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Impacts of New Zealand's Lowered Minimum Purchase Age on Context-Specific Drinking and Related Risks

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Abstract

Aims—The minimum purchase age (MPA) for alcohol in New Zealand (NZ) was reduced from 20 to 18 years in 1999. We assessed the degree to which this change was associated with alterations in uses of drinking contexts, drinking, and related problems.

Methods—NZ National Alcohol Surveys among persons 14+ years of age provided demographics, frequencies and amounts consumed in drinking places, and problem measures for 1995, 2000 and 2004. Censored regression estimates of parameters of a context-specific dose-response model identified MPA-associated changes in drinking and problems.

Results—The lowered MPA was associated with more frequent drinking at pubs/nightclubs among the newly of-age 18–19 year olds ($b=15.26$, $p=0.009$), moderated drinking quantities at these places ($b=-0.943$, $p=0.034$), and greater quantities consumed at home ($b=1.012$, $p=0.010$) and others' homes ($b=0.870$; $p=0.029$). Drinking frequency and quantity in the 16–17 age group increased at home ($b=22.11$, $p=0.040$ and $b=1.22$, $p=0.002$) and others' homes ($b=11.65$, $p=0.002$ and $b=0.915$, $p=0.021$). Problems associated with drinking contexts changed post-MPA ($G^2=27.45$, $p=0.002$), specifically increased association with drinking in pubs/nightclubs ($b=0.090$, $p<0.001$) across both age groups.

Conclusions—The 1999 change in New Zealand's minimum purchase age for alcohol from 20 years to 18 years appears to have been associated with substantive changes in uses of drinking contexts, drinking and associated drinking problems among 16–19 year olds.

A large research literature demonstrates substantive statistical relationships between changes in the minimum legal drinking (MLDA) or purchase age (MPA), youth drinking and alcohol related harms [1,2]. Increases in the MLDA and MPA are related to reductions in use and problems among of-age young adults. New Zealand lowered the MPA from 20 to 18 years on December 1, 1999. Although the prior law was difficult to enforce and included limited exceptions for sales to those age 18 and 19 years [3], the 1999 MPA reduction greatly increased retail alcohol access for that age group. To mitigate potential risks, the same act

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required that customers provide photo age identification, if asked, and increased penalties for sales to minors [4]. Early evidence indicated that lowered MPA was associated with increased relative risk of problems such as traffic crashes and presentations for intoxication at emergency departments [5–9]. While most public health researchers and agencies agreed that the lowered MPA would lead to greater use and problems among youth and young adults [10], some commentators and New Zealand industry groups argued that the lowered MPA could lead young people to drink in safe controlled environments [11–13] and thus reduce problems in this group. This argument strikes at a weak link in prior assessments of MPA effects, as it is not known to what degree changes in the MPA are associated with changes in the use of drinking contexts among under- and of-age drinkers.

In this paper we estimate the impact of New Zealand's MPA reduction on use of drinking contexts, levels of alcohol use therein, and associated rates of problems using national surveys of New Zealand youth and adults. Although availability theory suggests that MPA reductions will increase opportunities to drink among newly of-age drinkers and drinking will expand into commercial contexts like bars [14], until recently there has been no survey-based method for associating drinking in contexts to associated problem risks. We use a recently developed context-specific dose-response model and national survey data to assess frequencies of drinking in contexts by youth and adults before and after MPA reduction; use among newly of-age youth should shift toward commercial outlets following this change, and associated problems may measurably increase or decrease. Numbers of problems may be associated with drinking contexts themselves, regardless of drinking level, or heavier drinking in those contexts. We distinguish these risks using a model developed for this purpose and applied in previous studies [14, 15]. The model requires data on drinking frequencies and quantities consumed across contexts that provide good coverage of total alcohol use in a large population, fortunately available for New Zealand [16]. We expect that greater risks may arise in licensed drinking establishments like pubs and nightclubs as new of-age drinkers come into those contexts; this may be due either to greater drinking in those contexts or greater problem risks associated with a given drinking amount in those contexts. The arguments parallel those of other investigators who identified greater risks for child abuse and neglect specifically associated with heavier drinking in bars and pubs [14] and distinguished risks for intimate partner violence related to the use of drinking contexts from those related to heavier drinking [15].

The aims of the current paper are: (1) To determine if greater legal availability is related to increased use of licensed establishments by newly of-age 18 to 19 year old drinkers in the post-MPA period. Conversely, the concurrent enhancements of photo ID requirements and penalties for serving minors may decrease use of licensed establishments by individuals under 18 years of age. (2) To determine whether drinking context use is associated with risks for several drinking problems. (3) To assess the degree to which additional problem risks are associated with greater levels of drinking in those contexts. (4) To evaluate the extent to which context specific risks and risks associated with drinking are related to New Zealand's MPA reduction.

METHODS

New Zealand National Alcohol Surveys of youth and adults were conducted in 1995, 2000, and 2004 with a total of 16,420 respondents 14 to 65 years old [16,17]; response rates were 73%, 71% and 60% respectively. Interviews were conducted by trained personnel from a central location using an in-house computer-assisted telephone interview system. Households were selected using random digit dialing (including listed and unlisted phone numbers) and a computerized random selection process determined those interviewed. Validity and reliability of all drinking, context and problem measures were assessed as “good” in previous studies (e.g., coefficients α and test-retest $r = 0.70$) [16]. The surveys were designed to be nationally representative; here proportional weighting is used to account for purposeful oversampling of youth aged 14 to 19 in 2000 and 2004. Discarding cases missing demographic information reduced the overall sample to 16,240, of which 13,243 had consumed alcohol and provided required drinking data. Of these drinkers, 1,082 (8.2%) were age 16–17 and 919 (6.9%) were age 18–19. (Drinker counts by age, gender and survey year are presented as web-only supplementary material.)

Alcohol use was measured for 15 detailed drinking contexts. For ease of analyses, these were collapsed into five categories: the respondent’s own home, others’ homes, pubs/hotels/taverns plus nightclubs, restaurants/coffee shops, and a residual category containing all other drinking contexts (including sport clubs, other clubs/meetings, special events, theaters/movies, workplaces, domestic plane trips, private vehicles, sports events, and public places). For every context each drinker reported the number of occasions over the past year drinking at each context (frequency) and the typical quantity of alcohol consumed in each context (drinks per occasion, DPO). Categorical indicators of typical drinking frequency were converted to interval estimates with the top category “more than once per day” coded as 730 occasions per year. Total drinking frequency was calculated as the sum of the context-specific reports. As a result, a small proportion of individual respondents (1.3%) had total annual drinking frequencies greater than 730 occasions (up to 1,927). Specification tests indicated that the results presented here remain essentially unchanged when these values were Winsorized to 365 [18].

Respondents reported their typical quantities of alcohol consumed by context using terms familiar to New Zealand drinkers, coded by interviewers using the wide range of containers commonly used to serve and sell specific beverage types [16]. Conversions were based on container sizes and standard alcohol content as documented by Statistics New Zealand. This information was converted to standardized 15 ML ethanol units to estimate drinks per occasion. To mitigate problems with extreme outliers, DPO values above 24 were Winsorized to 24 drinks affecting 0.9% of reports across all contexts.

Self-reported alcohol problems were assessed over the previous year without regard to drinking contexts. Respondents reported annual counts across fifteen problem indicators. Following prior research [19], these items were combined into four categories: 1) Alcohol Related Disorder (physical fights, serious argument, forced to leave a place); 2) Symptoms of Dependency (drunk when needed to be sober, drank alcohol or experienced hand shakes in the morning, stayed intoxicated for several days); 3) Heavier Drinking Effects (ashamed

of actions while drinking, missed work or unable to remember after drinking); 4) Felt Effects of Alcohol the Next Day (overall, at work, on study). A fifth outcome summed all 15 problems. The maximum reported problems ranged from 420 for Alcohol Related Disorders to 1,068 for Symptoms of Dependence.

Demographic and economic covariates included categorical measures of respondent age, survey year, gender, ethnicity, income, education and employment. The coding and reference categories for these covariates are indicated in Table 1.

Statistical Approaches

The context-specific drinking analyses assessed whether an individual reported any alcohol use and, among drinkers, the frequencies and typical quantities used in different contexts. The analyses included demographic and economic covariates as well as year-specific indicators to account for unexplained population-wide temporal changes. The key indicators of MPA effects were interaction terms identifying post-1999 changes specific to the 16–17 and 18–19 age groups. Logistic analyses were used to assess drinking status and censored Tobit regression analyses were used to assess drinking frequencies and quantities using Stata 13. Tobit analyses correct for biases that arise in ordinary least squares regression analyses of censored interval data [20].

The context-specific analyses of risks related to drinking examined drinkers only and assessed relationships between measures of drinking within contexts and the five groupings of drinking problems measured across contexts. All demographic and economic covariates and measures identifying specific effects among age groups were included along with measures of context-specific drinking frequencies, F_i , and volumes consumed beyond the first drink ($V_i - F_i$). We treat the assessment of risks related to drinking as an essentially actuarial problem. The problem is to estimate associations between drinking measured within contexts and risks for problems across contexts. An explicit quantitative representation of context-specific risk relationships enables us to do so [14, 15]. The model generalizes a linear dose-response framework used to quantitatively assess drinking risks [21] to include variations in dose-response which may be context specific. Starting with a simple reduced form equation:

$$R = a + bF + c(V - F) \quad (\text{Equation 1})$$

Risks related to drinking (R) are assumed to be a linear function of drinking frequencies (F) and total volume (V) minus frequency ($V - F$) (continued volumes). As applied here, estimates of b represent the number of problems associated with the first drink and estimates of c represent the unit increase in problems related to each additional drink beyond the first (linear dose-response). We extend the model to context-specific risks noting that F and $V - F$ are composed of drinking frequencies and volumes measured within contexts ($F = F_1 + F_2 + \dots + F_n$, $V_i = F_i + Q_i$):

$$R_i = a_i + b_i F_i + c_i F_i (V_i - F_i) \quad (\text{Equation 2})$$

We assume that total risk, the total number of problems R , is the sum of unobserved risks (R_i) associated with individual contexts. With data on the frequency, F_i , and quantity, Q_i , consumed in each context (and thereby V_i and $V_i - F_i$), the sum of all problem risks R is represented by the expansion of the right side of equation 2 for all contexts ($R = R_1 + R_2 + \dots + R_n$). Numbers of problems associated with drinking in each context (b_i) and the linear increase in numbers of problems per additional drink consumed in each context (c_i) can be estimated using expanded Equation 2. This approach reduces collinearity when estimating context specific effects and separates risks related to drinking from risks associated with heavier drinking within contexts.

Since error variance increases with drinking frequencies and volumes and is a source of bias in applications of censored regression models, we conducted analyses using LIMDEP version 9.0 software that corrects for these sources of heteroskedasticity [22]. Additional specification tests, not further discussed here, examined whether the MPA was differently related to risks between age groups; these age $\times$ time $\times$ context interactions were not significant.

RESULTS

Table 1 presents weighted descriptive statistics for all measures used in the study. Drinkers reported an average of 166 drinking occasions during the prior year across all locations, with half of these occurring at home (88). Typical drinks per occasion averaged 3.8 across all contexts, ranging from 2.3 drinks at restaurants to 5.0 at pubs / nightclubs. The average drinker reported 9.6 drinking problems over the past year, of which over two-thirds were in the “felt effects” category. Median drinking values are uniformly lower than means across all drinking and problem measures, reflecting the influence of extreme cases in estimating the means.

Context-Specific Drinking

Table 2 presents the key tests of whether respondents in targeted age groups experienced different changes in drinking and context use following MPA reduction than did those in other age categories. The top two sections show drinking outcomes differed across all age groups and all survey years, while the bottom section tests whether two key age categories (16–17 and 18–19) had different post-MPA changes in drinking than did older or younger respondents. The latter results indicate that respondents aged 18–19 experienced a relative increase in likelihood of past-year drinking following the MPA compared to other age groups. The post-MPA period also had significantly increasing rates of context use among 16–17 year olds (42 additional occasions annually) and 18–19 year olds (34 additional occasions) beyond the changes experienced by other age groups. These changes were distributed across contexts in different ways. 16–17 year olds came to drink more often at home (+22 times per year), others’ homes (+12), and other contexts (+22). 18–19 year olds came to drink more often at pubs/nightclubs (+15). The lowered MPA was associated with increased frequencies of drinking across all contexts for 16–19 year olds, with 16–17 year olds more frequently drinking in social contexts and 18–19 year olds more frequently drinking in commercial contexts, especially pubs/nightclubs. There was a reduction in use of

pubs/nightclubs for drinking among 16–17 year olds. Results for the other demographic and economic covariates are presented as web-only supplementary material. Specification tests that Winsorized context-specific annual frequencies at 365 instead of 730 (for survey responses of “more than once a day”) provided nearly identical results. An additional specification test which also Winsorized the total drinking frequency measure at 365 provided very similar results except that the MPA interaction with the age 18–19 group no longer had a significant association with total frequency ($b=18.89$, $z=1.64$).

Table 3 presents equivalent analyses of whether the age groups most affected by the lowered MPA changed their typical quantities consumed in drinking contexts relative to respondents in other age groups. Across all contexts typical quantities consumed rose among 16–17 year olds with greater quantities consumed at home, others’ homes, and other contexts. Overall increases were not seen among 18–19 year olds, but some increases were evident for quantities consumed at home and others’ homes. A one-tailed marginal reduction in quantities consumed at pubs/nightclubs suggests somewhat less use in these environments. These age-specific post-MPA effects in Table 3 all remained significant in specification tests that did not Winsorize typical drinks per occasion at 24.

Context-Specific Drinking Risks

Table 4 presents key tests of relationships between drinking in contexts and risks for problem outcomes. The table is divided into four sections referring to risks for problems related to (A) drinking in each context, (B) greater amounts consumed in each context (dose-response), (C) association of the lowered MPA with problems related to each context, and (D) relationship of the lowered MPA to dose-response. Sections A and B display context-specific drinking risks prior to the MPA change. Sections C and D display associations of the MPA with these relationships. The non-significant direct post-MPA effect displayed at the bottom of the table shows that the context-specific measures statistically explained marginal effects otherwise related to the reduced MPA.

In the aggregate, across the 10 effects displayed in sections A and B of Table 4, the context-specific frequency and dose-response effects both contributed significantly to the explanation of problem rates across all problem groups. Likelihood ratio chi-square statistics ranged from $G^2=205.94$ to 804.74 ($df=5$) for effects related to the use of drinking contexts and from $G^2=93.95$ to 734.02 ($df=5$) for dose-response. Greater numbers of overall problems were associated with drinking in others’ homes and pubs/nightclubs, and dose-response was positively associated with greater drinking quantities in all contexts. Looking across the table at specific problem groups, there was considerable variation in context-specific effects with some problems remaining largely unresponsive (symptoms of dependence), but others exhibiting great responsiveness (felt effects of alcohol).

The context specific dose-response model enables comparisons between risks related to drinking in contexts (section A) and risks related to heavier drinking in those contexts (section B). In section A of Table 4, it appears that greatest risks related to drinking in contexts arise when drinking in others’ homes and pubs / nightclubs. At low levels of drinking, when drinking one drink, risks are greatest when drinking in these places. As shown in section B of Table 4, it appears that dose-response is greatest when drinking in

restaurants, pubs/nightclubs, and other contexts. Risks increased most in association with heavier drinking in these places. Combining these effects, and assuming an average drinking quantity of 3.79 drinks per occasion (Table 1), problem risks related to each context were 0.045 problems per drinking occasion at one's own home, 0.104 at others' homes, 0.129 at pubs/nightclubs, 0.132 at restaurants, and 0.109 in other contexts. Taking into account the very different quantities consumed in each context (Table 1), quantity adjusted risks were 0.043 at one's own home, 0.119 at others' homes, 0.166 at pubs/nightclubs, 0.060 at restaurants, and 0.102 in other contexts. Numbers of problems related to each occasion of drinking at pubs/nightclubs were on average 3.9 times as great as those which arose when drinking at one's own home. Since rates are estimated on a per occasion basis for a single average drinker, we can multiply out these estimates by annual frequencies of drinking in each place (Table 1) and estimate the annual numbers of problems associated with drinking in each context per 1000 drinkers; these become 3,753 problems per year associated with drinking at home, 2,478 problems at others' homes, 3,339 problems at pubs / nightclubs, 690 at restaurants, and 2,657 at other contexts.

Sections C and D of Table 4 present the estimated relationships of the lowered MPA with context-specific risks for alcohol related problems. With the exception of Symptoms of Dependence ($G^2=9.17$, $df=10$, $p=n.s.$), there were significant changes in context specific dose-response coinciding with the MPA change ($G^2=27.45$ to 40.42 , $df=10$, $p=0.002$). Generally, significant effects were focused in two contexts, pubs/nightclubs and other contexts, for two classes of problems, Heavy Drinking and Felt Effects of Alcohol use. Rates of problems associated with drinking at pubs/nightclubs increased after the MPA change (section C), while the relationships to heavier drinking (section D) declined somewhat. This pattern was most notable for the measures of alcohol related disorder and felt effects of alcohol. Context specific risks related to drinking at pubs/nightclubs increased by a factor of 3.17 from 0.042 to 0.132 problems per drinking occasion. Dose-response decreased by a factor of 0.56 from 0.031 to 0.018. Since dose-response remained positive post-intervention, this translates to a greater than 3-fold increase in rates of problems per occasion associated with drinking at pubs / nightclubs at all drinking quantities. A similar pattern of effects was obtained with respect to other contexts for use, but with a non-significant increase in context specific risks following the MPA and a significant decrease in dose-response (by a factor of 0.45).

Supplementary analyses assessed whether context-specific dose-response changed among directly affected age groups. No significant post-law differences were found across age groups and contexts ($G^2=16.76$, $df=20$), or when separately examining effects among 18–19 year olds ($G^2=2.14$, $df=10$) and 16–17 year olds ($G^2=14.82$, $df=10$, $p=0.038$). Once again there were substantive and statistically significant relationships between demographic and economic covariates and alcohol related problems; these are presented in the web-only supplementary material.

DISCUSSION

The reduced MPA in New Zealand was related to increases in the proportion of 18–19 year old drinkers, frequencies with which this age group drank in different contexts, especially

commercial contexts like pubs/nightclubs (rising an average of 15 occasions per year), and problem risks associated with drinking in these contexts. Among 16–17 year old drinkers, the lowered MPA was associated with more frequent drinking, greater drinking quantities, and more use in non-commercial social contexts. These increases appear to have countered any ameliorating effect of this group's shift away from the use of pubs/nightclubs (an average reduction of 12 occasions per year), with greater drinking frequencies and quantities associated with use in own homes (+22 occasions), others' homes (12 occasions), and other drinking contexts (+22 occasions). This shift to informal access may have also been related to the simultaneous policy change that strengthened photo age identification requirements and increasing penalties for sales to minors through commercial outlets. Importantly, contrary to the claims of advocates for the reduction in the MPA [11–13], problem risks were not ameliorated by changes in drinking patterns or use of drinking contexts; newly of-age drinkers, like all drinkers, reported greater problem risks in association with drinking at bars after the MPA reduction; underage drinkers reported greater drinking and, perforce, problems associated with drinking in non-commercial social environments. From the perspective of protecting youth, the natural experiment posed by the MPA-reduction appears to have failed, presenting more drinking and more problems among 16–19 year olds.

With one important exception, problem rates associated with a given level of drinking in the different contexts remained largely unaffected by the MPA change, either for the population as a whole or among the directly affected age groups. Greater frequencies and quantities of alcohol used among 16–17 year olds thus translated directly into increases in numbers of problems. The greater frequencies but lower quantities consumed by 18–19 year olds in pubs/nightclubs represents the one drinking context that is the exception. There was a 5% increase in the proportion of drinkers among 18–19 year olds, and a corresponding increase in the average frequency of drinking at pubs/nightclubs (+15 occasions). This was accompanied by a decline in average drinking quantities in pubs/nightclubs (–1 drink) but, nevertheless, a 3-fold increase in problems per drinking occasion; evidently the small reduction in drinking quantity was far outweighed by the additional risks for problems that accrued among drinkers in these contexts. As other published work has indicated, drinkers who frequent bars generally drink greater average quantities, are more likely to take risks, exhibit low impulse control, and are likely to be embedded in friendship networks with other heavy drinkers [23]. Following the MPA reduction more young people drank in commercial settings and these places became, on the whole, settings where more alcohol related problems accrued.

As a final observation, the increase in drinking frequencies and decrease in drinking quantities observed in association with drinking in bars among 18–19 year drinkers may best be understood as a compositional effect: a large number of relatively new moderate-drinking 18–19 year old drinkers likely began to use pubs/nightclubs after the MPA was reduced. As a consequence the average quantities used in those contexts also decreased. For complementary reasons, average quantities correspondingly increased among 18–19 year olds drinking at home or others' homes (Table 3). In this case the lower costs of alcohol purchased off-premise, possibly for the purpose of preloading (drinking in unlicensed contexts before attending a licensed premise), may have led to greater use in these contexts [24].

This study clearly demonstrates how context-specific dose-response models provide one means of disentangling different social and behavioral effects related to the reduction in the New Zealand MPA. Following the lowered MPA more drinkers began to use alcohol, drank more frequently, drank greater quantities on average in some new environments, and experienced some additional risks related to drinking in those environments. The results of these analyses provide detailed support for previously demonstrated changes following the MPA change [5–9]. They also show that the notion that commercial drinking venues provide safe drinking environments is quite likely erroneous [11–13]. Overall, newly of-age youth shifted use away from one set of drinking venues with relatively moderate risks to another with more substantial risks. In this group, accounting for shifts in frequencies and quantities of use coincident with the MPA, annual numbers of problems related to drinking increased 7.5% across all contexts, rising most in pubs and nightclubs (35.3%) and decreasing most in other contexts (–18.8%). Underage youth generally increased their use of alcohol in non-commercial social contexts, presumably reflecting increased retail availability for their now of-age acquaintances.

Policy Implications

This study joins many others demonstrating that lowered MPAs are related to increased use and alcohol related problems. The current study goes on to identify specific licensed establishments, pubs/nightclubs, as being particularly utilized and high risk among the cohort of newly legal drinkers 18–19 years of age. It also goes on to demonstrate that increased frequencies and quantities of use among underage 16–17 year old drinkers are distributed across social venues in which there may be limited legal or social control over risky drinking behaviors (i.e., home, others' homes, and other contexts.) Certainly, greater regulation of alcohol sales through retail on-premise establishments can reduce problem risks associated with drinking in those contexts. This could be achieved through increases in beverage prices, especially least prices, reductions in outlet densities or hours and days of sale, provisions for responsible beverage service, and other policy options [25, 26]. However, efforts to extend regulatory control over problem alcohol use among underage (or young of-age) drinkers in social contexts is at a nascent stage. Social host laws attempt to regulate use of alcohol in private settings among underage drinkers (e.g., at parties sponsored by adults, [27]) and may help reduce underage drinking in private settings [28]. Nuisance regulations can limit the negative impacts of alcohol parties on neighborhoods and communities [29] and alcohol control policies and enforcement activities oriented toward adult use often have secondary benefits with respect to underage drinking [30]. The current study demonstrates that high-risk drinking contexts can be identified, thus informing and providing guidance to the development of context-specific preventive intervention strategies.

Limitations

The timing of the New Zealand national surveys were not ideal for analyzing impacts of the MPA reduction, with only one pre-intervention survey four years before the law took effect. Response rates declined across survey years, which could bias estimated MPA effects if non-responders drink differently. Furthermore, the impacts of the MPA reduction on population-wide drinking and problems after 1999 cannot be distinguished from those of

related changes in other alcohol policies or economic changes that also occurred at that time (i.e., introduction of Sunday trading and beer for sale in grocery outlets [31]). This expansion in off-premise availability could explain the overall increases in drinking quantities and frequencies subsequently observed in 2000 and 2004, focused on drinking within the home (Tables 2–3). These concurrent policy changes could also serve to explain some of the temporal shifts seen in Table 4 as greater risks were observed in other drinking contexts. However, regardless of the merit of these speculations, the increase in use of commercial outlets, especially bars, by the newly at-risk group of 18–19 year olds remains the clearest signal of an MPA effect. It is highly unlikely that either Sunday trading hours or greater alcohol availability through grocery stores should be specifically related to greater drinking at bars in this age group.

While the results show that risks for problems increased substantially at pubs/nightclubs, we cannot determine if this effect was related to these contexts or a change in the composition of people who chose to drink there; risk taking impulsive heavier drinkers appear to preferentially drink at pubs/nightclubs [23], so a shift in the composition of the pub/nightclub drinking population in this direction could explain this effect. Distinguishing the determinants of the selection of drinking contexts from the social and behavioral influences which affect drinking in those contexts is not possible within the limitations of neither the context-specific dose-response model, nor New Zealand national survey data. Specific micro-ecological studies of selection and influence are required for this purpose [32].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Descriptive Statistics

Variable	Mean	Median	Std. Dev.	Variable	Mean	Std. Dev.
Drinking Participation (n=16,240)						
Any Drinking in Past Year (%)	84.80		35.90	Income (%):		
				Low ^a	26.76	44.27
				Medium	34.60	47.57
				High	30.38	45.99
Frequency of Context Use per Year (n=13,243 drinkers):						
Total All Contexts	166.27	111.50	171.30	Not Reported	8.26	27.53
Home	87.77	52.00	112.34			
Other Home	20.89	12.00	35.99	Education (%):		
Pub / Nightclub	20.11	2.50	46.05	Low ^a	19.07	39.28
Restaurant	11.44	5.00	23.89	Medium	49.60	50.00
Other Contexts	26.01	6.00	56.62	High	29.42	45.57
				Other Education ^b	1.91	13.68
Drinks Per Occasion (Only if used context, n varies):						
Total All Contexts	3.79	2.49	3.83	Employment Status (%):		
Home	3.68	2.05	4.08	Full-Time Employed ^a	58.88	49.21
Other Home	4.47	3.01	4.46	Part-Time Employed	14.56	35.27
Pub / Nightclub	4.99	3.02	5.15	Student	10.73	30.95
Restaurant	2.25	2.05	1.75	Unemployed	2.46	15.50
Other Contexts	3.62	2.23	3.77	Sick / Invalid	1.20	10.88
				Retired	3.67	18.80
Reported annual drinking problems (among drinkers):						
Alcohol Related Disorder	0.56	0.00	5.16	Parenting / Unpaid Work	8.04	27.19
Symptoms of Dependence	0.94	0.00	12.27	Other Employment	0.46	6.77
Heavy Drinking	1.65	0.00	8.93			
Felt Effects	6.45	1.00	24.58	Age Group (%):		
Sum of All Problems	9.64	1.00	37.85	14–15 years	3.10	17.33
				16–17 years	4.73	21.22
				18–19 years ^d	4.58	20.91
				20–24 years	9.72	29.62
Gender (%):						

Variable	Mean	Median	Std. Dev.	Variable	Mean	Std. Dev.
Female ^a	53.61		49.87	25–44 years	44.93	49.74
Male	46.39		49.87	45–65 years	32.94	47.00
Prioritized Ethnicity (%):				Survey Year (%):		
European ^a	82.70		37.82	1995 ^a	29.36	45.55
Maori	11.41		31.79	2000	29.77	45.73
Pacif	2.42		15.37	2004	40.87	49.16
Asian	2.79		16.47			
Other	0.68		8.20	Interact MPA Law with Age (%):		
				16–17 years	3.27	17.78
				18–19 years	3.29	17.84

Notes: Drinking participation statistics are estimated among all respondents age 14–65 with complete demographic information (n=16,240). Drinking frequency and demographic statistics are estimated among all drinkers with complete drinking data (n=13,243). Context-specific drinks per occasion are estimated only among those consuming in a context (n ranges from 7,676 at pubs to 12,074 at home). Drinking problem statistics are estimated among all drinkers who reported both their drinking and specific problems (n ranges from 12,952 to 13,143). Descriptive statistics are weighted to adjust for oversampling of ages 14–19 in years 2000 and 2004.

^a Reference category not included in regressions.

^b Education levels were coded based on years completed; "other" refers to credentials (often foreign) with unclear levels.

Table 2

Associations of MPA change and age with drinker status and drinking frequency

Variable	Frequency of context use per year among drinkers					
	Any drinking	Across Contexts	Home	Other Home	Pub or Nightclub	Restaurant
Age Group Effects (vs. 18–19)						
14–15	–0.64** (–2.86)	–84.05** (–5.08)	–1.95 (–0.17)	–16.24** (–4.01)	–115.51** (–15.35)	–16.11** (–4.84)
16–17	0.57 (1.90)	–84.41** (–4.67)	–23.92 (–1.89)	–10.37* (–2.36)	–62.61** (–8.73)	–8.02* (–2.28)
20–24	0.83** (3.70)	18.52 (1.31)	13.38 (1.36)	–5.03 (–1.47)	13.49** (2.60)	4.81 (1.81)
25–44	0.28 (1.33)	–35.46** (–2.59)	41.75** (4.40)	–15.97** (–4.83)	–39.66** (–7.87)	1.75 (0.68)
45–65	0.04 (0.18)	–15.94 (–1.15)	76.81** (7.99)	–20.89** (–6.23)	–59.46** (–11.59)	0.90 (0.35)
Year Effects (vs. 1995)						
2000	–0.06 (–0.85)	–3.85 (–0.95)	1.07 (0.39)	–1.49 (–1.49)	1.35 (0.85)	–3.71** (–4.93)
2004	–0.17** (–2.67)	4.02 (1.05)	6.58* (2.51)	0.55 (0.59)	2.89 (1.91)	–3.73** (–5.25)
Post-MPA effects specific to key age groups						
Post MPA * Age 16–17	–0.21 (–0.84)	42.04** (2.75)	22.11* (2.05)	11.65** (3.12)	–12.44# (–1.86)	–1.92 (–0.61)
Post MPA * Age 18–19	1.05** (4.50)	33.74* (2.13)	7.39 (0.67)	5.92 (1.54)	15.26** (2.62)	4.32 (1.45)
<i>Number of Cases</i>	16,240				13,243	

Note: All models also control for gender, primary ethnicity, income, education, employment status, and an intercept (results presented in web-only supplementary material). Coefficients for the any-drinking analyses are presented as log odds ratios. Z-scores shown in parentheses below model coefficients.

* p < 0.05;

** p < 0.01 (two tailed);

p < 0.05 using one-tailed test for a hypothesized negative effect

Table 3

Associations of MPA change and age with drinks per occasion (DPO)

Typical drinks per occasion among drinkers using context						
Variable	Total Across Contexts	Home	Other Home	Pub or Nightclub	Restaurant	Other Contexts
Age Group Effects (vs. 18–19)						
14–15	-2.23** (-6.53)	-2.78** (-6.85)	-1.91** (-4.40)	-3.01** (-3.16)	-0.60* (-2.38)	-1.46** (-3.67)
16–17	-0.75* (-2.01)	-1.48** (-3.28)	-0.47 (-1.01)	-0.94 (-1.27)	-0.34 (-1.33)	-0.64 (-1.50)
20–24	0.22 (0.75)	0.67 (1.93)	-0.07 (-0.21)	0.09 (0.20)	0.47** (2.64)	-0.58 (-1.76)
25–44	-1.90** (-6.73)	-1.73** (-5.18)	-2.84** (-8.29)	-1.73** (-3.85)	0.48** (2.80)	-1.77** (-5.56)
45–65	-3.02** (-10.55)	-2.84** (-8.41)	-3.99** (-11.48)	-3.50** (-7.59)	0.23 (1.33)	-2.42** (-7.51)
Year Effects (vs. 1995)						
2000	0.53** (6.31)	0.66** (6.94)	0.72** (6.81)	0.49** (3.25)	-0.19** (-3.86)	0.35** (3.55)
2004	0.82** (10.38)	0.57** (6.33)	0.65** (6.48)	2.06** (14.26)	-0.10* (-2.17)	1.01** (10.74)
Post-MPA effects specific to key age groups						
Post MPA * Age 16–17	1.01** (3.22)	1.22** (3.16)	0.91* (2.30)	-0.23 (-0.29)	0.19 (0.78)	0.97** (2.62)
Post MPA * Age 18–19	0.51 (1.57)	1.01** (2.59)	0.87* (2.19)	-0.94 (-1.82)	0.25 (1.23)	-0.06 (-0.16)
Number of Cases						
	13,243	12,074	11,357	7,676	9,130	10,045

Note: All models also control for gender, primary ethnicity, income, education, employment status, and an intercept (results presented in web-only supplementary material). Z-scores shown in parentheses below model coefficients.

*
p < 0.05;

**
p < 0.01 (2-tailed)

Table 4

Associations of drinking variables with alcohol-related problems, with changes following the MPA reduction (New Zealand National Surveys: 1995, 2000, and 2004)

	All Problems		Alcohol Related Disorder		Symptoms of Dependence		Heavy Drinking		Felt Effects	
	Coefficient	z-score	Coefficient	z-score	Coefficient	z-score	Coefficient	z-score	Coefficient	z-score
(A) Frequency Effects Pre-MPA										
Own Home	-0.007	(-1.21)	-0.010***	(-3.30)	0.011	(1.56)	-0.009*	(-2.57)	-0.015**	(-2.73)
Others' Home	0.046*	(2.09)	0.010	(0.98)	0.039	(1.62)	0.003	(0.19)	0.044*	(2.21)
Pub / Nightclub	0.042**	(2.60)	0.008	(1.11)	0.032	(1.46)	0.013	(1.33)	0.041***	(3.34)
Restaurant	0.002	(0.06)	0.004	(0.31)	0.007	(0.19)	-0.007	(-0.32)	-0.006	(-0.24)
Other Contexts	0.001	(0.09)	-0.011	(-1.39)	0.012	(1.04)	0.000	(0.05)	0.000	(-0.01)
(B) Dose-Response Effects Pre-MPA										
Own Home	0.019***	(6.89)	0.004***	(4.56)	0.003	(1.00)	0.005**	(3.23)	0.015***	(7.37)
Others' Home	0.021***	(3.85)	0.002	(1.41)	0.003	(0.99)	0.007*	(2.40)	0.013***	(3.84)
Pub / Nightclub	0.031***	(8.45)	0.003**	(2.87)	0.006	(1.88)	0.006**	(3.02)	0.022***	(8.23)
Restaurant	0.047*	(2.00)	0.003	(0.48)	0.000	(-0.01)	0.014	(1.20)	0.044*	(2.49)
Other Contexts	0.038***	(11.19)	0.005***	(3.48)	0.006*	(1.99)	0.013***	(7.75)	0.024***	(9.29)
(C) Post-MPA Change in Frequency Effect										
Own Home	0.007	(0.93)	0.008*	(2.41)	-0.010	(-1.09)	0.008*	(2.09)	0.008	(1.26)
Others' Home	-0.036	(-1.29)	-0.013	(-1.05)	-0.038	(-1.21)	-0.008	(-0.48)	-0.018	(-0.75)
Pub / Nightclub	0.090***	(4.86)	0.015	(1.81)	0.008	(0.30)	0.020*	(1.99)	0.078***	(5.20)
Restaurant	-0.004	(-0.10)	-0.017	(-1.01)	0.006	(0.13)	-0.001	(-0.05)	-0.001	(-0.04)
Other Contexts	0.024	(1.29)	0.017*	(1.98)	0.015	(0.96)	0.010	(1.34)	0.017	(0.98)
(D) Post-MPA Change in Dose-Response Effect										
Own Home	-0.004	(-1.21)	-0.0032**	(-3.17)	0.002	(0.54)	-0.003	(-1.52)	-0.003	(-1.08)
Others' Home	0.014*	(2.27)	0.002	(1.34)	0.007	(1.67)	0.006	(1.92)	0.007	(1.65)
Pub / Nightclub	-0.0137**	(-3.18)	-0.003*	(-2.46)	-0.002	(-0.66)	-0.002	(-0.94)	-0.012***	(-3.75)
Restaurant	0.011	(0.44)	0.001	(0.16)	0.016	(0.70)	0.006	(0.45)	0.005	(0.24)

	All Problems		Alcohol Related Disorder		Symptoms of Dependence		Heavy Drinking		Felt Effects	
	Coefficient	z-score	Coefficient	z-score	Coefficient	z-score	Coefficient	z-score	Coefficient	z-score
Other Contexts	-0.021***	(-4.51)	-0.002	(-1.49)	-0.003	(-0.81)	-0.010***	(-4.57)	-0.015***	(-4.49)
Direct Post-MPA Effect	0.233	(0.30)	-0.469	(-1.20)	-0.215	(-0.16)	0.354	(0.75)	0.247	(0.43)
Number of Cases	12,952		13,143		13,113		13,099		13,028	

Separate Tobit analyses were estimated for four individual problem categories plus the sum across all problem groups. Each problem outcome was regressed on annual frequency of consuming at each context (section A) as well as the context-specific quantity of drinks consumed beyond the first (section B). Sections C and D present the effects of interactions between these context specific drinking measures and a post-MPA indicator. Thus sections A and B are interpretable as the drinking variables' effects prior to the MPA reduction, and sections C and D are interpretable as the change in each relationship following the MPA law. A separate indicator variable tests for post-MPA changes in problems that are not explained by the drinking-related measures or other covariates. Each coefficient measures the number of additional problems associated with an additional visit to a context (for context utilization) or drink per occasion at that context (for dose response). All analyses also controlled for demographic and economic indicators including gender, age group, primary ethnicity, income, education, and an intercept; these results are presented as web-only supplementary material.

p < 0.001

**
p < 0.010

*
p < 0.050