40, 0.69)	<0.001	0.62 (0.52, 0.75)	<0.001

Abbreviation: AOR, adjusted odds ratio.