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Patterns and Predictors of Late-Life Drinking Trajectories: A 10-Year Longitudinal Study

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Abstract

This study examines the extent of group-level and intra-individual decline in alcohol consumption among adults as they traverse a 10-year interval spanning late-middle to early-old age. Further, it identifies key baseline predictors of these adults' 10-year drinking trajectories. Community residents ($n=1,291$; age 55 to 65 at baseline) were assessed at 4 points over a 10-year interval on demographic and health characteristics, coping responses, social context, and alcohol consumption. Descriptive cross-wave statistics, and multilevel regression analyses, indicated that in the sample overall, participants' 10-year patterns of alcohol consumption were relatively stable. However, men's patterns, and those of individuals drinking beyond recommended alcohol consumption guidelines at baseline, were more variable and showed steeper rates of decline, than did those of women and individuals drinking within recommended levels. Contrary to expectation, baseline use of substances to reduce tension and heavier reliance on avoidance coping predicted faster rate of decline in alcohol consumption. Post-hoc prospective mediation analyses suggested that this may have occurred because these and other baseline predictors heighten risk of developing new health problems which, in turn, motivate reduced alcohol consumption.

Keywords

older adults; alcohol; drinking trajectories

It is often assumed that alcohol consumption declines in later life, but the evidence for this assumption is based primarily on averaged group changes. Furthermore, almost no research has focused on the question of *why* alcohol consumption might decline in later life. This is important because identification of factors known at late-middle-age to facilitate, or discourage, older adults' subsequent levels of alcohol consumption might inform health interventions to support salutary use of alcohol in later life. This study adds to previous research by describing the drinking trajectories of women and men as they mature from late-middle-age (55-65 years) to early-old age (66-76 years). Further, it extends earlier research by identifying key baseline demographic, health-related, coping, and social context factors that predict change in late-middle-aged adults' 10-year drinking trajectories.

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Change in Alcohol Consumption with Age

Cross-sectional studies that encompass broad age ranges have consistently shown an association between older age and lower alcohol consumption (Barnes, 1979; Breslow & Smothers, 2004; Cahalan & Cisin, 1968; Dawson, Grant, Chou, & Pickering, 1995; Eigenbrodt, Mosley, Hutchinson, Watson, Chambless, et al., 2001; Fillmore, Hartka, Johnstone, Leino, Motoyoshi, et al., 1991; Johnson, Gruenewald, Treno, & Taff, 1998; Knupfer & Room, 1964). Longitudinal studies also generally show that older age is predictive of lower alcohol consumption, and of a steeper decline in alcohol use (Karlmanaga, Zhou, Reuben, Greendale, & Moore, 2006; Moore, Gould, Reuben, Greendale, Carter, et al., 2005; but see Kerr, Greenfield, Bond, Ye, & Rehm, 2004). However, selective mortality may contribute to the appearance of age-related decline in alcohol consumption in these studies (Atkinson, 2000). Earlier death of heavier drinkers leaves behind lighter-drinking survivors, who generally continue this lighter drinking as they age (Fillmore, Golding, Graves, Knipf, Leino, et al., 1998; Poikolainen, 1995; Leino, Romelsjö, Shoemaker, Ager, Allebeck, et al., 1998), strengthening the apparent association between older age and lower alcohol consumption.

The majority of the longitudinal studies focusing on individual older, age-restricted (i.e., 50+) cohorts also have identified a decline over time in participants' alcohol use (e.g., Adams, Garry, Rhyne, Hunt, & Goodwin, 1990; Fillmore, Hartka, Johnstone, Leino, Motoyoshi, et al., 1991) but some have shown stability or, less frequently, an increase in older adults' alcohol consumption (Glynn, Bouchard, LoCastro, & Laird, 1985; Gordon & Kannel, 1983; Stall, 1986a; Temple & Leino, 1989). Many of these studies have focused exclusively on men, and none have distinguished between individuals who enter later life as heavier drinkers (i.e., drinking beyond recommended alcohol consumption guidelines for older adults) and those who are drinking more moderately or within these guidelines. However, past studies of younger and mixed-age samples have demonstrated heterogeneity of drinking patterns among men and heavier, compared with women and lighter, drinkers (Johnstone, Leino, Ager, Ferrer, & Fillmore, 1996; Kerr, Fillmore, & Bostrom, 2002). If the heterogeneity of drinking patterns observed in this work extends into later life, it may in part explain conflicting past findings about whether there is stability or change, and the direction of change, in alcohol consumption patterns of older adults. Furthermore, almost all previous studies in this area have assessed change in drinking level using only group-level analyses of data collected at just two time points. Because this approach can mask important within-individual patterns of alcohol consumption, it should be supplemented by analyses that use multiple measures to describe intra-individual late-life drinking trajectories, and variation in those trajectories over time. Thus far, in prior work examining the cohort on which we focus here, we have identified at the group level an average, modest decline in alcohol consumption (Moos, Brennan, Schutte, & Moos, 2004a; Moos, Schutte, Brennan, & Moos, 2004b).

To extend our own and other investigators' previous research in this area, we describe here both group-level and within-person change in alcohol consumption from late-middle- to early-old-age, using data collected at 4 assessment points over a 10-year interval. We first provide descriptive cross-wave statistics for the group overall, and for gender and drinking-level subgroups within it, in order to summarize overall group level change in average drinking levels from late-middle to early old age, and to illustrate gender and drinking-level based variation from the overall group's pattern of drinking. Second, to extend these findings to include new information about the direction and rate of change in alcohol consumption in later life, we use multilevel regression analyses to estimate participants' 10-year drinking trajectories, and variation in the level and rates of change of these trajectories, as participants mature from late-middle to early-old age.

Predictors of Later-Life Drinking Trajectories

Several factors may shape the course of late-life drinking trajectories, including distal historical and social influences, as well as more proximal biological, psychological, and social effects (Douglass, Schuster, & McClelland, 1988; Stall, 1987). Macro-historical contexts (e.g., Prohibition era) and social demographic characteristics may place formative stamps on the drinking behavior of successive cohorts of adults. Effects of historical context are best detected through analyses of large longitudinal surveys that encompass a wide age range and multiple age cohorts. In this regard, prior research has found relatively consistent evidence for period effects, but less consistent evidence for age and cohort effects (Karlman et al., 2006; Kerr et al., 2004; Moore et al., 2005).

With respect to social demographic characteristics, older age, lower income, and being female, unmarried, and non-white are generally associated with lower levels of alcohol consumption. Men and unmarried individuals experience steeper declines in alcohol consumption than do women and married individuals (Moore et al., 2005; but see Johnstone et al., 1996; Karlman et al., 2006).

Almost no research has examined the more proximal biological, psychological, and social influences on late-life drinking identified by Douglass et al. (1988) and Stall (1987) as shaping late-life drinking trajectories. With respect to biological influences, older men identify health problems as a key reason that they cut down on or quit drinking (Stall, 1986b; Walton, Mudd, Blow, Chermack, & Gomberg, 2000). Consistent with this, Glass and colleagues (1995) showed that the occurrence of negative health events serious enough to merit hospitalization, or nursing home admission, predicted significant declines in older adults' alcohol consumption over a 3-year interval.

Risky health behaviors, such as smoking, and consuming alcohol in ways that incur negative physical, psychological, and social consequences (drinking problems) are associated cross-sectionally with higher levels of alcohol consumption (Mirand & Welte, 1996). However, longitudinal studies have shown that individuals who drink more heavily at baseline, and those who smoke at baseline, subsequently decrease their alcohol consumption more quickly than do lighter drinkers and non-smokers (Kerr et al., 2004; Moore et al., 2005). This may occur because engaging in health risk behaviors at late-middle-age elevates the risk of subsequent, new negative health events (e.g., onset of heart problems, cancer, diabetes), as well, possibly, of new, negative non-health life events indicative of "social friction" in response to risky health behaviors (e.g., separation, divorce, job loss). These life events may, in turn, motivate older adults to reduce their alcohol consumption.

With regard to psychological influences on late-life drinking, coping strategies may help explain change in late-life alcohol consumption. More self-reported use of substances to reduce tension, including "drinking to cope" is associated with slower decline in alcohol consumption over the course of early adulthood (Trim, Schuckit, & Smith, 2008). More generally, coping characterized by heavier reliance on avoidance-cognitive coping (e.g., trying not to think about a stressor) and avoidance-behavioral coping (e.g., crying or shouting to discharge one's emotions) has been shown to predict poorer drinking outcomes (Brennan & Moos, 1996; Cooper, Russell, & George, 1988; Cooper, Russell, Skinner, Frone, & Mudar, 1992; Timko, Finney, & Moos, 2005). However, it is not known to what extent avoidance coping is associated with rate of change in drinking over the course of late adulthood.

Proximal social influences, including socializing with friends and family, and friends' attitudes about and use of alcohol, may also affect late-life alcohol consumption. More frequent socializing exposes people to more opportunities to consume alcohol, such as parties, family celebrations, and leisure travel. Thus, higher levels of socializing with family and friends may

have the effect of slowing intra-individual decline in alcohol consumption. Friends' attitudes about and use of alcohol are clear predictors of adolescents' and young adults' drinking behavior (e.g., Poelen, Sholte, Willemsen, Boomsa, & Engels, 2007; Trim et al., 2008). Friends may continue to influence individuals' drinking behavior well into later life (Alexander & Duff, 1988); thus older adults who have more friends who approve of and engage in heavy drinking may also more slowly reduce their drinking over time.

On balance, previous findings lead us to expect that, as individuals age over a 10-year interval spanning late-middle to early-old age, they will demonstrate intra-individual decline in alcohol consumption. We expect several demographic characteristics to prospectively predict faster rate of decline in alcohol consumption, most notably male gender, unmarried status, and lower income. We also expect more health problems and health risk behaviors at baseline to predict steeper decline in alcohol use. In contrast, previous research findings lead us to expect that baseline use of substances to reduce tension, and more baseline use of avoidance coping strategies, more social activity, and having more friends who engage in and approve of heavier drinking, will predict slower decline in alcohol consumption over this same interval.

Method

Sample

A sample of late-middle-aged (age 55 to 65) adults was recruited to take part in a longitudinal study of the late-life course of alcohol consumption, health, stress, and coping. The sample comprised community residents who had had contact with outpatient medical clinics sometime within the three years prior to recruitment. Because a primary focus of this research was older adults' drinking behavior, a screening procedure implemented during recruitment excluded individuals who had never in their lives consumed alcohol.

Telephone contact was made successfully with 96% of eligible respondents, and 96% ($n=2,125$) of these individuals agreed to participate in the first wave of data collection. Overall, 1,884 (89%) of the individuals agreeing to participate completed the baseline data collection. Informed consent was obtained from all participants. (For additional details about participant recruitment, see Brennan & Moos, 1990; Moos, Brennan, Fondacaro, & Moos, 1990.)

The baseline sample was comparable to similarly-aged community samples with regard to such health characteristics as prevalence of chronic illness and hospitalization (Brennan & Moos, 1990). Participants were followed-up 1 and 4 years after baseline; a 94% response rate was attained at each of these follow-ups. Ten years after baseline, 93% of all surviving participants ($n=1,291$) completed another follow-up. There were no statistically significant differences between these surviving participants and surviving nonparticipants ($n=68$) on any demographic characteristics or baseline drinking variables. Compared with the surviving participants ($n=1,291$), participants who died or were too seriously impaired by illness (e.g., stroke) to participate further in the study ($n=525$; 93% deceased, 7% too ill) were more likely to be male, unmarried, and non-white, and to have somewhat less education and lower income at baseline. However, there was no difference between these groups on baseline number of drinks consumed or presence of drinking problems.

At baseline, the mean age in the $n=1,291$ sample was 61 ($SD=3.2$) years; 41% of the sample was female, and it was almost 92% white. Overall, 71% of participants were married, and participants had an average annual family income of \$41,504 ($SD=\$ 22, 679$).

Measures

Data were collected through a combination of mail and telephone surveys.

Baseline predictors—In addition to demographic data, information collected at baseline included *health-related* factors, which were assessed through items from the Life Stressors and Resources Inventory (LISRES; Moos & Moos, 1994; Moos, 2002) and the Health and Daily Living Form (HDL; Moos, Cronkite, & Finney, 1992). *Negative health events* was a count of 27 acute (began in the last 12 months) serious medical conditions (e.g., diabetes, heart problems, cancer), acute physical ailments (e.g., back problems, chest pain), and occurrence of hospitalization in the last 12 months.

Health risk behaviors included *smoker* (currently smoking one or more cigarettes, cigars, or pipefuls of tobacco each day, 0=no; 1=yes), *drinking two or more (2+) drinks per day* (0=no; 1=yes), and having one or more *current drinking problems* (0=no; 1=yes).

The choice of 2+ drinks per day to indicate drinking beyond recommended alcohol consumption guidelines is based on all-age alcohol consumption guidelines formulated by the U. S. Department of Agriculture (USDA; 2000) and the National Institute of Alcohol Abuse and Alcoholism (NIAAA; 1995), and age 65+ guidelines set forth by the American Geriatrics Society (AGS; 2003). At baseline assessment, 95% of participants identified as drinking beyond recommended guidelines were consuming more than 2 drinks per day; on average, they consumed 3.8 ($SD=2.5$) drinks per day.

Individuals were identified as having current drinking problems if, at baseline assessment, they endorsed one or more items from the Drinking Problem Index (DPI; Finney, Moos, & Brennan, 1991; see also Allen & Wilson, 2003), a 17-item survey designed for use with older adults to assess negative consequences of alcohol consumption, including physical problems (e.g., craving for alcohol), psychological difficulties (e.g., feeling confused after drinking), and social conflicts (e.g., family members' complaints about respondents' use of alcohol). The DPI has high internal consistency ($\alpha=.94$), good construct validity (Brennan & Moos, 1990; Finney et al., 1991; Kopera-Frye, Wiscott, & Sterns, 1999), and acceptable sensitivity and specificity for identification of late-middle-aged and older adults who have problems with alcohol (Bamberger, Sonnenstuhl, & Vashdi, 2006).

Individuals were classified as *using substances for tension reduction* (0=no; 1=yes) if at baseline they endorsed use of one or more of the following as a way of reducing tension: smoking, alcohol consumption, tranquilizer use. A separate set of items, drawn from the Coping Responses Inventory (CRI; Moos, 1993; 2002) assessed participants' use of avoidance coping to manage stressors. The CRI asks participants to identify their most important stressor of the past 12 months, then to complete 48 items that describe specific strategies they used to manage that stressor. Coping response items are rated on 4-point scales ranging from "not at all" to "fairly often". CRI avoidance coping indices include *cognitive avoidance*, which assesses cognitive attempts to avoid thinking realistically about a problem; *resigned acceptance*, which assesses cognitive attempts to react to the problem by accepting it; *alternative rewards*, which measures behavioral attempts to get involved in substitute activities and create new sources of satisfaction; and *emotional discharge*, which measures behavioral attempts to reduce tension by discharging negative feelings. CRI subscales also assess four approach coping strategies, which include *logical analysis*, *seeking guidance and support*, *positive reappraisal*, and *problem solving*. The eight CRI subscales have internal consistencies ranging from .61 to .74 and are moderately positively intercorrelated (average $r = .29$) (Moos, 1993; 2002). To assess *reliance on avoidance coping*, we divided participants' scores summed across the four avoidance coping subscales by their summed responses to the avoidance and approach coping subscales, yielding percentage of participants' overall coping efforts devoted to use of avoidance coping responses.

We used LISRES and HDL items to assess social influences on participants' drinking trajectories. We summed participants' number of *visits with family members and friends* in the past month, at baseline assessment, to capture the extent of participants' social interactions with friends and family. A 4-item *friends' drinking* measure was used to assess how many of the participants' friends approved of and engaged in social and heavier drinking.

Mediating variables—In post-hoc mediation analyses, two variables, both assessed at 4 years, were used to represent mediating variables: (a) a count of 27 acute (began in the last 12 months) *negative health events* (e.g., diabetes, heart problems, cancer), acute physical ailments (e.g., back problems, chest pain), and occurrence of hospitalization in the last 12 months, and (b) a count of 47 acute (occurred in the last 12 months) *non-health negative life events* (e.g., job loss, separation or divorce, loss of a friend) (LISRES; Moos & Moos, 1994; Moos, 2002).

Alcohol consumption indices—To calculate *number of drinks* consumed by participants, we used alcohol consumption items from the HDL (Moos et al., 1992), which provided information about participants' typical frequency and quantity of consumption of three types of alcoholic beverages (wine, beer, and hard liquor) in the past month. Separately for each beverage type, we multiplied participants' weekly frequency of consuming that beverage type (ranging from “less than once a week” to “every day”) by the quantity (number of drinks) of that beverage, when it was consumed. We summed across these three frequency-by-quantity products to calculate the total *number of drinks per day* consumed by participants. There were almost no missing data for this variable (0%, 3%, 3%, and <1%, respectively, for the 4 assessment points).

Summary of Analyses

Group-level 10-year patterns of alcohol consumption—To summarize overall group-level change in alcohol consumption from late-middle- to early-old age, we used SPSS 17.0 (SPSS, Inc) to calculate the means, standard deviations, and cross-wave correlations among drinks per day at each of the 4 assessment points. To show the extent of variation from overall, average drinking patterns, we present means, standard deviations, and cross-wave correlations of drinks per day separately among women and among men, and separately for those who were and were not drinking in excess of recommended alcohol consumption guidelines at baseline.

Next, we used multilevel regression analyses (SPSS 17.0 MIXED) to estimate participants' intra-individual, 10-year drinking trajectories; within- and inter-individual variation in these trajectories; and the contribution of participants' baseline demographic, health-related, coping, and social characteristics to prediction of their level of, and rate of change in, alcohol consumption over the next 10 years.

Multilevel regression analysis is one of a family of approaches to modeling growth or change in the characteristics or behaviors of individuals assessed at multiple time points (Muthen, 2004; Singer & Willet, 2003). In this analytic approach, individuals' outcome variables, measured at multiple time points, are used to generate regression trajectories or curves best describing intra-individual change in the multiple observations. These intra-individual growth curves or trajectories are considered “nested within” individuals. The parameters characteristic of the trajectories (i.e., *intercepts*, representing initial level of the outcome variable, and *slopes*, representing rate of change in the outcome variable over multiple measurement occasions), and the intra- and inter-individual variation in these parameters, are the foci of multilevel regression analysis, rather than the original values of the repeated measures (Duncan & Duncan, 2004; Singer & Willet, 2003).

Our first step in applying this method was to follow recommended guidelines for developing longitudinal growth models (Singer & Willet; 2003) by estimating the unconditional mean and unconditional growth (linear and quadratic) models of alcohol consumption over the 10-year period, in the group overall. In these and all subsequent multilevel regression models, growth trajectories were centered on years since age 55, the youngest chronological age of sample members, and the method of full maximum likelihood was used to estimate model parameters.

We next used SPSS 17.0 MIXED to determine baseline predictors of level and change in participants' drinking trajectories as they aged from late-middle to early-old age. Specifically, we generated a set of multilevel regressions to estimate the fixed effects of individual baseline demographic, health-related, coping, and social variables, unadjusted for other variables, on the intercepts and slopes of participants' 10-year drinking trajectories. These regressions also generated variance components indicative of within- and between-person variation in the trajectories, as well two indices of goodness-of-fit, -2LogLikelihood (-2LL) and the Bayesian Information Criterion (BIC).

We next conducted a set of multilevel regression analyses to determine whether there were statistically significant interactions between gender and each of the health-related, coping, and social variables, on level and rate of change in participants' 10-year drinking trajectories. Finally, we simultaneously entered into an overall predictive model all of the baseline variables and interaction terms that had had, as individual predictors, a statistically significant ($p < .01$) effect on the intercepts and/or slopes of participants' 10-year drinking trajectories. After trimming from the model variables that made little or no unique contribution ($p > .01$) to explaining trajectory characteristics, we generated a final, summary model of the most influential (all statistically significant to $p < .01$) baseline predictors of the level and direction of participants' 10-year drinking trajectories.

Post-hoc tests of prospective mediation effects—To follow up on the results of the multilevel regression analyses, we conducted exploratory post-hoc prospective mediation analyses. Our aim in doing so was to determine whether mediation processes among key baseline, 4-year, and 10-year variables might help explain unexpected results of the multilevel regression analyses.

We wanted our post-hoc mediation models to mirror our multilevel conceptualization of the data, i.e., to show that baseline predictors generate rates of change in the mediators, which in turn influenced rates of change in late-life drinking behaviors; a multilevel 2→1→1 mediation analysis (Krull & MacKinnon, 2001). However, we had too few data points (Singer & Willet, 2003) with which to estimate rates of change over two distinct, temporally non-overlapping intervals occurring within the overall, 10-year study. Instead, therefore, our prospective mediation analyses comprised tests of a set of simple mediation models in which the independent, mediating, and outcome variables were represented by values assessed at baseline, 4 years, and 10 years, respectively. The main virtue of this approach is that it retains clear temporal precedence among the variables in the mediation models, a key requirement for strong inference about mediating processes (MacKinnon, Fairchild, & Fritz, 2007a).

To construct these mediational models, we first conducted multiple regression analyses to estimate the unstandardized beta coefficients, and associated standard errors, for each of the two individual paths (a =independent variable to mediating variable; b =mediating variable to outcome variable) that comprised the overall mediating pathway in our models. The specific regression estimates were: (a) the mediating variable (e.g., negative health events at 4 years) regressed on the independent variable (e.g., baseline use of avoidance coping), and (b) the outcome variable (i.e., alcohol consumption at 10 years) regressed on the mediating variable, controlling for the independent variable.

To obtain the estimated mediating effect, we calculated the product of the coefficients representing paths *a* and *b*; to determine the statistical significance ($p < .01$) of this effect, we estimated its Asymmetric Confidence Interval (ACI), using PRODCLIN software (MacKinnon, Fritz, Williams, & Lockwood, 2007b). The ACI approach to constructing confidence intervals assumes that the product of coefficients used to estimate the mediating effect is asymmetrically rather than normally distributed; it yields confidence limits that have more statistical power and are more accurate than are normal-theory confidence limits (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; MacKinnon, Lockwood, & Williams, 2004).

Results

Group-level 10-year Patterns of Alcohol Consumption

Table 1 summarizes group-level change in drinks per day over the 10-year interval. In the group overall, participants as a group drank relatively lightly at baseline, an average of about 1.4 drinks per day, and continued to so over each of the 3 subsequent assessments. Men drank more, and were more variable within waves in number of drinks per day, than were women. Cross-wave means and correlations show that drinking levels were relatively stable over time in the group overall, although somewhat more stable for women (r s range from .61-.76) than for men (r s range from .31 to .54).

Table 1 also shows that, as expected, individuals exceeding alcohol consumption guidelines for older adults were at baseline consuming more drinks per day ($M=3.8$) than were individuals not exceeding the guidelines ($M=0.60$). There was a much clearer pattern of group-level decline among the “guideline exceeders” (from $M=3.8$ at baseline to $M=2.6$ at 10 years) than among the “below guideline” drinkers (from $M=0.60$ at baseline to $M=1.0$ at 10 years).

As indicated by cross-wave correlations, there was less stability in level of alcohol consumption among the “guideline exceeders” than among the lighter drinkers. Again, among individuals drinking both above and at or below recommended guidelines, women's drinking was more stable than was men's: r s ranging from .20-.54 among the heavier drinking women, compared with -.07 to .34 among the heavier drinking men; r s ranging from .57-.73 among the lighter drinking women, compared with .30-.49 among the lighter drinking men.

Unconditional Growth Models of Drinking Trajectories

Consistent with Table 1, the results of the unconditional mean model for the overall group (Table 2) show that, in the overall group, participants were on average consuming a little over 1 drink per day. The estimated linear growth model fit the data better than did the unconditional mean model (improvement in BIC model fit index=463.5, chi-square ($df=2$, $p < .01$)).

Individual growth plots were examined, and an unconditional quadratic growth model estimated, to determine whether a non-linear function might better describe the shape of participants' 10-year drinking trajectories. The difference between BIC fit indices for the unconditional linear growth and the unconditional quadratic models was 14.8 (chi-square ($df=4$, $p < .01$)) in favor of the linear over the quadratic fit. Therefore, the quadratic form was excluded from further consideration as the best description of 10-year drinking trajectories in this sample.

The unconditional linear growth model estimated for the overall sample was consistent with group-level data in Table 1 in showing an average, within-individual trajectory slope of 0, i.e., an average flat trajectory. There was however, statistically significant variability in both the intercepts and slopes of participants' drinking trajectories (3.25 and .01, respectively), as well as in residual within-individual variance (1.24). This indicated sufficient variability in the

trajectories to be explained by covariates, specifically, the baseline demographic, health-related, coping, and social variables we hypothesized would predict change over time in participants' 10-year drinking trajectories.

Individual Predictors of Levels and Change Over Time in Drinks Per Day

As shown in Table 2, age at baseline did not influence initial level or change with increased age in daily alcohol consumption. However, as expected from group-level patterns shown in Table 1, gender was associated with number of drinks per day initially consumed, with men consuming more drinks per day than did women. However, gender did not significantly predict rate of change in alcohol consumption over the 10-year interval.

Regarding ethnicity, non-white participants drank somewhat fewer drinks per day than did white participants, but non-white status had no statistically significant effect on the rate of change in alcohol consumption. Being unmarried and having lower income at baseline each contributed to faster decline in drinks per day consumed.

With respect to health and health-related behaviors, participants' baseline number of negative health events did not contribute to the level of or rate of change in their drinking as they aged from late-middle to early old age. However, participants who smoked at baseline initially consumed more drinks per day than did non-smokers, and experienced a steeper decline in drinks per day. Consistent with results in Table 1, individuals exceeding recommended drinking guidelines at baseline were consuming more drinks per day than were those not exceeding guidelines. Drinking beyond guidelines at baseline also foreshadowed a steeper rate of decline in number of drinks per day over the next 10 years. Similarly, having one or more active drinking problems at baseline was associated with substantially more initial alcohol consumption but a significant decline in number of drinks per day over the next 10 years.

Several coping and social variables assessed at baseline also predicted change in drinking over the follow-up interval, but not always in the expected direction. Baseline self-reported use of substances to reduce tension was associated with a higher initial level of alcohol consumption and with a faster rate of decline in alcohol use over the next several years. Similarly, heavier reliance on avoidance coping strategies at baseline was associated with a statistically significant steeper decline over time in number of drinks per day.

Baseline level of socializing, as indicated by more frequent visits with family members and friends, was predictive of a lower initial level of, and slower rate of change in, alcohol consumption over the 10-year interval. Having more friends who approved of heavy drinking was associated with somewhat higher initial levels of alcohol consumption and with a faster rate of decline in number of drinks per day.

There were two statistically significant interactions between gender and the health-related, coping, and social predictors on 10-year drinking parameters. Independent of gender and smoking, being a male smoker added significantly to prediction of heavier initial drinking. Furthermore, independent of gender and problem drinker status, being a male problem drinker predicted more initial alcohol consumption. Neither of these interaction terms predicted rate of change in alcohol consumption over the 10-year interval.

Independent Baseline Predictors of Level and Change in Alcohol Consumption

After all individual baseline variables that had had a statistically significant effect on trajectory parameters were entered into a simultaneous predictive model, then trimmed to retain only those variables that continued to exert a statistically significant ($p < .01$) effect on the parameters, a total of 5 baseline predictors accounted for higher initial levels of alcohol consumption: being male, problem drinker status, being a male and a problem drinker,

consuming 2 or more drinks per day, and having more friends who approved of heavier drinking. Independent of all other variables in the model, these predictors added significantly ($p < .01$) .18, 2.4, .32, .32, and .06, respectively, to average level of initial alcohol consumption. Two baseline variables, lower income and drinking in excess of guidelines, predicted more decline over time in participants' drinking levels significantly (-.004 and -.08, respectively, $p < .01$). The -2LL statistic for this model was 11,050 compared with 18,238 for the unconditional linear growth model. This summary model explained an 86% increment in the variance of intercepts, and an 80% increment in the variance of slopes, over the variance in intercepts and slopes in the unconditional linear growth model. However, the variance components of this summary model all remain statistically significant, indicating that it still excludes relevant predictors for explaining late-middle-aged and older adults' 10-year drinking trajectories.

Post-Hoc Tests of Mediation Effect

Several of the individually predictive variables, including baseline use of substances to reduce tension, and heavier reliance on avoidance coping, had effects opposite to those expected; that is, they were associated with faster, rather than decelerated, decline in drinking levels over the 10-year interval. To further explore reasons for this, we conducted post-hoc prospective mediation analyses to see whether these downward effects might result from a mediating process whereby risky health behavior at baseline, such as smoking, drinking beyond alcohol consumption guidelines, problem drinking, and use of substances and avoidance coping to manage stressors, might foreshadow more health problems and non-health crisis events 4 years later, which would, in turn, predict lower alcohol consumption at 10 years. To test these mediation models, we first conducted 9 separate prospective mediation analyses in which each of the significant individual predictors of rate of change in drinking level was a baseline predictor, the mediating variable was number of negative health events at 4 years, and the outcome variable was number of drinks per day at 10 years. We next conducted these same prospective mediation analyses using number of negative non-health events at 4 years as the mediating variable.

The first set of mediation analyses yielded evidence of a statistically significant ($p < .01$) mediation process initiated by 4 baseline variables: smoking, problem drinker status, use of substances to reduce tension, and use of avoidance coping to manage stressors. Smoking at baseline indirectly reduced alcohol consumption at 10 years via elevated levels of acute health events at 4 years (mediated effect = -.022; ACI = (-.0578, -.0012)). Similarly, individuals who had drinking problems at baseline experienced more acute health problems at 4 years, which was associated subsequently with lower alcohol consumption at 10 years (mediated effect = -.024; ACI = (-.0681, -.0021)). The same mediation effect was initiated by baseline use of substances to reduce tension (mediated effect = -.027; ACI = (-.0644, -.0036)) and by heavier reliance on avoidance coping strategies to manage stressors (mediated effect = -.114; ACI = (-.2720, -.0152)).

None of the second set of mediation analyses, in which non-health negative life events at 4 years was the mediating variable, yielded statistically significant mediation effects. This was because, although some of the baseline predictors, such as use of substances to reduce tension, and more use of avoidance coping, were significantly associated with heightened non-health negative events at 4 years, there was no statistically significant association between the non-health negative events and participants' 10-year alcohol consumption.

Discussion

Group-level 10-year Patterns of Alcohol Consumption

In the sample overall, average alcohol consumption at baseline was relatively light, a little over 1 drink per day, and remained so over the next 10 years. As indicated by cross-wave correlations, and an average zero rate of change estimated in unconditional linear growth modeling, there was no strong decline in these individuals' alcohol consumption as they aged from late-middle to early-old age.

However, as illustrated by the group-level descriptive statistics and the variance components of the unconditional linear growth model, there also was considerable deviation from a consistently-light, 10-year drinking pattern in this sample. Specifically, within- and cross-wave variability in alcohol consumption was more characteristic of older men than of older women, and of individuals who were drinking beyond recommended alcohol consumption guidelines at baseline than of those who were not. This heterogeneity introduced by gender and drinking level has also been found in the longitudinal drinking patterns of younger adults (Johnstone et al., 1996; Kerr et al., 2002); it underscores the importance of considering sample composition in interpreting and designing studies of later-life drinking patterns. For example, samples comprised exclusively of men, or mainly of heavier drinkers, such as treated samples, may show sharper rates of decline in and more variability of drinking patterns than samples that include women and lighter drinkers. This drinking pattern variability also suggests the need to address whether older drinkers are in fact a monolithic group with respect to longitudinal drinking patterns or might better be described as comprising multiple classes of individuals sharing distinctive longitudinal drinking patterns. Future research, using such analytic approaches as latent growth mixture modeling (Muthen, 2004), should address this issue.

Predictors of 10-Year Drinking Trajectories

There was sufficient variability in participants' drinking trajectories to enable identification of key baseline predictors of level and change in alcohol consumption over the 10-year interval subsequent to baseline assessment. The single strongest predictor of 10-year drinking trajectories was baseline alcohol consumption in excess of recommended drinking guidelines for older adults (AGS, 2003; NIAAA, 1995). This is consistent with previous research (Kerr et al. 2004; Moore et al. 2005) showing that heavier initial drinking foreshadows steeper decline in subsequent alcohol use in both mixed-age and older samples. However, it is not clear why this occurs. Statistical regression to the mean may help account for some of the decline (Kerr et al. 2004), but we suspected it might occur as well because beyond-guideline drinkers consume alcohol in ways that generate stressors (e.g., new serious health problems; conflicts with other people) that then put pressure on them to reduce their drinking. However, results of post-hoc mediation analyses provided no support for this idea. Another future research goal is to identify relevant components of mediating processes that might help explain why beyond-guideline drinking at late-middle-age predicts subsequent downward trends in drinking during later life.

Our findings replicate those of previous studies in showing that several demographic factors predict later-life drinking trajectories. Specifically, being male and non-white were each associated with higher initial levels of alcohol consumption; being unmarried, and having lower income, were predictive of a somewhat steeper decline in alcohol consumption over the follow-up interval (Moore et al. 2005). Although our mediation model provided a plausible explanation for this decline (i.e., having fewer social and financial resources contributes to accumulation of unresolved health and interpersonal stressors, which in turn compel reduction of alcohol consumption), we found no empirical support for it. It is possible that these demographic characteristics predict decline because they are closely associated with declining levels of

socializing and exposure to drinking opportunities during later life, but further research is needed to determine whether this is the case.

It is noteworthy that, although we used years since age 55 to center participants' drinking trajectories, and examined age at baseline as a predictor of level and rate of change with age in alcohol consumption, neither of these approaches yielded evidence that chronological age *per se* is tied closely to late-life drinking patterns. It may be that the age range in this study was too narrow, or covered "too young" an age group, for effects of age on alcohol consumption to be manifest in this study. However, it is also possible that because alcohol consumption is a health and life-style behavior, and not linked intrinsically to developmental or aging-related processes or states (e.g., perception, cognition, functional physical capacity) it should not be expected to map closely onto advancing chronological age *per se*. As previous researchers have suggested (Douglass et al., 1988; Stall, 1987), and as demonstrated here, a myriad of other factors, including coping and social context, may be more important than chronological age *per se* for predicting the level and course of alcohol consumption during later life.

Contrary to expectation, poorer baseline health did not foreshadow decline in subsequent alcohol consumption. Again, perhaps the relative youth of this sample at baseline made it unlikely that they would be experiencing enough, or severe enough, negative health events to prompt them to begin to change their patterns of drinking behavior at that point. However, the data imply that as individuals age further, health problems may become increasingly important for shaping their drinking trajectories. Results of post-hoc mediation analyses suggest an indirect effect, wherein engaging in risky health behaviors, such as smoking and problem-drinking, at late-middle-age foreshadows elevated acute negative health events at 4 years; these in turn predict lower levels of alcohol consumption at 10 years. Possibly, in much older age groups, poorer health is related directly to cessation or reduction of alcohol use, but in "younger" samples such as this one, engaging in risky health behavior merely sets the stage for the serious health problems that will eventually motivate older adults to change their drinking behavior.

With respect to psychological factors, individuals who used substances to reduce tension, and those who engaged in more avoidance coping to manage stressors, declined more steeply in use of alcohol than did other sample members. This was an unexpected finding because past research has shown that more use of substances to reduce tension, including "drinking to cope", is associated with slower decline in alcohol consumption during early adulthood (Trim et al., 2008), and that heavier reliance on avoidance coping is generally associated with poorer drinking outcomes (Brennan & Moos, 1996; Cooper et al., 1988; Cooper, et al., 1992; Timko et al., 2005). Post-hoc mediation analyses provided support for the idea that managing tension and stressors with avoidance coping strategies at baseline resulted in reduced alcohol consumption via new health problems. This mediation effect is consistent with previous studies showing the prospective "stressor generation" potential of avoidance coping (Holahan, Moos, Holahan, Brennan, & Schutte, 2005). Heavy reliance on avoidance coping may be another "health risk factor" at late-middle-age insofar as it involves ignoring or ineffectively managing early signs of illness that eventually culminate in health crises requiring reduced alcohol consumption.

We showed also that social variables are a salient influence on older adults' 10-year drinking trajectories. As predicted, individuals who had more frequent interactions with family members and friends were more likely to experience a slower rate of decline in alcohol consumption as they aged from late-middle to early old age. However, those who had more friends who approved of drinking experienced a somewhat faster decline in drinking. More social interaction with friends and family may be associated with more opportunities to consume alcohol; exposure to such high-opportunity settings may exert a decelerating effect on late-life

alcohol consumption. Participants who reported having more friends who approve of heavy drinking were probably themselves heavier drinkers, and thus were more likely to reduce their alcohol. Together, these findings highlight the fact that the salient influence of family and friends on drinking patterns so characteristic of adolescents and young adults (e.g., Poelen et al., 2007; Trim et al., 2008) continues to be important well into later life. They indicate, in fact, that this social influence outweighs such factors as age *per se*, gender, and health, in prediction of late-life drinking trajectories.

Limitations and Future Directions

This study has several limitations. Our sample is not representative of late- middle-aged and older adults with respect to alcohol consumption. Because this study was designed to focus on late-life drinking behavior, lifetime non-drinkers were excluded from the sample at study recruitment. Hence, the findings reported here apply only to older adults who entered late-middle-age having consumed alcohol at least at some point earlier in their lives. Furthermore, the baseline sample was comprised almost entirely of white adults; thus, present findings await replication in other samples to determine their generalizability to other ethnic groups.

Mortality attrition analyses showed that there were no baseline differences in the drinking behavior of non-surviving and surviving participants. However, at baseline, individuals who would not survive to the 10-year follow-up had somewhat fewer social and financial resources than did individuals who would survive to the follow-up. This may have affected the 10-year drinking patterns described here in unknown ways.

A further limitation is the unequally-sized and widely-spaced assessment intervals in this study. Our assumption of evenly-distributed, linear rates of change in drinking between assessment points may have been incorrect. Also, because of long intervals between assessments, this study may not have captured information about important fluctuations in participants' drinking behavior between assessments.

The conclusions presented here are based mainly on analyses of multiple univariate relationships between participants' baseline characteristics and their 10-year drinking trajectories. Future research should consider how relations among these factors may alter the course of late-life drinking trajectories.

Finally, our conclusions rely heavily on inferences drawn from the results of post-hoc mediation analyses. We caution that, although we used a prospective design to test mediation effects, there remain alternative competing hypotheses to explain the statistically significant mediation effects reported here (e.g., unmeasured effects may have influenced both the mediating and outcome variables). To inspire more confidence in results reported here, our mediation models should be replicated in other samples and in studies that exert more rigorous statistical and experimental control over factors that provide alternative explanations for the findings (Cole & Maxwell, 2003; MacKinnon et al. 2007a).

Notwithstanding its limitations, this study provides new information about individuals' patterns of alcohol consumption as they age from late-middle to early-old age, and about key baseline variables that prospectively account for variation in these individuals' 10-year drinking trajectories. Further research is needed to more completely characterize older adults' longitudinal patterns of alcohol consumption and to identify the antecedents and consequences of these patterns. This information should prove useful to health care providers and public health policy-makers who want to know whether there are distinguishable salutary and harmful patterns of alcohol consumption in later life, and which older adults, under what circumstances, are more likely to deviate from healthier drinking patterns.

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Table 1

Group-level descriptive statistics: Drinks per day

	Overall		Women		Men		Correlations			
	M (SD)		M (SD)		M (SD)		DPDB	DPD1	DPD4	DPD10
Group Overall										
Drinks per Day - Baseline	1.4 (1.9)		1.0 (1.2)		1.6 (2.2)		--	.54**	.47**	.31**
Drinks per Day - 1-YR	1.3 (1.8)		1.0 (1.0)		1.6 (2.0)		.76**	--	.52**	.38**
Drinks per Day - 4-YR	1.5 (1.5)		1.2 (1.1)		1.8 (1.7)		.71**	.75**	--	.53**
Drinks per Day - 10-YR	1.4 (1.5)		1.0 (1.0)		1.6 (1.8)		.68**	.61**	.68**	--
2+Drinks per Day										
Drinks per Day - Baseline	3.8 (2.5)		3.3 (1.2)		4.0 (2.9)		--	.24**	.11	-.07
Drinks per Day - 1-YR	3.1 (2.3)		2.7 (1.8)		3.3 (2.5)		.47**	--	.34**	.16**
Drinks per Day - 4-YR	2.9 (1.7)		2.4 (1.1)		3.1 (1.8)		.48**	.54**	--	.32**
Drinks per Day - 10-YR	2.6 (1.8)		2.2 (1.1)		2.7 (2.0)		.43**	.20	.46**	--
<2 Drinks per Day										
Drinks per Day - Baseline	0.6 (0.6)		0.7 (0.6)		0.6 (0.6)		--	.44**	.47**	.40**
Drinks per Day - 1-YR	0.8 (1.1)		0.7 (1.2)		0.9 (1.2)		.73**	--	.31**	.30**
Drinks per Day - 4-YR	1.1 (1.1)		0.9 (0.8)		1.2 (1.2)		.59**	.70**	--	.49**
Drinks per Day - 10-YR	1.0 (1.2)		0.8 (0.8)		1.2 (1.4)		.59**	.63**	.57**	--

Notes. Overall group N=1291; 762 men, 529 women

2+ Drinks per Day N=310; 221 men, 89 women

<2 Drinks per Day N=981; 541 men, 440 women

DPDB=drinks per day at baseline

DPD1=drinks per day at 1 year

DPD4=drinks per day at 4 years

DPD10=drinks per day at 10 years

**
p < .01

Table 2

Individual Predictors of 10-Year Drinking Trajectories

	Fixed Effects			Variance Components			Goodness of Fit	
	Initial Status	Rate of Change	Resid	Var I	Var S	Cov	-2LL	BIC
IntI	βI	IntS	βS					
<i>Unconditional Growth Models</i>								
Mean	1.41**	---	---	1.39**	1.43**	---	18238.4	18624.0
Linear growth	1.41**	---	---	1.24**	3.25**	.01**	18109.3	18160.5
<i>Baseline Predictors</i>								
<i>Demographic</i>								
Age	.96	.14	.00	1.24**	3.25**	.01**	18104.2	18172.5
Gender (male)	1.13	-.01	.00	1.24**	3.18**	.007**	18045.9	18114.2
Ethnicity (white)	1.40	-.16**	.00	1.24**	3.25**	.007**	18103.8	18172.0
Marital status (married)	1.43	.05	.00	1.24**	3.24**	.007**	18090.6	18158.8
Income (higher)	1.54	-.03	-.03	1.18**	3.36**	.001**	17321.6	17389.6
<i>Health</i>								
Negative health events	1.45**	-.03	.00	1.24**	3.24**	.007**	18099.8	18168.0
Smoker	1.96**	.71**	-.03**	1.24**	3.12**	.006**	18085.8	18154.1
2+ Drinks per day	3.96**	3.34**	-.08**	1.27**	.94**	.003**	17148.6	17216.9
Problem drinker	2.63**	1.93**	-.03**	1.25**	2.28**	.006**	17730.5	17798.8
<i>Psychological</i>								
Substances for tension reduction	2.06**	1.02**	-.02**	1.24**	2.98**	.006**	18031.5	18105.7
Avoidance coping	1.07**	.99	.03*	1.21**	3.20**	.007**	17661.9	17730.1
<i>Social</i>								
Visits friends and relatives	1.77**	-.09*	-.02*	1.24**	3.23**	.007**	18103.4	18171.7
Friends' approval of drinking	.21	.24**	.02	1.28*	3.09**	.007**	16067.0	16134.3
<i>Gender Interactions</i>								
Gender by smoker	2.29	.68*	-.03**	1.24**	3.04**	.006**	18019.1	18121.5
Gender by problem drinker	2.88**	.84**	-.03**	1.25**	2.22**	.005**	17669.9	17772.3

Notes: **Int_i** = estimated average initial status; **β₁** = increment in initial status; individuals with predictive factor; **Resid** = within-person variation of observed from hypothesized change trajectories **Var I** = between-person variability in initial status; **Var S**=between-person variability in rate of change; **Cov** = residual covariance between intercepts and slopes; **-2LL** = log-likelihood deviance statistic; **BIC** = Bayesian Information Criterion;

* = p< .05

** = p< .01. All models estimated with full maximum likelihood estimation.