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Transitions Through Stages of Alcohol Use, Use Disorder and Remission: Findings from Te Rau Hinengaro, The New Zealand Mental Health Survey

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Abstract

Aims: To understand transitions from alcohol use to disorder, we examine timing of transitions between stages of alcohol use and associations between transitions and socio-demographic factors.

Short summary: Using nationally representative data, we found that the majority of alcohol use disorders develop by age 25. Increased alcohol use within a participant's cohort was associated with subsequent transition across all stages of alcohol use and disorder. Fifty percent of dependence cases had not remitted after 9 years.

Methods: A nationally representative sample with a 73% response rate included 12,992 participants aged 16 and older. The Composite International Diagnostic Interview (CIDI 3.0) was used to assess age at initial alcohol consumption, commencement of regular consumption, symptoms of alcohol abuse and dependence, and year-long remission. Alcohol consumption in an age- and gender-matched cohort, education, gender and age at commencement of use were investigated as covariates.

Results: Among all respondents, 94.6% used alcohol, 85.1% used alcohol regularly, 11.4 and 4.6% had developed alcohol abuse and dependence disorders, respectively. Of those with an abuse or dependence disorder, 79.9 and 67.2% had remitted, respectively. Increased alcohol use within a participant's cohort was associated with subsequent transition across all stages. The majority of disorders had developed by age 25. Considerable time was spent with disorder; 50% of dependence cases had not remitted after 9 years. Men were at greater risk of disorder and less likely to remit.

Conclusions: Interventions should target young people and cohort-specific consumption with resources also allocated to long-term treatment provision for alcohol dependency.

INTRODUCTION

For the minority of individuals who develop alcohol use disorders, alcohol results in substantive human and economic costs (Hsiang et al., 2015; Wilson and Blakely, 2015; Richardson et al., 2016). Understanding transitions from alcohol use to disorders is important for timing risk reduction strategies effectively and limiting the burden of alcohol-related harm. Although a number of studies have investigated associations between socio-demographic factors and alcohol use (Kalaydjian et al., 2009; Lee et al., 2009; Suliman et al., 2010; Wells et al., 2011), fewer studies have investigated factors that are associated with transitions between stages of first use, regular use, disorders and remission from disorders (Kalaydjian et al., 2009; Lee et al., 2009; Suliman et al., 2010). Moreover, within peer groups, social norms are known to influence use behaviour (Trucco et al., 2011; Sudhinaraset et al., 2016; Janssen et al., 2018) and to interact with broader structural factors such as advertising and accessibility of alcohol (Popova et al., 2009; Ayuka et al., 2014; Gruenewald et al., 2015) but the degree to which cohort-specific consumption is associated with use, and with transitions from use to disorder, has rarely been investigated.

To ensure the greatest policy relevance of research into the patterns and predictors of alcohol use country-specific data are necessary. Therefore, using data from Te Rau Hinengaro: The New Zealand Mental Health Survey (NZMHS), a large nationally representative study of New Zealand adults sampled across all cohorts in the population, the aims of the present study were to (a) examine the timing of transition across stages of alcohol use from first use to regular use, from use to disorders (abuse and dependence) and from disorders to remission and (b) to examine the correlates of transition across stages of alcohol use, in particular increases in cohort-specific consumption.

METHOD

Te Rau Hinengaro: The New Zealand Mental Health Survey (NZMHS) was a nationally representative sample of residents in permanent private dwellings, aged 16 years and over, using a stratified multistage clustered area probability sampling design including oversampling of Māori and Pacific people. Computer-assisted personal interviews were carried out face to face with 12,992 people from October 2003 to December 2004. A response rate of 73.3% was achieved. The NZMHS was designed to provide reliable estimates of mental, behavioural and substance use disorders in New Zealand. A detailed description of the survey method is provided elsewhere (Wells et al., 2006). All 14 health ethics committees throughout New Zealand approved the survey.

Measures

The World Mental Health Composite International Diagnostic Interview (WMH-CIDI 3.0; Kessler and Ustun, 2004) was used to assess if individuals met criteria for DSM-IV (American Psychiatric Association, 1994) alcohol abuse and alcohol dependence. In the version of the CIDI used in New Zealand, all participants were asked how old they were when they first drank an alcoholic beverage (use) and how old they were when they first started drinking at least 12 drinks in a year (regular use). All participants were asked three alcohol-related screening questions; if a participant responded positively to at least one screening

question, they were assessed for symptoms of abuse. A participant was only assessed for lifetime symptoms of dependence if they endorsed at least one symptom of abuse. As abuse and dependence are independent diagnoses (National Institute on Alcohol Abuse and Alcoholism, 2016), failing to assess dependence without abuse would lead to differential underestimation of dependence. To address this, cases of dependence without abuse were imputed. Further details relating to this imputation are described elsewhere (Lago et al., 2017).

Analysis

We investigated the age of onset and speed of transition between stages. These stages were use (first time drank a standard alcoholic drink), regular use (12+ drinks per year), DSM-IV abuse without prior dependence and DSM-IV dependence. We also assessed remission from dependence and from abuse without dependence, where remission was defined as the absence of all disorder-related symptoms for more than 12 months prior to the interview. Estimates were weighted to take into account the probability of selection; to adjust for intentional oversampling of Māori and Pacific peoples; to adjust for non-response and to post-stratify by age, gender and ethnicity to the 2001 census population.

All analyses were carried out using SAS Version 9.4. All estimates of lifetime prevalence percentages came from PROC SURVEYFREQ and discrete-time survival analyses came from PROC SURVEYLOSTIC, both of which account for the complex survey design. Life table (actuarial) estimates of the survival functions for age of onset and remission were produced using the SAS PROC LIFETEST procedure and are reported as weighted prevalence. Univariate and multivariate discrete-time survival models (Singer and Willett, 1993) with person-year as the unit of analysis were used to investigate associations of covariates with (a) commencement of use (onset); transitions from (b) use to regular use; (c) use/regular use to disorder (abuse/dependence) and (d) remission from disorder. Although the data collection was cross-sectional, with information relating to the year of onset of each alcohol stage, it was possible to map out individuals' lifetime progression involvement with alcohol. A person-year data set was created in which each year in the life of each respondent was treated as a separate observational record, with the year of onset for each outcome coded 1 and earlier years coded 0.

We defined a contextual variable to represent the level of alcohol use in an individual's birth and gender cohort to estimate the effect of changes in the social context of use as individuals aged, over time. An individual's birth cohort was defined as all survey respondents born within ± 5 years of the respondent, creating 11-year wide cohorts centred around each year of birth. Cohort widths were reduced for respondents who were aged 22 years or younger at the time of interview to as close as possible ensure symmetry around birth year while maintaining a minimum number of 50 in each gender-specific cohort. Cohorts were top-coded for those aged 65+. The resulting covariate was the estimated proportion of people (/10) in the individual's birth cohort who had used alcohol by the prior person-year. We assessed linearity between this variable and the log odds.

Other covariates were gender, time-varying education level (student, low, low/average, average/high or high), age of commencing use (except for modelling commencement of use) defined as early (≤ 13 years), mid (14–16 years) or late (17+ years) tertile, and person-year age groups (≤ 15 , 16–17, 18–20, 21–24, 25–29

and 30+ for all use/use disorder models and ≤ 18 , 19–20, 21–22, 23–24, 25–29, 30–39 and 40+ for remission from alcohol abuse or dependence). Remission models also adjusted for years with the disorder and speed of transition from use to disorder defined as early (abuse: 0–4 years; dependence: 0–5 years), mid (abuse: 5–9 years; dependence: 6–10 years) or late (abuse: 10+ years; dependence: 11+ years) tertile.

Table 1. Lifetime prevalence of alcohol use, DSM-IV alcohol use disorders and remission in the New Zealand Mental Health Survey

	N ^a	Weighted prevalence (%)	Standard error
Prevalence			
Use	12,992	94.6	0.3
Regular use	12,992	85.1	0.5
Abuse ^b	12,992	11.4	0.4
Abuse without dependence	12,992	7.4	0.3
Dependence	12,992	4.6	0.2
Remission from abuse	12,992	5.9	0.3
Remission from dependence	12,992	3.1	0.2
Conditional prevalence ^c			
Regular use among users	12,033	90.0	0.4
Abuse ^b among users	12,033	12.1	0.4
Dependence among users	12,033	4.9	0.2
Remission among abuse cases ^d	994	79.9	1.8
Remission among dependence cases	742	67.2	2.1

^aThe total unweighted number of respondents.

^bAmong those with or without lifetime alcohol dependence.

^cPrevalence given use history.

^dRemission from abuse excludes those persons with lifetime alcohol dependence.

RESULTS

Lifetime prevalence of use, use disorders and remission

Table 1 presents lifetime prevalence estimates. Alcohol use (94.6%) and regular use (85.1%) were common. Abuse with or without prior dependence (11.4%) was more common than dependence (4.6%). Conditional prevalence estimates are also presented among alcohol users for regular use (90.0%), abuse (12.1%) and dependence (4.8%). When taking use history into account, remission from abuse for those with lifetime abuse without dependence (79.9%) was higher than remission among dependence cases (67.2%).

Age of onset distributions

Cumulative age of onset curves for alcohol use, regular use, abuse, dependence, remission from abuse and remission from dependence, scaled to reach 100%, are displayed in Fig. 1. Most individuals (73rd percentile) had commenced alcohol use by age 17 and had commenced regular use by age 19. Onset of alcohol abuse and dependence typically had occurred by age 25 (72nd and 69th percentiles, respectively). The median age of remission was 35 years for both alcohol abuse and dependence.

Transitions across stages of involvement with alcohol use

Figure 2 shows the cumulative curves for transition time between stages among respondents with a diagnosis of the second stage. Among those who ever used alcohol regularly, over 50% made the transition by 3 years of first alcohol use and 71% did so by 5 years of first use. The median time to transition from use to either abuse or dependence was slower, at 7 and 8 years, respectively. There was also a considerable lag between the development of a disorder to

Fig. 1. Age of onset curves for alcohol stages in the New Zealand Mental Health Survey; includes respondents with and without the specific diagnosis, with estimates scaled up to reach 100%.

Fig. 2. Time between alcohol stages in the New Zealand Mental Health Survey; each curve includes only respondents with a diagnosis of the second stage.

when the majority of those who experienced remission, did experience remission. For example, 68% of remissions from abuse and 55% of remissions from dependence occurred by 10 years from development of the disorder.

Covariates of transitions

Bivariate and multivariate results from investigating associations of socio-demographic covariates with onset, use, regular use and disorder are presented in Tables 2 and 3. Bivariate analyses indicate male gender and increased cohort use were individually associated with increased risk of transitioning across all stages. Having 11, or fewer, years of education was associated with increased likelihood of transition from use and regular use to disorder compared to those with higher levels of education. Student status was not associated with transition between stages relative to a high education level except in the transition from use to dependence where reduced odds are observed. Age of commencing alcohol use, categorized according to survey-specific tertiles, was associated with stage transitions. Early age of onset (13 years or younger) was protective against transition from use to regular use but was associated with increased odds of transition from use and regular use to disorder.

Once adjusting for all other covariates, a similar pattern of associations was observed between male gender and transitions between stages as was observed in the bivariate analysis. Overall, the magnitude of the odds ratios were reduced from those observed in the bivariate results, although the odds for men remained 7% higher than women for commencing use, and 30 and 35% higher for the transition from use to abuse and from regular use to abuse, respectively. Cohort use remained consistently associated with transition across all stages, from initial use to regular use and from use to abuse and dependence. Specifically, a 10% increase of people in an individual's age-gender cohort having commenced use by the previous person-year was associated with 45% greater odds of

transitioning to use and 76% greater odds of transitioning from use to abuse.

Lower levels of education were associated in a graded fashion with increased likelihood of transition from use and regular use to disorder. For example, compared to those with high education levels, transitioning from use to abuse was associated with an odds ratio of 1.62 for those with high-average education, an odds ratio of 1.86 for those with a low-average education, and with an odds ratio of 2.48 for those with low education levels. This pattern was less pronounced in the transition to use and from use to regular use.

Associations between age of commencing alcohol use and transitions were similar to the bivariate results, with delayed commencement of use associated in a graded fashion with the development of a disorder. Specifically, relative to those who began alcohol use late (at age 17 or older), early commencement of alcohol (at 13 years or younger) was associated with increased odds of transitioning from use to problem drinking by 2- to 3-fold (OR 2.43 for abuse and 2.94 for dependence); this pattern was similar although attenuated for those who commenced use between 14 and 16 years of age (OR 1.49 for abuse and 1.66 for dependence). Commencing alcohol use early relative to late was associated with reduced odds of transitioning from use to regular use.

Remitting from abuse and dependence

Table 4 shows bivariate and multivariate results investigating predictors of remission from alcohol use disorders. An increase in the proportion of an individual's age-gender cohort using alcohol was associated with increased odds of transitioning to remission from abuse and dependence. Male gender was associated with reduced odds of transitioning to remission from abuse and disorder. Fewer years spent with disorder was associated with increased odds of remission from abuse, whereas more years spent with disorder was associated with increased odds of transitioning to remission from

Table 2. Bivariate associations of socio-demographic variables with transitions between lifetime alcohol use/use disorders in the New Zealand Mental Health Survey

Bivariate results	Commencing Use		Use to regular use		Use to abuse (without prior dependence)		Use to dependence		Regular use to abuse (without prior dependence) ^c		Regular use to dependence	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Male	1.42*	(1.37–1.49)	1.42*	(1.34–1.50)	2.16*	(1.88–2.47)	1.58*	(1.30–1.91)	1.81*	(1.58–2.06)	1.33*	(1.10–1.62)
X^2_1 [P]	276.15**	[<0.001]	145.34**	[<0.001]	122.78**	[<0.001]	21.46**	[<0.001]	76.69**	[<0.001]	8.67**	[0.003]
Proportion of age–gender cohort using alcohol ^a	1.45*	(1.43–1.48)	1.39*	(1.37–1.41)	1.89*	(1.77–2.03)	1.80*	(1.61–2.02)	1.55*	(1.44–1.68)	1.40*	(1.23–1.59)
X^2_1 [P]	1939.09**	[<0.001]	1394.54**	[<0.001]	340.83**	[<0.001]	100.80**	[<0.001]	125.39**	[<0.001]	26.81**	[<0.001]
Education ^b												
Student	0.92	(0.78–1.09)	0.97	(0.83–1.14)	0.92	(0.65–1.31)	0.66	(0.42–1.04)	1.13	(0.81–1.59)	0.85	(0.55–1.31)
Low	1.12	(0.95–1.32)	1.04	(0.89–1.21)	2.13*	(1.57–2.89)	2.37*	(1.63–3.43)	2.21*	(1.64–2.98)	2.40*	(1.66–3.46)
Low average	1	(0.81–1.12)	1.18*	(1.01–1.38)	1.77*	(1.31–2.40)	1.78*	(1.14–2.76)	1.79*	(1.33–2.42)	1.77*	(1.14–2.74)
High average	1.30*	(1.11–1.52)	1.23*	(1.05–1.45)	1.89*	(1.42–2.53)	1.98*	(1.31–2.98)	1.80*	(1.34–2.41)	1.87*	(1.25–2.81)
High	1	–	1	–	1	–	1	–	1	–	1	–
X^2_4 [P]	23.82**	[<0.001]	21.88**	[<0.001]	62.91**	[<0.001]	66.54**	[<0.001]	57.43**	[<0.001]	63.73**	[<0.001]
Age tertile of first use ^c												
Early	–		0.76*	(0.68–0.83)	2.97*	(2.37–3.73)	3.45*	(2.40–4.96)	2.13*	(1.68–2.69)	2.46*	(1.71–3.55)
Mid	–		1.10*	(1.01–1.20)	1.82*	(1.43–2.31)	1.97*	(1.34–2.88)	1.36*	(1.07–1.74)	1.49*	(1.02–2.18)
Late	–		1	–	1	–	1	–	1	–	1	–
X^2_2 [P]			107.48**	[<0.001]	120.42**	[<0.001]	60.16**	[<0.001]	69.70**	[<0.001]	36.90**	[<0.001]
Total (N ^d)		12,992		12,033		12,033		12,033		10,736		10,764

ORs, odds ratios; C, confidence interval. */** Significant at the 0.05 level, two-sided test.

All discrete-time logistic regression analyses are based on weighted person-year data controlling for person-year age groups of ≤15, 16–17, 18–20, 21–24, 25–29 and 30+.

^aPercentage (/10) of ±5-year sex-specific cohort who had used alcohol by the prior person-year. For example, for a female born in 1975, the cohort would be females born between 1970 and 1980. A context OR of 1.5 in commencement of use would be interpreted as an increase of 50% in the odds of commencing use with a 10% increase of people in the age–gender cohort having commenced use by the previous person-year.

^bLow education is defined as completed 11 or less years, low/med is completed 12 years, medium 13–15 years and high 16 or more years.

^cIndividuals' age of commencing alcohol use is split into tertiles among all those who ever used alcohol. The earliest (first) tertile is age ≤ 13, the 2nd tertile age 14–16 and the 3rd tertile aged 17+.

^dN = The total unweighted number of respondents included in model conditioning on initial stage.

^eRespondents were excluded from the modelling of the transition if they never met criteria for the initial stage, or if the onset of the initial stage was after the onset of the second stage.

Table 3. Multivariate associations of socio-demographic variables with transitions between lifetime alcohol use/use disorders in the New Zealand Mental Health Survey

Multivariate results	Commencing Use		Use to regular use		Use to abuse (without prior dependence)		Use to dependence		Regular use to abuse (without prior dependence) ^c		Regular use to dependence	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Male	1.07*	(1.01–1.12)	1.06*	(1.00–1.13)	1.30*	(1.10–1.53)	0.93	(0.75–1.14)	1.35*	(1.16–1.59)	1.26*	(1.03–1.55)
X^2_1 [P]	5.68**	[0.017]	3.86**	[0.050]	9.42**	[0.002]	0.52	[0.470]	14.21**	[<0.001]	4.94**	[0.026]
Proportion of age–gender cohort using alcohol ^a	1.45*	(1.42–1.47)	1.38*	(1.35–1.40)	1.76*	(1.63–1.90)	1.74*	(1.55–1.96)	1.43*	(1.31–1.55)	1.34*	(1.18–1.53)
X^2_1 [P]	1688.49**	[<0.001]	1124.93**	[<0.001]	208.41**	[<0.001]	85.21**	[<0.001]	67.43**	[<0.001]	19.66**	[<0.001]
Education ^b												
Student	1.05	(0.88–1.25)	1.02	(0.87–1.19)	1.08	(0.77–1.52)	0.82	(0.53–1.26)	1.21	(0.87–1.70)	0.92	(0.60–1.40)
Low	1.34*	(1.12–1.62)	1.18*	(1.01–1.38)	2.48*	(1.83–3.36)	2.71*	(1.88–3.90)	2.42*	(1.79–3.27)	2.59*	(1.80–3.72)
Low average	0.98	(0.82–1.18)	1.22*	(1.04–1.44)	1.86*	(1.37–2.54)	1.84*	(1.19–2.86)	1.88*	(1.38–2.55)	1.83*	(1.18–2.83)
High average	1.21*	(1.01–1.45)	1.18	(0.99–1.40)	1.62*	(1.21–2.18)	1.76*	(1.17–2.65)	1.60*	(1.19–2.16)	1.74*	(1.16–2.60)
High	1	-	1	-	1	-	1	-	1	-	1	-
X^2_4 [P]	25.83**	[<0.001]	18.74**	[0.001]	84.20**	[<0.001]	81.90**	[<0.001]	69.08**	[<0.001]	70.58**	[<0.001]
Age tertile of first use ^c												
Early	-		0.79*	(0.71–0.88)	2.43*	(1.93–3.06)	2.94*	(2.02–4.26)	1.92*	(1.51–2.44)	2.31*	(1.59–3.36)
Mid	-		0.93	(0.85–1.02)	1.49*	(1.17–1.89)	1.66*	(1.13–2.45)	1.27	(0.99–1.62)	1.41	(0.96–2.08)
Late	-		1	-	1	-	1	-	1	-	1	-
X^2_2 [P]			23.93**	[<0.001]	98.14**	[<0.001]	50.39**	[<0.001]	56.57**	[<0.001]	32.60**	[<0.001]
Total (N ^d)		12,992		12,033		12,033		12,033		10,736		10,764

ORs, odds ratios; CI, confidence interval. */** Significant at the 0.05 level, two-sided test.

All discrete-time logistic regression analyses are based on weighted person-year data controlling for person-year age groups of ≤15, 16–17, 18–20, 21–24, 25–29 and 30+.

^aPercentage (/10) of ±5-year sex-specific cohort who had used alcohol by the prior person-year. For example, for a female born in 1975, the cohort would be females born between 1970 and 1980. A context OR of 1.5 in commencement of use would be interpreted as an increase of 50% in the odds of commencing use with a 10% increase of people in the age–gender cohort having commenced use by the previous person-year.

^bLow education is defined as completed 11 or less years, low/med is completed 12 years, medium 13–15 years and high 16 or more years.

^cIndividuals' age of commencing alcohol use is split into tertiles among all those who ever used alcohol. The earliest (first) tertile is age ≤ 13, the 2nd tertile age 14–16 and the 3rd tertile aged 17+.

^dN = The total unweighted number of respondents included in model conditioning on initial stage.

^eRespondents were excluded from the modelling of the transition if they never met criteria for the initial stage or if the onset of the initial stage was after the onset of the second stage.

Table 4. Bivariate and multivariate associations of socio-demographic predictors with transitions from alcohol disorder to remission in the New Zealand Mental Health Survey^a

	Abuse (without dependence) to remission from abuse				Dependence to remission from dependence			
	Bivariate		Multivariate		Bivariate		Multivariate	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Male	0.58*	(0.48–0.71)	0.26*	(0.19–0.34)	0.79*	(0.64–0.97)	0.16*	(0.10–0.26)
X ² ₁ [P]	29.12**	[<0.001]	83.74**	[<0.001]	5.13**	[0.023]	63.18**	[<0.001]
Proportion of age–gender cohort using alcohol ^b	1.36*	(1.12–1.66)	5.05*	(3.20–7.94)	1.58*	(1.23–2.02)	16.00*	(8.00–31.98)
X ² ₁ [P]	9.31**	[0.002]	48.80**	[<0.001]	12.91**	[<0.001]	61.55**	[<0.001]
Education ^c								
Student	0.33*	(0.16–0.69)	0.6	(0.30–1.29)	0.32	(0.08–1.29)	0.9	(0.21–3.42)
Low	1.0	(0.70–1.28)	1.0	(0.76–1.30)	0.86	(0.64–1.15)	1.0	(0.72–1.34)
Low average	1.07	(0.77–1.47)	1.04	(0.77–1.41)	1.05	(0.73–1.51)	1.17	(0.78–1.76)
High average	0.9	(0.71–1.18)	1.0	(0.74–1.24)	0.83	(0.60–1.16)	0.93	(0.67–1.30)
High	1.00	–			1.00	–		
X ² ₃ [P]	11.69**	[0.020]	2.55	[0.636]	4.5	[0.344]	1.51	[0.825]
Age of first use ^d								
Early	1.0	(0.75–1.30)	0.99	(0.77–1.28)	1.15	(0.85–1.55)	0.9	(0.62–1.28)
Mid	0.91	(0.68–1.21)	0.91	(0.69–1.19)	0.88	(0.62–1.25)	0.76	(0.55–1.06)
Late	1.00	–			1.00	–		
X ² ₂ [P]	0.79	[0.675]	0.96	[0.619]	4.34	[0.114]	2.88	[0.237]
Speed to transition from use to disorder ^e								
Early	0.90	(0.71–1.13)	1.1	(0.85–1.53)	1.0	(0.75–1.32)	0.85	(0.57–1.28)
Mid	0.87	(0.69–1.10)	0.98	(0.75–1.29)	1.10	(0.81–1.35)	0.9	(0.67–1.22)
Late	1.00	–			1.00	–		
X ² ₂ [P]	1.47	[0.480]	2.06	[0.357]	0.18	[0.912]	0.66	[0.718]
Years with disorder	0.98*	(0.97–1.00)	0.98*	(0.97–1.00)	1.03*	(1.01–1.05)	1.03*	(1.01–1.06)
X ² ₁ [P]	6.71**	[0.010]	4.31**	[0.038]	9.47**	[0.002]	6.35**	[0.012]
Total (N ^{f,g})			950				703	

ORs, odds ratios; CI, confidence interval; */** Significant at the 0.05 level, two-sided test.

All discrete-time logistic regression analyses are based on weighted person-year data controlling for person-year age groups of ≤18, 19–20, 21–22, 23–24, 25–29, 30–39 and 40+.

^aRemission is defined as having reported more than 12 months, or at least two birthdays, since the last disorder-related problem.

^bPercentage (/10) of ±5-year sex-specific cohort who had used alcohol by the prior person-year.

^cLow education is defined as completed 11 or less years, low/med is completed 12 years, medium 13–15 years and high 16 or more years.

^dIndividuals' age of commencing alcohol use is split into tertiles among all those who ever used alcohol. The earliest (first) tertile is age ≤ 13, the 2nd tertile age 14–16 and the 3rd tertile aged 17+.

^eIndividuals' speed of transition from alcohol use to disorder is split into tertiles. When predicting remission from abuse, tertiles were calculated for transition from use to abuse: the fastest at 0–4 years, the middle tertile 5–9 years and late transitions were 10+ years. Among those who transition from use to dependence when predicting remission from dependence, the early tertile is 0–5 years from use to dependence, mid is 6–10 years and late is 11+ years.

^fN = The total unweighted number of respondents included in the model conditioning on the initial stage.

^gIndividuals with a missing age of onset of remission were excluded from the model (N = 44 for remission from abuse and N = 39 for remission from dependence).

dependence. In a bivariate model, student status was associated with reduced odds of remission from abuse but this association became non-significant after adjustment for the other covariates.

DISCUSSION

Using data from a nationally representative survey of New Zealanders, we identified four key features of transition across stages of alcohol use: (a) An increase in the use of alcohol within a person's age- and gender-matched cohort within the year prior was associated with an increase in the odds of transition to the subsequent stage of use; (b) transition from non-disordered use of alcohol to development of disorder was typically rapid and occurred before age 25; (c) transition from disorder to remission was slow, particularly for alcohol dependence; (d) male gender, younger relative age of onset of use and lower education level were associated with

transition to disorder; male gender was associated with decreased odds of remission.

The first finding of this study emphasized the importance of the social context of alcohol use. Each 10% increase in the number of people using alcohol within a person's age- and gender-matched cohort in the year prior was associated with an increased likelihood of subsequent transition across every stage of alcohol use. Specifically, increased cohort use was associated with a 76 and 72% increase in the adjusted odds of subsequent transition to an abuse or dependence disorder, respectively. Prior research has shown the social context influences alcohol use through beliefs and attitudes about social norms (Trucco et al., 2011; Sudhinaraset et al., 2016; Janssen et al., 2018). Our study found that the broad social context of level of drinking within an individual's cohort also influences consumption and development of disorder. Although counter-intuitive at first, the association between increased cohort use and increased

odds of remission from disorders may indicate that as disorder prevalence increases in a cohort, at a group level there will be a greater range of disorder severity thus a greater number of people with less severe disorder who are more responsive to remitting.

The second key finding of this study was that first use of alcohol and transition to disorder typically occurred during adolescence. Put into context: by the end of high school, 79% of 18-year olds had used alcohol, with 57% regularly using alcohol. A large number of previous studies in high-income countries also report first alcohol use commencing in adolescence (Kalaydjian *et al.*, 2009; Lee *et al.*, 2009; Suliman *et al.*, 2010). What has been less clear from prior research is the speed of transition and age at transition to disorder; in the present study, approximately one-third of abuse and dependence cases developed within 5 years of first use, with close to 50% of abuse and dependence cases having developed by age 20 and 70% by age 25. It is interesting to note that this speed of transition was faster than within Lopez-Quintero *et al.*'s US-based study in which 50% of dependence cases had developed by 13 years after first use (Lopez-Quintero *et al.*, 2011a), whereas in our study 53% of dependence cases had developed by 8 years after first use.

Our third finding was that an alcohol use disorder was long-lasting for many people. Although several studies confirm that alcohol use problems can persist from one to two decades without remitting (Vaillant, 2003; Gual *et al.*, 2009; Lopez-Quintero *et al.*, 2011b; Fleury *et al.*, 2016), there has been minimal prior research that uses clinical assessment tools, assesses abuse in addition to dependence and that examines the timing of the transition to remission. In our study, remission from dependence was slower than remission from abuse. For people who transitioned to an abuse disorder, the majority (57%) spent 5 years or longer living with the consequences of the disorder, whereas remission from a dependence disorder was achieved by 55% of people after 10 years; this was slower than in Lopez-Quintero *et al.*'s study in which 50% of people had remitted after 6 years. Our finding that individuals with a dependence disorder are less likely to remit (67%) than those with an abuse disorder (80%) is consistent with other research (Xie *et al.*, 2010; Trim *et al.*, 2013). We also found that more years lived with a dependence disorder was associated with an increased likelihood of remission, this finding perhaps reflects an interaction between disorder severity and likelihood of encountering effective treatment. Individuals with a dependence disorder are likely to come into contact with a treatment service eventually due to the debilitating effect on functioning; however our study indicates that it can take over a decade for effective treatment to be accessed.

Finally, consistent with much previous research, we found that males are more likely than women to drink in their lifetimes and also have significantly elevated odds of transitioning from use to regular use and from regular use to abuse and dependence as well as significantly reduced odds of remitting once they develop an alcohol use disorder (Kalaydjian *et al.*, 2009; Lee *et al.*, 2009; Suliman *et al.*, 2010). Also consistent with prior research, lower education and early onset of alcohol use predicted transition to abuse and dependence, but not remission (Kalaydjian *et al.*, 2009; Lee *et al.*, 2009; Abidin *et al.*, 2014). Interestingly, although media often focuses on student alcohol use (Connor *et al.*, 2013; Cousins *et al.*, 2014; Kypri *et al.*, 2014); student status did not predict transitions to regular use or to disorder in bivariate or multivariate models. That is, even when not adjusting for cohort use of alcohol, students were not more likely to report patterns of problem drinking.

The findings of our study have implications for policy and intervention planning. The finding that increased alcohol use within a

cohort was associated with increases in disorder in the following year supports policy recommendations aimed at reducing overall population consumption, including reducing availability of alcohol through restrictions on place, times, outlet density, and reducing demand through price (Law Commission, 2010). Our findings regarding cohort effects along with the finding that regular use and disordered use of alcohol predominately begin during adolescence indicate that policies focused specifically on decreasing supply to young people, such as a raised drinking age, may be particularly important. In addition, with use and disordered use occurring in adolescence, it is important to employ multiple strategies targeted at young people including delaying first use, harm reduction and treatment for disorder (Toumbourou *et al.*, 2007) as well as structural interventions that reduce availability and access within a cohort. Finally, it is also necessary to consider alcohol disorders, in particular alcohol dependence, to be chronic disorders requiring long-term care resourcing.

The findings of this study must be considered within several caveats. This survey relied on retrospective reporting; accurate measurement of age of onset of behaviours and disorders may be limited due to memory failure and low motivation to accurately recall the timing of events. Further, poor question comprehension and a reluctance to disclose stigmatized behaviour may limit the accuracy of information reported. Efforts to address these challenges are described in detail elsewhere (Kessler and Üstün, 2004; Kessler and Üstün, 2008) and included a life review strategy that encouraged recall of specific events in time. Some success capturing the timing of events was indicated by a 10-year follow-up using CIDI 3.0, which found reporting to be reliable across this period (Knäuper *et al.*, 1999; Borges *et al.*, 2008).

It must also be considered that this survey was a community survey. As a result, people who were homeless or who were living in institutions, for example, those incarcerated or living in rest homes, sheltered accommodation, university colleges and armed forces group accommodation, were not included in the sampling frame. Thus, those with a high likelihood of being affected by alcohol use disorders are unlikely to be represented in this study. For example, lifetime prevalence of alcohol abuse (43%) and dependence (36%) have been found to be substantive among those incarcerated (Indig *et al.*, 2016). In addition, survivor bias will result in attenuated odds to the degree that alcohol use disorders increase early mortality whereby those most affected by alcohol use and less likely to have experienced remission will not have been included in the study due to early mortality.

Despite several caveats, our study had several strengths including achieving a response rate of 73%, oversampling of Māori and Pacific Island people, weighted estimates and modelling of non-response resulted in a nationally representative sample that included a wide range of ages. In addition, a diagnostic tool was used to capture particular stages of alcohol use. Finally, the use of discrete-time survival analysis enabled modelling time-varying covariates for each and every year that respondents were at risk of the transitions occurring.

Conclusions

In this large, retrospective community survey, we found that use and regular use of alcohol were almost universal. Overall, 11.4 and 4.6% of the population developed alcohol abuse and alcohol dependence disorders, respectively. Around two-thirds of individuals with dependence, and four-fifths of those with abuse, experienced

remission. We identified four key factors that add to our understanding of the transitions between stages of alcohol use. First, we found that an increase in the number of individuals in a cohort consuming alcohol was associated with higher odds of an individual transitioning to subsequent stages of alcohol use in the following year. Second, the majority of use, regular use and disorder onset occurred during adolescence/young adulthood. Third, remittance was not rapid, with many individuals symptomatic for a decade or more from onset of the disorder. Fourth, a greater number of socio-demographic covariates were associated with increased odds of transition to disorder (male, low education, young age at first use) than from disorder to remission, whereby male gender was associated with decreased odds of transition to remission from disorder. Cohort-specific interventions, particularly during adolescence and young adulthood, aimed at reducing overall alcohol consumption may contribute to reduced risk of individuals developing alcohol use disorders. Population level use is modifiable by policy intervention; such interventions that may particularly target an adolescent-aged cohort include increasing price (Wagenaar et al., 2009; Purshouse et al., 2010), a raised age of eligibility to purchase alcohol (Martineau et al., 2013) and reducing availability through limiting outlets (Popova et al., 2009). Finally, alcohol dependence can be a chronic condition and preparedness to invest in long-term treatment provision is necessary.

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CONFLICT OF INTEREST STATEMENT

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REFERENCES

- Abdin E, Subramaniam M, Vaingankar JA, et al. (2014) The role of sociodemographic factors in the risk of transition from alcohol use to disorders and remission in Singapore. *Alcohol Alcohol* 49:103–08.
- American Psychiatric Association. (1994) *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*. Washington, DC: APA.
- Ayuka F, Barnett R, Pearce J. (2014) Neighbourhood availability of alcohol outlets and hazardous alcohol consumption in New Zealand. *Health Place* 29:186–99.
- Borges G, Angst J, Nock MK, et al. (2008) Risk factors for the incidence and persistence of suicide-related outcomes: A 10-year follow-up study using the National Comorbidity Surveys. *J Affect Disord* 105:25–33.
- Connor J, Psutka R, Cousins K, et al. (2013) Risky drinking, risky sex: A national study of new zealand university students. *Alcohol Clin Exp Res* 37:1971–78.
- Cousins K, Connor JL, Kypri K. (2014) Effects of the Campus Watch intervention on alcohol consumption and related harm in a university population. *Drug Alcohol Depend* 143:120–26.
- Fleury MJ, Djouini A, Huynh C, et al. (2016) Remission from substance use disorders: A systematic review and meta-analysis. *Drug Alcohol Depend* 168:293–306.
- Gruenewald PJ, Treno AJ, Ponicki WR, et al. (2015) Impacts of New Zealand's lowered minimum purchase age on context-specific drinking and related risks. *Addiction* 110:1757–66.
- Gual A, Bravo F, Lligoña A, et al. (2009) Treatment for alcohol dependence in Catalonia: Health outcomes and stability of drinking patterns over 20 years in 850 patients. *Alcohol Alcohol* 44:409–15.
- Hsiang JC, Bai WW, Raos Z, et al. (2015) Epidemiology, disease burden and outcomes of cirrhosis in a large secondary care hospital in South Auckland, New Zealand. *Intern Med J* 45:160–69.
- Indig D, Gear C, Wilhelm K. (2016) *Comorbid Substance Use Disorders and Mental Health Disorders Among New Zealand Prisoners*. Wellington: New Zealand Department of Corrections.
- Janssen T, Padovano HT, errill JE, et al. (2018) Developmental relations between alcohol expectancies and social norms in predicting alcohol onset. *Dev Psychol* 54:281–92.
- Kalaydjian A, Swendsen J, Chiu WT, et al. (2009) Sociodemographic predictors of transitions across stages of alcohol use, disorders, and remission in the National Comorbidity Survey Replication. *Compr Psychiatry* 50:299–306.
- Kessler RC, Üstün B. (2004) The World Mental Health (WMH) Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *Int J Methods Psychiatr Res* 13:93–121.
- Kessler RC, Üstün TBT. (2004) The World Mental Health (WMH) Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *Int J Methods Psychiatr Res* 13:93–121.
- Kessler RC, Üstün TB. (2008) The World Health Organization Composite International Diagnostic Interview. In Kessler RC, Üstün TB (eds). *The WHO World Mental Health Surveys: Global Perspectives on the Epidemiology of Mental Disorders*. New York: Cambridge University Press, 58–90.
- Knäuper B, Cannell CF, Schwarz N, et al. (1999) Improving accuracy of major depression age-of-onset reports in the US national comorbidity survey. *Int J Methods Psychiatr Res* 8:39–47.
- Kypri K, Vater T, Bowe SJ, et al. (2014) Web-based alcohol screening and brief intervention for university students: A randomized trial. *JAMA* 311: 1218–24.
- Lago L, Glantz MD, Kessler RC, et al. (2017) Substance dependence among those without symptoms of substance abuse in the World Mental Health Survey. *Int J Methods Psychiatr Res* 26:e1557.
- Law Commission. (2010) *Alcohol in Our Lives: Curbing the Harm (Law Commission Report; no 114)*. Wellington, New Zealand: Law Commission.
- Lee S, Guo WJ, Tsang A, et al. (2009) Associations of cohort and socio-demographic correlates with transitions from alcohol use to disorders and remission in metropolitan China. *Addiction* 104:1313–23.
- Lopez-Quintero C, Cobos JPDL, Hasin DS, et al. (2011a) Probability and predictors of transition from first use to dependence on nicotine, alcohol, cannabis, and cocaine: Results of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Drug Alcohol Depend* 115:120–30.
- Lopez-Quintero C, Hasin DS, De Los Cobos JP, et al. (2011b) Probability and predictors of remission from life-time nicotine, alcohol, cannabis or cocaine dependence: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Addiction* 106:657–69.
- Martineau F, Tyner E, Lorenc T, et al. (2013) Population-level interventions to reduce alcohol-related harm: An overview of systematic reviews. *Prev Med* 57:278–96.
- National Institute on Alcohol Abuse and Alcoholism (2016) Alcohol Use Disorder: A comparison between DSM-IV and DSM-5: NIH Publication No. 13–799.
- Popova S, Giesbrecht N, Bekmuradov D, et al. (2009) Hours and days of sale and density of alcohol outlets: Impacts on alcohol consumption and damage: A systematic review. *Alcohol Alcohol* 44:500–16.

- Purshouse RC, Meier PS, Brennan A, *et al.* (2010) Estimated effect of alcohol pricing policies on health and health economic outcomes in England: An epidemiological model. *Lancet* 375:1355–64.
- Richardson A, Hayes J, Frampton C, *et al.* (2016) Modifiable lifestyle factors that could reduce the incidence of colorectal cancer in New Zealand. *N Z Med J* 129:13–20.
- Singer JD, Willett JB. (1993) It's about time: Using discrete-time survival analysis to study duration and the timing of events. *J Educ Stat* 18:155–95.
- Sudhinaraset M, Wigglesworth C, Takeuchi DT. (2016) Social and cultural contexts of alcohol use: Influences in a social-ecological framework. *Alcohol Res Curr Rev* 38:35–45.
- Suliman S, Seedat S, Williams DR, *et al.* (2010) Predictors of transitions across stages of alcohol use and alcohol-use disorders in South Africa. *J Stud Alcohol Drugs* 71:695.
- Toumbourou J, Stockwell T, Neighbors C, *et al.* (2007) Interventions to reduce harm associated with adolescent substance use. *Lancet* 369: 1391–401.
- Trim RS, Schuckit MA, Smith TL. (2013) Predictors of initial and sustained remission from alcohol use disorders: Findings from the 30-Year follow-up of the san diego prospective study. *Alcohol Clin Exp Res* 37:1424–31.
- Trucco EM, Colder CR, Wieczorek WF. (2011) Vulnerability to peer influence: A moderated mediation study of early adolescent alcohol use initiation. *Addict Behav* 36:729–36.
- Vaillant GE. (2003) A 60-year follow-up of alcoholic men. *Addiction* 98: 1043–51.
- Wagenaar AC, Salois MJ, Komro KA. (2009) Effects of beverage alcohol price and tax levels on drinking: A meta-analysis of 1003 estimates from 112 studies. *Addiction* 104:179–90.
- Wells JE, Browne MAO, Scott KM, *et al.* (2006) Te Rau Hinengaro: The New Zealand Mental Health Survey: Overview of methods and findings. *Aust N Z J Psychiatry* 40:835–44.
- Wells JE, Haro JM, Karam E, *et al.* (2011) Cross-national comparisons of sex differences in opportunities to use alcohol or drugs, and the transitions to use. *Subst Use Misuse* 46:1169–78.
- Wilson N, Blakely T. (2015) The high health burden from alcohol in New Zealand and the need for an appropriate government response. *N Z Med J* 128:6–8.
- Xie H, Drake RE, McHugo GJ, *et al.* (2010) The 10-year course of remission, abstinence, and recovery in dual diagnosis. *J Subst Abuse Treat* 39: 132–40.