Full length article

Alcohol consumption in very old age and its association with survival: A matter of health and physical function

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ABSTRACT

Background: Alcohol consumption in very old age is increasing; yet, little is known about the personal and health-related characteristics associated with different levels of alcohol consumption and the association between alcohol consumption and survival among the oldest old.
Methods: Nationally representative data from the Swedish Panel Study of Living Conditions of the Oldest Old (SWEOLD, ages 76–101; $n = 863$) collected in 2010/2011 were used. Mortality was analyzed until 2014. Alcohol consumption was measured with questions about frequency and amount. Drinks per month were calculated and categorized as abstainer, light-to-moderate drinker (0.5–30 drinks/month) and heavy drinker (>30 drinks/month). Multinomial logistic regressions and Laplace regressions were performed.
Results: Compared to light-to-moderate drinkers, abstainers had lower levels of education and more functional health problems, while heavy drinkers were more often men, had higher levels of education, and no serious health or functional problems. In models adjusted only for age and sex, abstainers died earlier than drinkers. Among light-to-moderate drinkers, each additional drink/month was associated with longer survival, while among heavy drinkers, each additional drink/month was associated with shorter survival. However, after adjusting for personal and health-related factors, estimates were lower and no longer statistically significant.
Conclusions: The association between alcohol consumption and survival in very old age seems to have an inverse J-shape; abstention and heavy use is associated with shorter survival compared to light-to-moderate drinking. To a large extent, differences in survival are due to differences in baseline health and physical function.

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1. Introduction

Recent studies have shown that alcohol consumption is prevalent among the oldest old aged 80 years and above in Europe; between 30 and 60% in these ages drink alcohol (Hoeck and Van Hal, 2013; Immonen et al., 2011; Kelfve et al., 2014). In more recent cohorts of older adults there are fewer abstainers and more weekly drinkers (Ahacic et al., 2012; Kelfve et al., 2014; Waern et al., 2014). Yet, the circumstances surrounding alcohol consumption and alcohol's association with health/survival in this expanding segment of the population are largely unexplored. In this study, we will investigate personal and health-related characteristics associated with

different levels of alcohol consumption among the oldest old as well as the association between alcohol consumption and survival.

The body's tolerance for alcohol decreases with age and so the equivalent amount of alcohol leads to a higher blood alcohol concentration in older individuals compared to younger (Novier et al., 2015; Vestal et al., 1977). In older adults, alcohol consumption can potentially harm health through increasing the risk of falls and accidents, interactions with medications, and complications related to various diseases (Heuberger, 2009; Immonen et al., 2011). To a certain extent then, maintained health and function, as well as the absence of certain chronic diseases, are central for continued alcohol consumption in old age. Older individuals that stop drinking often do so because of health problems (Moos et al., 2005). Impaired health and mobility can also hamper the ability to access alcohol.

Previous studies have suggested a U- or J-shaped association between the amount of alcohol consumption and mortality in other segments of the population, including middle aged and older

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people (Bellavia et al., 2014; Halme et al., 2010; Rehm and Sempos, 1995; White et al., 2002). A handful studies have investigated the association between alcohol consumption and survival among older adults and found varying results. In a study of 45–83-year-olds, 0.5 drinks/day for women and 1.5 drinks/day for men was associated with the longest survival time, while both lower and higher consumption was related to shorter survival (Bellavia et al., 2014). In a study of 65–79-year-olds, mortality risk was lowest in weekly consumers drinking 1–2 drinks/day (women) and 4 drinks/day (men) compared to non-weekly drinkers. Alcohol-free days during the week were related to an additional decrease in mortality risk among the weekly drinkers (McCaul et al., 2010). Two studies of individuals aged 65 years and older suggested higher mortality risks among abstainers and those consuming more than 2 drinks/day compared to those drinking less than 2 drinks/day (Halme et al., 2010; Lang et al., 2007). However, the association between alcohol consumption and survival is still largely unexplored among those aged 80 years and older. A study of nonagenarians (90+) did not find the J- or U-shaped association between alcohol and mortality, but results did indicate a higher mortality risk among abstainers compared to drinkers (Nybo et al., 2003). However, the health benefits of moderate alcohol consumption – at any age – is not uncontroversial (for a recent editorial, see Chikritzhs et al., 2015), and alcohol abstinence, particularly in old age, is often due to underlying health problems that constrain alcohol consumption.

Considering the increasing rates of drinking among the oldest old (80+), more information about the characteristics of abstainers and drinkers, as well as how alcohol consumption is related to survival in this age group is warranted. With nationally representative data of the oldest old aged 76–101, the present study investigated (1) personal and health-related characteristics in three alcohol consumption groups, to see if and how abstainers, moderate and heavy drinkers differ; and (2) the association between alcohol consumption and survival, to see if the inversely J- or U-shaped association can be found also among the oldest old.

2. Material and methods

2.1. Data

Data were from the Swedish Panel Study of Living Conditions of the Oldest Old (SWEOLD), a nationally representative survey of individuals aged 76 years and older conducted since 1992 in Sweden (Lennartsson et al., 2014). SWEOLD is based on probability samples and includes institutionalized individuals. The survey covers a wide range of topics, such as health and function, living conditions and health behaviors. The current study used data from the fourth wave of SWEOLD, conducted in 2010–2011. Men aged 85–99 and women aged 90–99 were oversampled to allow for more detailed analyses. In addition, questions about alcohol consumption were more detailed, including both frequency and amount of drinking.

More than half of the participants (64%) were interviewed face-to-face. Indirect/proxy interviews (20.1%) with a spouse, relative, or healthcare personnel were performed when the older person was too frail or cognitively impaired to participate. Telephone interviews (9.7%) were primarily used for the proxy interviews, but were also used when respondents refused a visit. A questionnaire was sent by mail to those who refused an interview (6.2%). The response-rate of the whole survey was 86.2%. The full sample consisted of 931 individuals. Due to item non-response related to items concerning alcohol consumption (n = 14), education (n = 24) and health/function (n = 30), the analytical sample consisted of 863 persons. The study has been approved by the Ethical Review Board in Stockholm, dnr 2010/403-31/4.

2.2. Variables

Frequency and amount of *alcohol consumption* were measured in the survey. Frequency was measured with the question "How often do you drink alcoholic beverages such as wine, beer, or spirits?" Response alternatives were Never, 1–6 times/year, 1 time/month, 2–3 times/month, 1–2 days/week, 3–4 days/week, and 5–7 days/week. Amount was measured with the question "How many drinks do you drink on a typical day when you consume alcohol?" Response alternatives were 1–2, 3–4, 5–6, 7–9, and >9 drinks.

The frequency and amount questions were combined to estimate the number of drinks consumed per month. For simplicity, yearly consumption was calculated first. The midpoint of the frequency answer (Never = 0, 1–6 times/year = 3.5, 1 time/month = 12, 2–3 times/month = 30, 1–2 days/week = 78, 3–4 days/week = 183, 5–7 days/week = 313) was multiplied by the midpoint of the volume answer (1–2 = 1.5, 3–4 = 3.5, 5–6 = 5.5, 7–9 = 8, >9 = 10). For instance, a person who reported consumption 2–3 times/month, with a consumption of 1–2 drinks on a typical day, will get an estimation of 45 drinks/year (30 days × 1.5 drinks). Yearly alcohol consumption was then divided by 12 to get monthly consumption.

Respondents were coded into three categories based on their drinking behavior. Those who did not drink alcohol were categorized as abstainers. Those who did drink alcohol were categorized as light-to-moderate drinkers and heavy drinkers. Light-to-moderate drinkers were persons drinking up to 30 drinks/month, regardless of consumption pattern. Heavy drinkers were those drinking more than 30 drinks/month.

Most countries do not have specific guidelines regarding alcohol consumption for older people. However, based on current research and guidelines it has been suggested that one drink per day, or up to seven drinks per week, can be considered safe for persons over the age of 65 (Crome et al., 2012; National Institute on Aging, 2012). The cutoffs used in this study focus on monthly consumption and consider more than 30 drinks/month as heavy drinking.

Survival was calculated in days from the baseline interview until death or censoring on June 30, 2014 and served as the outcome in the analyses. Mortality information was obtained from the Swedish National Cause of Death Registry.

Level of education was measured by highest attained level of education. The categories were primary, secondary (e.g., vocational education or upper secondary school), and university.

Living situation was categorized as living together with someone, living alone or living in an institution (nursing home, retirement home, or group living arrangement with service around the clock). In Sweden, older people move to an institution only after a needs assessment in the municipality where they reside. In this study, living situation was considered an indicator of how accessible alcohol was for the older person as well as an indicator of health.

Three other indicators of health were also included in the study, one measuring function and the ability to move around without problems, and two measuring chronic diseases that can interact negatively with alcohol consumption. *High blood pressure* and *diabetes* were measured with the question "Have you had any of the following diseases or symptoms during the last 12 months?" This was followed by a list of health problems, including high blood pressure and diabetes. For each item, the given answers were No, Yes, mild problems, and Yes, severe problems. *Mobility problems* included two items, difficulties walking 100 meters fairly briskly and walking up and down stairs. The index ranged 0–2, indicating the number of mobility problems.

Interview type was coded as direct, indirect or mixed interviews. Although this variable concerns the data collection, it is also an indirect measure of health as very frail or cognitively impaired persons can usually not be interviewed in person (Kelfve et al., 2013).

2.3. Statistical analyses

Chi square tests and multinomial logistic regressions were used to analyze differences between the three categories of alcohol consumers.

Laplace regression was used to analyze survival (Bottai and Orsini, 2013; Orsini et al., 2012). The Laplace regression assumes that the error term follows a type of asymmetric Laplace distribution. Like hazard regressions, the Laplace regression allows censoring even when censoring depends on covariates. Hazard regressions and Laplace regressions are equally appropriate for data like this, including censoring (Bottai and Zhang, 2010). A major difference between Laplace regressions and hazard regressions is that the Laplace regression estimates the results in terms of days of survival while the hazard regression estimates relative differences in mortality risk. We chose Laplace regressions mainly because results are easier to interpret. The outcome is the number of days until death has occurred for specific percentiles – in this study, the number of days until the first 10% and 30% of the sample have died. We chose these percentiles because those in the 10th percentile are the first to die and those in the 30th constitute the majority that die (in all, 36% of the sample died during follow-up).

We expected the association between alcohol consumption and survival to be non-linear. In order to determine what level of alcohol consumption that corresponded to the longest survival and to better represent the association in case of an inverse J- or U-shaped distribution, piecewise linear representation variables (splines) were used. Linear splines are a series of concatenated variables separated by pre-defined cut-points (knots). Within each interval, alcohol consumption (measured as drinks/month) is explored as a continuous variable. In this way, linearity is only assumed within each interval within the scale while at the same time retaining some of the statistical power of the original continuous variable. The first knot was chosen to distinguish between the abstainers and those that consumed any alcohol. The lowest amount of alcohol consumption recorded was 0.5 drinks/month and therefore we set the lower knot at 0.5. Within the group that consumed alcohol, knots at 10, 25, 30 and 38 drinks/month were explored. Among these, a knot at 30 drinks/month best captured the shape of the survival time. The results are presented as (1) differences in survival between abstainers and persons drinking any alcohol, (2) average difference in survival among persons drinking 0.5–30 drinks/month