10-year Trajectories of Alcohol Consumption in Older Adult New Zealanders

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Abstract

Objective: Older adults are often treated as a homogenous drinking group, but research suggests they engage with alcohol in various ways, ranging from abstention to heavy drinking. The study aimed to 1) identify subgroups of older adults based on changes in frequency and quantity of alcohol use over ten years, and 2) examine co-occurring changes in mental and physical health. **Methods:** Data were collected between 2006 and 2016 biennially from 2632 New Zealanders (55-70 years old at baseline). Latent class growth analysis was performed to identify trajectories of alcohol use. Co-occurring changes in physical and mental health were examined using latent growth curve analysis. **Results:** Five drinking profiles emerged: 1) infrequent, low quantity consumers; 2) highly frequent, low quantity consumers; 3) moderately frequent, high quantity consumers; 4) moderately frequent, low quantity consumers; and 5) highly frequent, high quantity consumers. Drinking trajectories demonstrated no change or slight declines in frequency and quantity over time. Frequent and moderately frequent, high quantity drinking was more prevalent among men, younger participants, and active smokers. Moderately frequent, heavy drinkers were in very poor health. Frequent and moderately frequent, low quantity drinking was associated with better health and economic wellbeing. Infrequent, low quantity consumers were more likely to be women and in poor health. **Discussion:** The five drinking profiles indicate that older adults engage with alcohol in diverse ways. Two of these patterns indicated potentially hazardous use, which highlights the need for screening and intervention in this age group.

Keywords: AUDIT-C; chronic conditions; latent class growth analysis; SF-12; smoking

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In New Zealand, high quantity alcohol consumption is common among adults aged 55 and over. Population-based surveys estimate that around 20% of adults aged 55 to 64 years old and 16% of those aged 65 to 74 years old might be drinking hazardously, i.e., at levels that can put the individual at risk of harm (Ministry of Health, 2019). These figures are concerning given that physiological sensitivity to alcohol increases with age, and older adults are more likely to have alcohol-related comorbidities that make lower levels of consumption harmful for their health, and to take medication for chronic conditions that can interact with alcohol (Moore et al., 2006). Understanding if, how and why drinking patterns change over time, especially as people transition into older adulthood, can provide important insights for policy and clinical practice.

Patterns of Alcohol Use in Older Adulthood

Longitudinal research has shed some light on changes in alcohol use across older adulthood. Using data from the Rancho Bernardo Study of Healthy Ageing, McEvoy et al. (2013) modelled changes in alcohol use (frequency and quantity) over 24 years with Californians aged 50-89 years old at first assessment. Alcohol consumption remained stable in those aged 50-74 at baseline, with many exceeding recommended drinking guidelines by the United States National Institute on Alcohol Abuse and Alcoholism (i.e., 1 drink/day for women and for men aged 65 and over; and 2 drinks/day for men under 65). However, alcohol intake declined over time among those aged 75 or older at first assessment. Brennan et al. (2011) also estimated change in alcohol consumption over 20 years in Americans aged 55-65 years. Consumption was relatively stable through to 70 years of age, after which both men and women reported a gradual decline in alcohol use, with the decline being greater in women.

Although these studies provide important longitudinal information about general trends in alcohol intake in older adults, their analyses assume that older adults are a homogenous drinking group. Understanding general trends of alcohol use is informative, but it can also mask important differences within the population. For example, the stable consumption documented in previous studies might be a result of distinct subgroups of older adults with contrasting drinking patterns (e.g., declining use in one group and increasing consumption in the other) that cancel each other out when averaged across the sample.

Recent studies have investigated changes in drinking patterns as people transitioned into older adulthood. Knott, Bell and Britton (2018) used data from the Whitehall II Study and identified seven groups of drinkers when first interviewed in mid-life. These included a non-drinking group, a low risk group consuming up to seven drinks weekly, and further graduated drinking groups up to the riskiest who were drinking more than 32 drinks per week. Drinking frequency and quantity were stable across three decades for light to moderate drinking groups, but those in the heavy drinking group reduced their drinking over time. However, the probability of giving up alcohol was unlikely for all groups. The authors proposed health decline as the mechanism driving reductions in heavy drinking, but in the absence of concurrent measurement of health across time, it is unclear whether this is correct.

Halonen et al. (2017) provide further insights into drinking trajectories and sociodemographic characteristics of older drinkers. They investigated 12-year drinking trajectories of Finnish public-sector employees in the transition from work to retirement. Using government guidelines of risky drinking (i.e., weekly consumption of 16+ units for women and 24+ units for men), they identified three drinking groups: 1) consistent low-risk drinking (81% of the sample); 2) low-risk drinking but with a spike in risky drinking immediately after retirement (12% of the sample); and 3) consistent high-risk drinking with a gradual reduction post-retirement (7%). Consistent high-risk drinkers were more likely to be

men, with high socioeconomic status and education level, current or former smokers, experiencing mental health issues and reporting job strain, working in a city, and undertaking limited physical activity. Compared with consistent high-risk drinkers, those in the group with a temporary increase in retirement-related drinking had lower socioeconomic status and education levels, were more likely to be former smokers and less likely to work in a city.

These findings are consistent with results reported by Moore et al. (2005) and Platt, Sloan and Costanzo (2010) with Americans aged 50 years and older. High or increasing alcohol use was more likely to occur in individuals who were male, of European ethnicity, single, of higher socioeconomic status and education, and current smokers. Similar findings were reported in the New Zealand context by McKenzie, Carter and Filoche (2014) who identified a range of drinking behaviours from abstention, to light drinking through to risky drinking (defined as more than 8 drinks per drinking occasion for men and more than 6 drinks per drinking occasion for women) in adults aged 60 years or older. Alcohol use was higher among men and those with better health outcomes, and higher socioeconomic status. Furthermore, they found that the rate and level of drinking were stable across eight years. Overall, findings suggest that distinct subgroups of older drinkers exist, and they can be differentiated based on sociodemographic factors.

Alcohol Use and Health in Older Adulthood

From a clinical and public health perspective, it is of interest to elucidate the relationship between drinking patterns and other health behaviours as well as their associations with health outcomes. Frequent and high quantity consumption has been consistently linked to poor mental (Choi & DiNitto, 2011; Merrick et al., 2007) and physical health (Immonen, Valvanne, & Pitkala, 2011), as well as increased mortality (Holahan, Brennan, Schutte, Holahan, & Moos, 2014). Frequent and heavy drinking also co-occurs with other risky health behaviours, such as smoking (Immonen et al., 2011; Kim, De La Rosa,

Rice, & Delva, 2007; Room, 2014). In contrast, low risk or moderate drinking has been associated with better self-reported health (Merrick et al., 2007) and better physical health outcomes over time (León-Muñoz et al., 2017; Lin, Guerrueri, & Moore, 2011; Ortolá et al. 2016). However, the positive relationship between moderate drinking and health has been disputed, and research suggests that this association might be better explained by a confounding effect of socioeconomic status (Towers, Philipp, Dulin, & Allen, 2018a). Further, it has been suggested that changes in alcohol consumption reflect changes in health status as people age (Holdsworth et al., 2016). For example, the 'sick-quitter hypothesis' posits that those with declining health are more likely to reduce their drinking over time (Sarich et al., 2019). Overall, previous research highlights that the relationship between different health outcomes and alcohol use is not a linear function. The way older adults engage with alcohol has significant implications for their heath, but at the same time health deterioration can also impact alcohol use practices.

Present Study

In the present study, we investigated the relationship between alcohol use trajectories (based on frequency and quantity) and health during early older adulthood (55-70 years of age at baseline). First, we explored longitudinal drinking profiles and their sociodemographic characteristics within a sample of older New Zealanders, using latent class growth analysis. Based on previous findings from Europe (Halonen et al., 2017; Knott et al., 2018) and North America (Moore et al., 2005; Platt et al., 2010), we expected to identify drinking profiles reflecting a) infrequent and low quantity consumption, b) frequent and low quantity consumption, c) infrequent and high quantity consumption, and d) frequent and high quantity consumption. Considering the exploratory nature of the analytic technique, other configurations could also emerge from the data. With respect to change over time, we expected to see a small, gradual decline in consumption indicators over time. However, we

did not rule out the possibility of some groups displaying stable or increasing trajectories. Next, we examined co-occurring changes in mental and physical health as well as associations with chronic health conditions and smoking. We expected that drinking profiles reflecting high quantity consumption would be characterized by poorer mental and physical health, more alcohol-related chronic conditions and other risky health behaviours, such as smoking. In contrast, drinking profiles reflecting low quantity consumption were expected to be associated with better physical and mental health, less alcohol-related chronic conditions, and lower likelihood of smoking. Further, it was expected that reductions in alcohol consumption would reflect changes in mental and physical health over time.

Method

Design

We used data collected between 2006 and 2016 from the New Zealand Health, Work and Retirement Study. In 2006, a random population sample was drawn from the New Zealand Electoral Roll (*N* = 12494; aged 55-70 years). Persons of Māori descent (the indigenous people of New Zealand) were oversampled to ensure adequate representation. The final sample in 2006 included *n* = 6,662 participants (51% response rate). Of this sample, 46% (n = 3,065) agreed to participate in the longitudinal study. Participants were re-surveyed in postal surveys on a biennial basis. More details about the data collection can be found elsewhere (Towers, Stevenson, Breheny, & Allen, 2017). Individuals who entered the study in 2006 and had participated in at least two waves were included in the current analyses (*n* = 2632). The baseline demographic composition of the data was compared with the 2006 New Zealand census data of people aged 50 years or older (Statistics New Zealand, n.a.; Table 1). The data approximate the national distribution in terms of gender, marital status, and educational

background. Māori ($p < .001$), those younger than 65 years of age ($p = .001$) and employed ($p < .001$) were overrepresented.[1]

Measures

Demographic variables. Age (measured in years), gender (male vs female), Māori descent (non-Māori vs Māori descent), marital status (not married nor in de facto relationship vs married or in de facto relationship), work status (working vs not working), educational qualification (measures on a 4-point scale ranging from no qualification to tertiary), and place of residence (urban vs rural) were included as covariates. Covariates were based on self-report; however, age, gender, and Māori descent were cross validated against participant information registered in the Electoral Roll (Allen, 2017).

Economic Living Standards Index. The short form version of the Economic Living Standards Index (ELSI) was used to measure financial and economic wellbeing (Jensen, Spittal, Crichton, Sathiyandra, & Krishnan, 2002). ELSI is a multi-dimensional measurement tool assessing restrictions on ownership of assets and social participation, economising behaviour, and self-reported satisfaction with standard of living. It was specifically designed to assess living standards in the New Zealand context. A total score can be derived by summing all items (range: 0 - 31) with higher scores indicating better financial and economic wellbeing.

Alcohol use. Frequency and quantity of alcohol use were assessed with the Alcohol Use Disorders Identification Test - Consumption (AUDIT-C; Bush et al., 1998). The AUDIT-C is equivalent to the 10-item AUDIT in identifying hazardous drinkers across a range of populations (Aalto, Alho, Halme, & Seppa, 2009), is recommended for use in primary health care by the US National Institute on Alcohol Abuse and Alcoholism (U.S. Department of

[1] Data and study materials are available upon request. The analyses for this study were not preregistered.

Health Human Services, 2005), and has been used in New Zealand population surveys (Ministry of Health, 2018). The AUDIT-C frequency and quantity items are as follows: "How often do you have a drink containing alcohol?" (never, monthly or less, 2-4 times per month, 2-3 times per week, 4 or more times per week); and "How many drinks containing alcohol do you have on a typical day when drinking?" (1 or 2, 3 or 4, 5 or 6, 7 to 9, 10 or more).[2]

Smoking. Participants were asked to indicate if they considered themselves to be a regular smoker. Non-regular smokers were asked to indicate if they had every been a regular smoker. Based on these two questions, we differentiated between current smokers, past smokers, and life-time non-smokers.

Chronic conditions. To assess the number of alcohol-related chronic health conditions, participants had to indicate whether a doctor, nurse, or other health care professional had told them that they had any of the following health problems: cancer, diabetes, blood pressure, heart trouble, and stroke.

Mental and physical health. The 12-item Short Form Health Survey (SF-12, Ware, Keller, & Kosinski, 1998) was administered to assess functional health and wellbeing in eight domains (i.e., physical functioning, role functioning, bodily pain, general health, vitality, social functioning, and mental health). Scores on each dimension were combined into a composite summary of mental and physical health with higher scores indicating better mental and physical health. Scores have been normed to the New Zealand general population (M = 50, SD = 10) by Frieling, Davis and Chiang (2013).

Data Analytic Plan

[2] There were 49 participants, who reported that they had never consumed alcohol, and they accounted for less than 2% of the sample. Because of their small number, we were not able to treat abstainers as a separate group and to run comparative analyses.

Latent growth curve analysis was performed to model change in drinking frequency and quantity over ten years (Duncan & Duncan, 2009). Three models were compared: intercept only, linear change, and quadratic change. To assess model fit, the following indices were used: comparative fit index (CFI) higher than .95, root mean square error of approximation lower than .06, and standardised root mean square residual lower than .08 indicating good fit to the data (Hu & Bentler, 1999; Tabachnick & Fidell, 2007). To compare model fit, an increase of .01 or higher in the CFI was considered to indicate improved model fit (Cheung & Rensvold, 2002).

Latent class growth analysis was employed on responses to drinking frequency and quantity to identify subgroups of individuals who demonstrated similar change trajectories over time in alcohol consumption (Muthén & Shedden, 1999). We compared solutions with 2 to 6 profiles. The following fit indices were considered: significant Lo-Mendell-Rubin Likelihood Ratio Test, lower Bayesian and adjusted Bayesian Information Criterion, higher entropy and posterior membership probabilities, and profiles representing at least 5% of the data (Nylund, Asparoutiov, & Muthen, 2007).

Next, data were subjected to a multinomial logistic regression to determine which baseline sociodemographic variables predicted profile membership. Mental and physical health trajectories across profiles were estimated using latent growth curve analysis. Differences in chronic conditions and smoking behaviour were analysed with chi-square statistics.

Results

Change in Frequency and Quantity of Drinking

Changes in frequency and quantity could be explained with a linear model and a negative slope, suggesting that both were decreasing over time (Supplementary Table 1).

Latent Class Growth Analysis

A 5-profile solution provided the best fit to the data (Table 2). Intercept and slope estimates are reported in Supplementary Table 2. Profile 1 (34.8%, LF↓LQ↓)[3] displayed low initial levels of frequency and quantity, both of which decreased over time (Figure 1a). Profile 2 (30.1%, HF↕LQ↕) was characterised by high and stable frequency and low and stable quantity (Figure 1b). Profile 3 (4.7%, MF↓HQ↓) displayed moderate and decreasing frequency in combination with high and declining quantity (Figure 1c). Profile 4 (22.6%, MF↓LQ↓) reported moderate frequency and low quantity, both declining over time (Figure 1d). Finally, Profile 5 (7.9%, HF↕HQ↓) indicated high and stable frequency along with high and declining quantity (Figure 1e).

Socio-demographic Predictors of Profile Membership

Table 3 displays the demographic characteristics of Profiles. Characteristics of Profiles 2 through 5 were compared with characteristics of Profile 1 (reference group: LF↓LQ↓). Marital status, work status and place of residence were not significant predictors of profile membership. Membership in Profile 2 (HF↕LQ↕) was predicted by higher economic living standards (O.R. = 1.13; 95%CI: 1.11-1.15), higher levels of education (O.R. = 1.29; 95%CI: 1.16-1.44), and male gender (O.R. = 0.42; 95%CI: 0.34-0.53). Membership in Profile 3 (MF↓HQ↓) was predicted by younger age (O.R. = 0.92; 95%CI: 0.88-0.97), lower levels of education (O.R. = 0.63; 95%CI: 0.49-0.81), and male gender (O.R. = 0.20; 95%CI = 0.12-0.30). Membership in Profile 4 (MF↓LQ↓) was predicted by higher economic living standards (O.R. = 1.06; 95%CI: 1.04-1.08), higher levels of education (O.R. = 1.14; 95%CI: 1.02-1.27), and male gender (O.R. = 0.60; 95%CI: 0.47-0.76). Membership in Profile 5 (HF↕HQ↓) was predicted by younger age (O.R. = 0.92; 95%CI: 089-0.96), higher economic

[3] The following abbreviations are used to indicate quantity and frequency: LQ, MQ and HQ = low, moderate and high quantity, respectively; LF, MF and HF = low, moderate and high frequency, respectively. The following abbreviations are used for direction of change: ↓ = decreasing; ↕ = stable.

living standards (O.R. = 1.08; 95%CI: 1.05-1.11), lower levels of education (O.R. = 0.83; 95%CI: 0.70-0.99), and male gender (O.R. = 0.07; 95%CI: 0.04-0.10).

Health and Smoking

Chronic health conditions

There were significant differences across Profiles in reporting three or more alcohol-related chronic conditions across ten years; $\chi^2(4) = 70.83$, $p < .001$, Cramer's $V = .164$. In Profile 3 (MF↓HQ↓), 25% reported three or more alcohol-related chronic conditions. The corresponding values in Profiles 1 (LF↓LQ↓), 2 (HF↕LQ↕), 4 (MF↓LQ↓), and 5 (HF↕HQ↓) were 19.1%, 7.2%, 11.3%, and 10.1%, respectively.

Smoking status

There were significant differences across Profiles in smoking status: $\chi^2(4) = 109.27$, $p < .001$, Cramer's $V = .204$. In Profile 3 (MF↓HQ↓), 90.2% were current or ex-smokers. The corresponding proportions in Profiles 1 (LF↓LQ↓), 2 (HF↕LQ↕), 4 (MF↓LQ↓), and 5 (HF↕HQ↓) were 54.9%, 57.6%, 47.8%, and 76.3%, respectively.

Physical and mental health

There were significant differences across Profiles in baseline physical and mental health; $F(4,2376) = 37.44$, $p < .001$, $\mu^2 = 0.06$ and $F(4,2376) = 23.03$, $p < .001$, $\mu^2 = 0.04$, respectively. Profile 1 (LF↓LQ↓) and Profile 3 (MF↓HQ↓) had significantly lower physical health scores than the other three profiles. In contrast, Profile 2 (HF↕LQ↕) reported significantly better physical health than Profiles 1 (LF↓LQ↓), 3 (MF↓HQ↓), and 4 (MF↓LQ↓) (post hoc analyses and significance tests are reported in Supplementary Table 3). Physical health significantly declined over time in Profiles 1 (LF↓LQ↓), 2 (HF↕LQ↕), 4 (MF↓LQ↓), and 5 (HF↕HQ↓), and remained stable in Profile 3 (MF↓HQ↓) (Table 4).

Profile 3 (MF↓HQ↓) had significantly poorer mental health at baseline than the other four profiles. In contrast, Profile 2 (HF↕LQ↕) showed significantly better mental health than

the rest of the profiles. Differences between Profile 5 (HF↕HQ↓) and Profile 1 (LF↓LQ↓) and between Profile 5 (HF↕HQ↓) and Profile 4 (MF↓LQ↓) in mental health at baseline were non-significant (post hoc analyses and significance tests are reported in Supplementary Table 4). Mental health trajectories were stable for Profiles 1 (LF↓LQ↓), 2 (HF↕LQ↕), 3 (MF↓HQ↓), and 5 (HF↕HQ↓), indicating no significant change in mental health over ten years (Table 4). For Profile 4 (MF↓LQ↓), results revealed a slight increase in mental health from 2008 to 2016.

Discussion

We explored changes in alcohol consumption patterns (frequency and quantity) over ten years of early older adulthood and examined sociodemographic and health characteristics of older drinkers in New Zealand. In this sample of older New Zealanders, five drinking profiles were identified that reflect long-term changes in drinking behaviour (as opposed to daily or weekly variation in consumption). In these profiles, frequency and quantity of alcohol consumption either remained stable (↕) or slightly declined (↓) over ten years. The largest group (Profile 1; LF↓LQ↓) comprised individuals who reported low frequency of drinking, low levels of consumption on days when they drink (both of which declined over time), and who had poor and declining physical health and numerous alcohol-related chronic conditions. The profile was likely to represent a combination of occasional, light drinkers and sick quitters, i.e., people who decided to reduce their drinking because of their poor health (Marti, Choi, DiNitto, & Choi, 2015; Sarich et al., 2019). More than half of the participants were frequent (Profile 2; HF↕LQ↕) or moderately frequent (Profile 4; MF↓LQ↓) drinkers who consumed low amounts on typical drinking days. Both groups included older adults who were healthy and relatively wealthy. This supports previous findings linking better socioeconomic status to frequent but light drinking (Halonen et al., 2017; McKenzie et al., 2014).

Analyses suggest that both moderately frequent (Profile 3; MF↓HQ↓) and frequent (Profile 5; HF↕HQ↓) heavy drinking exist among older New Zealanders. Members of these groups consumed large quantities of alcohol on each drinking occasion and were active smokers. Furthermore, moderately frequent heavy drinkers (Profile 3; MF↓HQ↓) reported very poor physical health and numerous alcohol-related chronic conditions, such as cancer. This finding indicates that, at least for some older adults, heavy drinking is associated with high burden of ill health. Members of this group are likely to take medications for their health conditions, many of which may interact with alcohol. Alcohol interactions can exaggerate side effects (e.g., nausea), intensify sedation, alter the effectiveness of medications, and increase the risk of complications (e.g., heart problems) and falls (Moore, Whiteman, & Ward, 2007). Considering consequences for further health deterioration and associated health care costs, it is important that these people receive intervention. Due to their health conditions, they are likely to visit health care services regularly; therefore, with appropriate screening, health care professionals should be able to identify these individuals (Towers et al., 2018b).

Similar to previous findings reported with the same age group (Brennan et al., 2011; McEvoy et al., 2013), drinking trajectories were relatively stable over ten years. Although slope estimates indicated statistically significant decline in frequency and quantity in four of the profiles, decrements were so small that they did not reflect meaningful change from a screening perspective. In line with findings reported by Knott et al. (2018), the largest decline in quantity consumed was observed in the moderately frequent heavy drinking group (Profile 3; MF↓HQ↓), a reduction from ‘7 to 9 drinks’ to ‘5 to 6 drinks’ per drinking occasion over ten years. While alcohol use had decreased, the final level of consumption reported was still considered as heavy drinking. This suggests that a small number of people progress through older adulthood with concerning rates of heavy drinking that may remain undetected.

A main contributing factor to older adults' decision to reduce drinking is health concerns (Borok et al., 2013; Britton & Bell, 2015; Khan, Wilkinson, & Keeling, 2006). Our longitudinal analysis of health across drinking profiles provides some insights into co-occurring changes in alcohol use and health status. Physical health generally declined over time. The one exception was Profile 3(MF↓HQ↓). Although members of this profile reported the greatest number of chronic health conditions and the poorest physical health at baseline, their health did not deteriorate further over the observation period. It is, however, unclear whether their poor health prompted them to start reducing their consumption level (Sarich et al., 2019) or the change in alcohol use contributed to slower health decline (León-Muñoz et al., 2017; Lin, Guerrueri, & Moore, 2011). The relationship could also be reciprocal. Additionally, it is important to note that physical decline across drinking groups could have been confounded by age-related changes in health. Mental health was relatively stable in the five drinking profiles. This is in line with previous findings reported by Ortolá et al. (2016), suggesting that self-reported mental health is less affected by alcohol use patterns than physical health.

There were large differences at baseline in mental and physical health between groups, suggesting that disparities reported in health most likely accumulated over the life-course (Adler & Stewart, 2010). This highlights the importance of early intervention and health promotion. Increasing people's understanding of the effects of alcohol on the ageing body could likewise provide a useful focus for health promotion programmes.

Limitations and Strengths

Both alcohol use and health outcomes were assessed with self-report, and social desirability effects might come into play. Self-reported health and chronic conditions should be cross validated against national health records in future research. Similarly, the measure of smoking was based on respondents' perspectives on what constitutes a regular smoker. We

investigated co-occurring changes in alcohol use and self-perceived health, but it is important to acknowledge that alcohol use may change in response to other life events as well, such as retirement (Midanik, Soghikian, Ransom, & Telkawa, 1995; Zins et al., 2011) or bereavement (Stahl & Schulz, 2014). While it was outside of the scope of the present study, stressful life events could be investigated in future research as potential factors moderating alcohol use trajectories.

The sample at baseline had a limited age range; therefore, our analyses did not adequately represent changes in alcohol consumption among the very old. Previous research indicates that alcohol consumption declines more rapidly after the age of 75 (McEvoy et al., 2013). Differences between age groups can also reflect cohort effects. Finally, analyses included individuals who participated in at least two data collection waves, including the baseline survey. As in all longitudinal cohort studies, selective attrition is a methodological problem. Those with poorer health and fewer resources are more likely to drop out over the course of the study, thus the sample in this analysis is not representative of the New Zealand older adult population. While people of Māori descent and those in active employment were overrepresented at baseline, neither ethnicity nor employment were significantly associated with alcohol use profiles once economic living standards were accounted for. This suggests that differences in alcohol use patterns are driven mostly by socioeconomic disparities between these groups (Towers et al., 2018a).

Our study also has a number of strengths. We used ten years of data from a large sample of older New Zealanders to model changes in both frequency and quantity of alcohol use. Previous research examined changes in alcohol use by combining quantity and frequency into an overall indicator of hazardous or heavy drinking (Frisher et al., 2015). Our study provides a more nuanced picture of longitudinal drinking patterns by highlighting that changes in quantity and frequency can occur independently. This approach allowed us to

emphasise the heterogeneity of older drinkers and to isolate groups of older adults who are at risk of alcohol-related harm. Further, the extensive longitudinal data enabled the examination of baseline differences and co-occurring changes in health as well as the assessment of socio-demographic correlates of drinking profiles. This provided insights into the characteristics of older adults who are likely to engage in hazardous drinking, which has implications for screening in primary health care (Towers et al., 2018b).

From a policy perspective, there is merit in understanding overall trends in alcohol consumption indicators to identify whether there is a general decline or incline in use over time as a response to particular policies. Further, cross-national comparative studies would help us understand to what extent these general trends are influenced by national alcohol policies or social-cultural norms around drinking. However, from a clinical and intervention perspective, there is a lot to gain from moving beyond averaged trends to exploring the diversity of drinking behaviours and their correlates to identify vulnerable or at-risk populations.

Conclusion

Distinct drinking profiles were present among older New Zealanders and they could be differentiated based on key sociodemographic and health-related correlates. Frequency and quantity showed small changes over a decade, which suggests that dominant drinking habits are likely to develop early and consolidate over the lifespan. A life-course perspective would provide further insights into those critical early- and mid-life events that might lead to hazardous drinking patterns in the older population. Future research should focus on examining individual motivations and the broader social contexts associated with alcohol consumption in older age.

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Table 1. *Characteristics of the New Zealand Health, Work and Retirement (NZHWR) baseline sample compared with the New Zealand population.*

	NZHWR longitudinal sample (2006)	NZ population aged 50+ (2006)
Demographics		
N	2,632	1,161,519
aged 65+	26.6%	42.7%
Female	53.4%	52.7%
Māori	50.7%	6.8%
Employment status		
Working	66.3%	48.8 %
Retired	21.7%	47.2%
Other	12.0%	4.0%
Marital Status		
Married/partnered	72.5%	69.8%
Divorced/separated	15.1%	13.6%
Widow/widower	8.2%	13.1%
Single/never married	4.5%	4.5%
Education		
No qualification	33.2%	32.4%
High School	23.5%	33.5%
Post-High School/Trade	31.4%	23.8%
Tertiary	11.9%	10.3%

Table 2. *Fit indices for the latent class growth analysis*

N of profiles	LMR-LRT	BIC	aBIC	Entropy	Posterior Probabilities
2 profiles	10135.28***	56890	56823	.936	.981-.984
3 profiles	4204.60***	52618	52535	.945	.954-.980
4 profiles	2267.35***	50332	50234	.916	.919-.967
5 profiles	1653.67*	48676	48561	.925	.924-.970
6 profiles	1226.94	47457	47327	.924	.913-.970

Note. *$p < .05$; ***$p < .001$; LMR-LRT: Lo-Mendell-Rubin likelihood ratio test; BIC: Bayesian Information Criterion; aBIC: sample-size adjusted BIC

Table 3. *Sociodemographic and health characteristics of drinking profiles*

	Profile 1 (LF↓LQ↓)	Profile 2 (HF↕LQ↕)	Profile 3 (MF↓HQ↓)	Profile 4 (MF↓LQ↓)	Profile 5 (HF↕HQ↓)
% of the overall sample	34.8%	30.1%	4.7%	22.6%	7.9%
Age: *M (SD)*	61.35 (4.58)	61.22 (4.57)	60.31 (4.42)	60.94 (4.50)	60.17 (4.22)
Gender					
Female	70.1%	45.8%	36.3%	55.2%	13.5%
Male	29.9%	54.2%	63.7%	44.8%	86.5%
Māori descent					
Non-Māori	37.5%	66.4%	12.9%	53%	47.3%
Māori	62.5%	33.6%	87.1%	47%	52.7%
Educational qualification					
No qualification	41.7%	21.0%	63.8%	28.2%	39.8%
Secondary school	22.4%	24.9%	14.7%	25.8%	21.9%
Post-secondary/trade	27.2%	36.7%	19.0%	33.8%	29.4%
Tertiary	8.7%	17.3%	2.6%	12.2%	9.0%
Marital status					
Married/de facto	64.7%	81.3%	54.8%	74.0%	76.4%
Not married/nor de facto	35.3%	18.7%	45.2%	26.0%	23.6%
Work status					
Retired	30.2%	23.8%	20.2%	20.1%	20.8%
Working	69.8%	76.2%	79.8%	79.9%	79.2%
Place of residence					
Rural	21.1%	19.9%	21.8%	18.8%	23.8%

Urban	78.9%	80.1%	78.2%	81.2%	76.2%
Economic living standard					
Hardship	26.2%	5.0%	38.1%	12.5%	13.0%
Comfortable	37.8%	27.7%	29.9%	38.1%	29.2%
Good	36.0%	67.3%	32.0%	49.4%	57.8%
Physical health (2006): *M* (*SD*)	44.3 (10.8)	49.7 (8.3)	42.6 (10.8)	47.9 (9.6)	48.1 (9.2)
Mental health (2006): *M* (*SD*)	47.2 (11.9)	51.5 (8.5)	44.0 (11.6)	49.7 (10.4)	49.1 (10.2)
Chronic conditions					
0	30.1%	44.5%	31.4%	37.5%	32.4%
1 or 2	50.8%	48.3%	43.6%	51.2%	57.5%
3+	19.1%	7.2%	25%	11.3%	10.1%
Smoking					
Current/ex-smoker	54.9%	57.6%	90.2%	47.8%	76.3%
Abstainer	45.1%	42.4%	9.8%	52.2%	23.7%

Note. LF: low frequency; MF: moderate frequency; HF: high frequency; LQ: low quantity; HQ: high quantity; ↓ = decreasing; ↕ = stable

Table 4. 10-year change in mental and physical health across drinking profiles: model fit, intercept and slope parameters

	Model fit						Physical health			Mental health		
	$\chi2$	df	$\chi2$/df	CFI	RMSEA (90%CI)	SRMR	intercept	linear	quadratic	intercept	linear	quadratic
Profile 1 (LF↓LQ↓)	95.9	51	1.9	.988	.031 (.021-.041)	.035	44.463***	-0.654***	0.023*	47.177***	0.095	0.004
Profile 2 (HF↕LQ↕)	127.2	51	2.5	.974	.043 (.034-.053)	.046	49.643***	-0.606***	0.024*	51.721***	0.055	-0.010
Profile 3 (MF↓HQ↓)	94.7	51	1.9	.909	.084 (.057-.109)	.119	42.559***	-0.368	0.013	44.279***	-0.386	0.047
Profile 4 (MF↓LQ↓)	130.7	51	2.6	.966	.051 (.041-.062)	.063	47.879***	-0.511***	0.020	49.582***	-0.166	0.030*
Profile 5 (HF↕HQ↓)	70.2	51	1.4	.976	.043 (.011-.066)	.079	47.880***	-0.666**	0.030	48.938***	-0.285	0.037

Note. *p<.05; **p<.01; *** p<.001; CFI: Comparative Fit Index; RMSEA: Root Mean Squared Error of Approximation; SRMR: Standardized Root Mean Residual; intercepts and slopes indicate unstandardized estimates; LF: low frequency; MF: moderate frequency; HF: high frequency; LQ: low quantity; HQ: high quantity; ↓ = decreasing; ↕ = stable

Figure legend:

Figure 1. Change trajectory in frequency and quantity of alcohol use across profiles: a) Profile 1 – low frequency and low quantity; b) Profile 2 – high frequency and low quantity; c) Profile 3 – moderate frequency and high quantity; d) Profile 4 – moderate frequency and low quantity; e) Profile 5 – high frequency and high quantity.