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**Population-based study of premature mortality in relation to neighborhood density of
alcohol sales and cheque cashing outlets**

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Abstract

Background: Alcohol overuse and poverty often co-exist within a neighborhood. Cheque cashing places (CCP), an independent marker of poverty, may facilitate rapid access to cash and alcohol from local bars and retail stores.

Objective: We explored whether neighborhood density of CCPs and alcohol outlets are related to premature mortality among adults aged 20-59 years.

Design: Retrospective population-based study.

Setting: All 140 neighborhoods in Toronto, Ontario, 2005-2009.

Participants: Adults aged 20-59 years.

Primary and secondary outcome measures: Across all neighborhoods we explored, separately and jointly, neighborhood density of CCPs and alcohol outlets and their relation to premature mortality. Poisson regression was used to generate relative risks (aRRs) and 95% confidence intervals (CIs), adjusting for material deprivation quintile, crime quintile and number of banks. A sensitivity analysis examined alcohol-focused establishments, namely, on-premise establishments like bars and nightclubs, in addition to retail liquor and beer stores.

Results: Premature mortality for males ranged from 83-116 deaths per 10,000, nearly double that for females (54-61 per 10,000). Comparing the highest vs. lowest CCP quintiles (Q), the aRR for death was 1.22 (95% CI 1.12-1.34) in men and 1.14 (95% CI 1.01-1.28) in women. The association between alcohol outlet density and premature mortality was U-shaped, but was not significant upon restricting to alcohol-focused sales outlets. Neighborhoods with joint CCP Q3 and alcohol-focused outlet Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36-1.75) and females (1.39, 95% CI 1.18-1.64). This study was done at the area level, so individual data such as alcohol consumption were not known.

Conclusion: CCP and alcohol outlet density within neighborhoods may be a marker of premature mortality.

Keywords: Premature mortality, cheque cashing places, cheque cashing outlets, ethanol, alcohol sales, bars, gender, poverty.

Strengths and Limitations of the Study

- Premature death among young and middle-aged adults has received little attention, despite the fact that many deaths are accidental and potentially highly preventable.
- This study was done within a universal health setting in which all residents have full access to primary and hospital care services, and where both retail in-store and on-premise alcohol sales are completely regulated by provincial licensing.
- We showed that a moderate to high concentration of cheque cashing places, in conjunction with a higher concentration of outlets specifically focused on alcohol sales, was associated with the highest risk of premature mortality.
- We did not capture alcohol consumption at the individual level, nor did we consider race/ethnicity, a potentially important confounder between low income status and premature mortality.

Background

Preventing untimely or premature death is a major goal of healthcare and public health programs. Current definitions of “premature mortality” differ, but most studies use an age range of birth to 75 years¹⁻⁴. While this broad age range may identify potential years of life lost^{4,5}, it may obscure our understanding of those factors that are preventable in adulthood. The reason is that most deaths among children are from events arising around or in the perinatal period, while most seniors succumb to cancer or cardiovascular disease. Indeed, the top causes of death in young and middle aged adults are very different from those that claim the lives of older adults. For example, in Canada, accidents and self-harm are leading causes of death among those aged 25 to 44 years. After age 64 years, accidents are no longer in the top three, displaced by cancer and heart disease⁶.

Most premature deaths among young and middle-aged adults are potentially highly preventable. In many nations, alcohol use is an important risk factor for mortality. In Russia, for example, premature mortality has been studied among working-aged males 25 to 54 years⁷⁻⁹. It is estimated that 43% of reported deaths among males aged 25 to 54 in Izhevsk, Russia are attributed to hazardous drinking⁷. In early and middle adulthood, alcohol leads to accidental death through impaired functioning and a higher propensity for risky behavior among males^{10,11}. We recently showed a higher risk for being hospitalized as a result of serious assault in association with alcohol sales, especially true among young urban men¹².

Evidence suggests that poverty too is a driver of premature mortality¹³, with higher rates of mortality at lower income levels¹⁴. Lochner et al¹⁵ found that people living in US states with greater income inequality experienced higher mortality than those living in states with less income inequality, an effect especially seen among impoverished Whites. Others have found a doubling in death due to homicide among residents living in low-income versus high-income neighborhoods¹⁶. Beyond direct measures of income status, one may use other area indicators of economic and social instability, such as the presence of cheque cashing places (CCP), for example. Previous research suggests that these outlets are strategically placed in low income neighborhoods to meet the needs of more vulnerable populations¹⁷. We and others have shown that there is a linear relation between the density of CCP and crime, independent of classic indicators of poverty^{18,19}.

What is not well understood is the relation between CCP (as an indicator of both low income and access to quick cash), the density of alcohol sales outlets and premature mortality at the neighborhood level, especially among susceptible adults aged 20 to 59 years. We explored this question in a setting where both retail in-store and on-premise alcohol sales are completely regulated by provincial licensing, and in which there is detailed information on CCP density and premature mortality.

Methods

This population based study was conducted in the City of Toronto, Canada using its 140 pre-defined neighborhoods as the geographic units for analysis. These neighborhoods, created by the Social Policy Analysis and Research unit in the City's Social Development & Administration Division, with assistance from Toronto Public Health, contain an average of 7,000-10,000 residents (<http://www.toronto.ca/demographics/neighbourhoods.htm>). Toronto is the largest city in the province of Ontario, where universal health care is available to virtually all residents.

The study outcome was **all-cause mortality** among adults aged 20-59 years, based on Ontario Mortality Data from 2005 to 2009 (Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO). Data were also available by sex.

We explored two exposure variables, separately, and in combination. The first was the neighborhood density of **CCPs**. The second was the neighborhood density of **alcohol outlets**. Toronto CCPs were identified through online Google and Yellow Pages directory Internet searches, using the terms “cheque cashing”, “payday loans” and “cash”, as described elsewhere¹². **All alcohol outlets** comprised all retail liquor¹² and beer stores, as well as all on-premise licensed facilities, including restaurants, bars, pubs, social clubs and hotels. Since all retail and on-premise alcohol sales in Ontario are governmentally licensed and regulated, this approach captures nearly all places where alcohol can be purchased by the public.

Using the address postal code, a CCP or alcohol outlet was assigned to a given Toronto neighborhood. The density of CCPs and alcohol outlets were each expressed as a number per 10,000 residents per neighborhood, and then further assigned to a quintile based on ranking neighborhoods from lowest density (quintile 1) to highest (quintile 5). Quintiles were calculated using the RANK procedure in SAS.

Based on previous work¹⁸, as covariates, we assigned to each neighborhood all-cause police-reported crime from the 2006 Uniform Crime Reporting Survey (<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3302>) and number of full-access main bank branches ([http://en.wikipedia.org/wiki/Big_Five_\(banks\)](http://en.wikipedia.org/wiki/Big_Five_(banks))) – each per 10,000 residents, further transformed into quintiles. Neighborhood prosperity, another covariate, was expressed as a material deprivation index quintile, based on the 2006 Ontario Marginalization Index²⁰; <http://www.torontohealthprofiles.ca/onmarg.php>. Material deprivation includes six census measures expressed as percentages: aged ≥ 20 years without high school graduation, lone parent families, population receiving government transfer payments, aged ≥ 15 and unemployed, living below the low income cut-off, and homes needing major repairs.

Data analysis

The association between premature mortality and the quintile-defined density of CCPs was examined using Poisson regression, with the natural log of the number of residents in each neighborhood as the offset variable, based on the 2006 Canada Census (http://en.wikipedia.org/wiki/Canada_2006_Census). An unadjusted relative risk (RR) and 95% confidence interval (CI) expressed the relation between premature mortality and increasing CCP density, with the lowest CCP quintile as the referent. Adjusted RRs (aRR) were calculated by adding quintiles of crime, banks and material deprivation to the model, for males and females combined, as well as individually by sex.

The same unadjusted and adjusted models were used to explore the relation between alcohol outlet quintiles and premature mortality. We performed a sensitivity analysis restricting the alcohol outlets to those not typically associated with food service or accommodation (called “**alcohol focused outlets**” herein), namely, on-premise establishments designated for adult entertainment, bars, taverns, nightclubs, billiard/pool halls, gaming facilities, lounges, and stadiums, in addition to retail liquor and beer stores (Supplemental Table 1).

To analyze the **joint effect** (i.e., co-presence) of CCPs and alcohol outlets and their relation to premature mortality, we collapsed the lowest two (Q1 and Q2) and highest two (Q4 and Q5) quintiles together for each variable, and kept Q3 on its own, for ease of interpretation. We ran the same multivariable Poisson regression models as above, separately for males and females. All statistical analyses were performed using SAS Version 9.3 (SAS Institute Inc., Cary,

North Carolina, USA). The study was approved by the Research Ethics Board of St. Michael's Hospital.

Results

In 2006, Toronto's 140 neighborhoods together had a population of 2,493,125 residents, of whom 1,478,610 were aged 20 to 59 years, and 48% were male (Table 1). Overall, the density of **all alcohol outlets** was 19.4 per 10,000, **alcohol focused outlets** 1.8 per 10,000, and CCPs 1.3 per 10,000 persons. The average crime rate was 425.9 per 10,000 residents.

Among adult males aged 20 to 59 years, intentional self-harm, accidental poisoning and liver disease were on the top-five leading causes of death (Supplemental Table 1). For females, cancer was the dominant cause of death, and intentional self-harm was among the top-five causes.

Premature mortality for males ranged from 83 to 116 deaths per 10,000, nearly double that for females (54 to 61 per 10,000) (Figure 1). There was a graded relation between CCP density and premature mortality (Table 2 and Figure 1). This was seen for males and females, and after adjusting for certain covariates. For example, the RR between CCP Q5 vs. 1 was 1.22 (95% CI 1.12 to 1.34) for men and 1.14 (95% CI 1.01 to 1.28) for women.

The relation between the density of **all alcohol outlets** and premature mortality was U-shaped, with the lowest risk at Q3, especially among males (Figure 1). Upon limiting the analysis to **alcohol focused outlets**, the adjusted RR was significantly lower in Q2 and Q5 among men (Table 2 and Figure 1).

In the joint analysis of the density of CCPs and **all alcohol outlets**, there was a significantly increased risk of premature mortality for Q3 CCP with either Q1&2 or Q4&5 (Table 3, Figure 2). Neighborhoods with joint CCP Q3 and **alcohol-focused outlet** Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36 to 1.75) and females (1.39, 95% CI 1.18 to 1.64).

Upon repeating the above analyses, but restricting the definition of premature mortality to deaths between ages 20 and 49 years, the results were generally the same (Supplemental Tables 2 and 3).

Discussion

Moderate to high neighborhood density of CCPs was significantly associated with a higher risk of premature mortality for both men and women, even after adjusting for material deprivation, crime, and number of banks. Alcohol outlet density had a U-shaped relation to premature mortality. Low CCP density in the presence of either low (Q1&2), moderate (Q3) or high (Q4&5) alcohol outlets had virtually no relation to premature mortality, potentially suggestive of a threshold effect for CCPs.

Previous research has observed an association between location of CCPs and violent crime^{18 19}, as well as alcohol sales and serious assault^{12 21 22}. There is growing evidence about the negative effects of CCPs and pay day loan services on health and welfare of communities^{19 23 24}. Moreover, the link between alcohol sales and premature mortality is well established^{2 7 25 26}, as is that between poverty and increased morbidity and mortality²⁷⁻³⁰. However, little attention has focused on premature death among young and middle-aged adults, despite the fact that many deaths are accidental and potentially highly preventable. Most studies considered premature mortality from birth to aged 75 years¹⁻⁴, but the differing age-related causes of death across this broad age range obscures a deeper understanding of the causes of death among young and middle-aged adults. Furthermore, this population constitutes the majority of the workforce and is sensitive to economic conditions such as those that contribute to the CCP density. Hence, it was both logical and novel for us to assess whether CCP density and alcohol outlet density – both individually and together – impact on premature mortality at the neighborhood level, especially among young and middle-aged adults. This study was done within a universal health setting in which all Ontario residents have full access to primary and hospital care services.

To reduce data suppression due to small cell sizes, we aggregated our data at the neighborhood level. Accordingly, the presence of an on-premise or retail alcohol sales outlet did not necessarily reflect alcohol consumption by those who reside in a given neighborhood. Herein, we did not consider race/ethnicity, a potentially important confounder between low income status and premature mortality. In the US, victims of violent crime are more likely to be of Black or Hispanic ancestry³¹ and assault-related premature mortality is four-fold higher in the US than in Canada (<http://www.conferenceboard.ca/hcp/details/health/premature-mortality-rate.aspx>). While CCPs are more concentrated in US ethnic minority enclaves³², Toronto's neighborhoods tend to be more ethnically diverse, and homicide is not a leading cause of death

(Supplemental Table 1). Given the cross-sectional nature of the data we could not assess when CCPs or alcohol outlets were first introduced to each neighborhood. We also could not assign a neighborhood postal code to persons of no fixed address. Future studies might examine changes in mortality patterns with the opening and closing of CCPs or alcohol outlets, as well as creating a category for persons without a residential address.

It is challenging to conduct large population-based studies on alcohol-related harm using individual-level data on alcohol consumption³³⁻³⁵. Certainly, persons who are most apt to overuse alcohol may be least likely to respond to household surveys^{36,37}, for example. Rather, a “birds-eye” view like ours is often necessary, wherein individual alcohol consumption cannot be measured. In Ontario, alcohol is completely regulated¹², enabling us to account for all places where alcohol is sold, unlike in other Canadian provinces or US states where private retail outlets exist³⁸⁻⁴⁰. Hence, in our study, where both retail in-store and on-premise alcohol sales were documented, it was possible to evaluate the general availability of alcohol within the population.

This study assessed two risk factors for premature mortality. The first was density of alcohol outlets. In recent research studies in Russia, alcohol-related premature mortality was explored among males aged 25-54 years^{7-9,40}. A large percentage of deaths in this age group was from hazardous drinking⁷. In early and midlife, alcohol impairs cognitive functioning, and, combined with a propensity for risk-taking behaviors among males, this increases the likelihood of injury and accidental death^{10,11}. In a study of hospitalizations for serious assault, we previously found that victimization increased with alcohol sales, especially among young urban men¹². For **all alcohol outlets**, at low to moderate density (Q2 and Q3) there was the lowest observed relative risk of premature mortality among males (Figure 1, middle panel). This association was not evident for **alcohol focused outlets** (Figure 1, lower panel). What differed between **alcohol focused outlets** and **all alcohol outlets** was on-premise facilities such as restaurants and social clubs (see Supplemental Table 2). Although seemingly contradictory, the presence of the latter type of facilities in neighborhoods may be protective. For one, they may be social gathering places, where activities are less centred on alcohol consumption, and their hours of operation are limited^{41,42}.

The second risk factor studied herein was the density of CCPs. Density of CCPs is most likely a proxy for poverty, which is a well-established risk factor for premature mortality^{1,2,25,42-45}. However, we accounted for a complex measure of material deprivation in our analyses.

Previous research on CCPs suggests that they are strategically placed in low income neighborhoods to meet the needs of more vulnerable populations¹⁷. Research also suggests that CCPs are often placed in areas where there is a high volume of violent and property crime^{18 19}, which we also adjusted for.

Our findings suggest that there may also be a synergistic effect between alcohol outlets and CCPs on premature mortality. Moderate to high saturation of CCPs, in combination with higher presence of alcohol-focused outlets, was a particularly bad combination, in terms of the risk of premature mortality. Thus, strategic placement of CCPs and alcohol-focused outlets in certain areas may provide local residents with ready access to quick cash and the purchase of alcohol. A provoking question that we cannot answer is whether economic bankruptcy foretells “health bankruptcy”, which in turn may result in premature death? We can generally identify economic bankruptcy at the individual level, and even at the area level if it affects enough local residents. A high density of CCPs may be an economic signpost that health interventions are needed within a community, including strategies that address the causes of premature death among men and women, such as intentional self-harm, poisoning and alcohol-related liver disease (Supplemental Table 1).

Solving the problem of alcohol-related harm at the community level is not easy⁴⁶. As alcohol and CCP industries are each often government regulated, should there be a restriction on the number of CCPs and/or the type of alcohol outlets in neighborhoods with high rates of premature death? While there is some compelling evidence for limiting alcohol sales⁴⁷ – both by number of outlets and hours of operation^{38 39 48} – less is known about that for CCPs. One approach to the latter would be to offer money management services for people at risk of alcohol overuse, in whom addiction overwhelms all aspects of their lives, including financial stability⁴⁹. In terms of CCPs themselves, we and others have argued that they are strategically placed where customers abound^{18 19 50}, and where mental illness and self-neglect are more prevalent. Offering support to these individuals, in terms of formal banking, budget management and addiction counseling all seem sensible as part of a strategy to reduce premature mortality. Moreover, physicians, nurses, addiction counselors and social workers who help persons with alcohol problems might use an individual’s neighborhood as an indicator of their risk for health decline, and even recommend relocation to an area with few CCPs and alcohol outlets. For example, residential relocation has been associated with greater cessation of injection drug use, especially

moving from a highly deprived to less deprived neighborhood⁵¹. For alcohol addiction, recovery is less likely among those who dwell in disadvantaged neighborhoods. Certainly, the place where one lives partly determines health behaviors and opportunities for health improvement⁴⁹.

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None.

Authors' contributions

JR, FIM, and MC conceived and designed the study. FIM, JR, MC and PG were involved in data collection. FIM, PG and AP performed data preparation and analysis. JR and FIM wrote manuscript. MC and AP helped revised manuscript. All authors read and approved the final manuscript.

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Competing interest

The authors declare that they have no competing interest.

Data Sharing Statement

There are no unpublished data related to the current study.

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Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females together and separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as well as all liquor and beer stores.

Figure 2. Risk of premature mortality in relation to the joint effect of cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years.

Table 1. Description of study variables for all 140 neighbourhoods in Toronto, Canada.

Variable	Value for that variable
Population of Toronto (2006)	
<i>Total size of population studied for all ages, across all neighbourhoods</i>	2 493 125
<i>Total number of residents aged 20-59 years, across all neighbourhoods</i>	1 478 610
<i>% male of residents aged 20-59 years, across all neighbourhoods</i>	48.4
<i>Mean (SD) number of residents per neighbourhood aged 20-59 years</i>	10 562 (5115)
<i>Mean (SD) number of residents per neighbourhood aged 20-49 years</i>	8307 (4149)
<i>Mean (SD) number of males aged 20-59 years per 10 000 residents</i>	5113 (2520)
<i>Mean (SD) number of females aged 20-59 years per 10 000 residents</i>	5448 (2623)
<i>Mean (SD) number of males aged 20-49 years per 10 000 residents</i>	4042 (2061)
<i>Mean (SD) number of females aged 20-49 years per 10 000 residents</i>	4264 (2110)
All alcohol outlets*	
<i>Total number for all neighbourhoods</i>	4626
<i>Mean (SD) number per 10 000 residents</i>	19.4 (23.7)
<i>Number (%) of neighbourhoods with no outlets</i>	1 (0.7)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	139 (99.3)
Alcohol focused outlets**	
<i>Total number for all neighbourhoods</i>	428
<i>Mean (SD) number per 10 000 residents</i>	1.8 (2.4)
<i>Number (%) of neighbourhoods with no outlets</i>	34 (24.3)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	106 (75.7)
Median (IQR) material deprivation index	4 (3)
Banks	
<i>Total number for all neighbourhoods</i>	472
<i>Mean (SD) number per 10 000 residents</i>	1.9 (1.6)
<i>Number (%) of neighbourhoods with no banks</i>	14 (10.0)
<i>Number (%) of neighbourhoods with ≥ 1 banks</i>	126 (90.0)
All crime (2006)	
<i>Mean (SD) number of all crimes per 10 000 residents</i>	425.9 (255.6)
<i>Mean (SD) number of violent crimes per 10 000 residents</i>	103.5 (54.3)
Cheque cashing places	
<i>Total number for all neighbourhoods</i>	310
<i>Mean (SD) number of cheque cashing places per 10 000 residents</i>	1.3 (1.4)
<i>Number (%) of neighbourhoods with no cheque cashing places</i>	42 (30.0)
<i>Number (%) of neighbourhoods with ≥ 1 cheque cashing places</i>	98 (70.0)

* Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as well as liquor and beer stores.

Table 2. Risk of premature mortality among adults aged 20 to 59 years in relation to density of cheque cashing place (CCP) or alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)			Adjusted relative risk (95% confidence interval)*		
	All	Males	Females	All	Males	Females
CCP quintile						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	1.01 (0.95 to 1.07)	0.99 (0.92 to 1.07)	0.98 (0.90 to 1.08)	0.96 (0.91 to 1.03)	0.96 (0.88 to 1.04)	0.96 (0.87 to 1.06)
<i>Q3</i>	1.34 (1.26 to 1.43)	1.36 (1.26 to 1.48)	1.26 (1.14 to 1.39)	1.17 (1.09 to 1.26)	1.20 (1.10 to 1.31)	1.15 (1.03 to 1.28)
<i>Q4</i>	1.23 (1.16 to 1.31)	1.26 (1.17 to 1.36)	1.10 (1.00 to 1.21)	1.05 (0.98 to 1.12)	1.09 (1.00 to 1.19)	1.00 (0.90 to 1.12)
<i>Q5</i>	1.41 (1.33 to 1.49)	1.42 (1.32 to 1.52)	1.25 (1.14 to 1.36)	1.19 (1.11 to 1.28)	1.22 (1.12 to 1.34)	1.14 (1.01 to 1.28)
All alcohol outlet quintile**						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.96 (0.90 to 1.03)	0.93 (0.85 to 1.01)	1.00 (0.90 to 1.11)	0.93 (0.87 to 1.00)	0.90 (0.82 to 0.98)	0.99 (0.88 to 1.11)
<i>Q3</i>	0.92 (0.86 to 0.98)	0.86 (0.78 to 0.93)	0.98 (0.88 to 1.09)	0.89 (0.83 to 0.96)	0.85 (0.77 to 0.93)	0.97 (0.86 to 1.09)
<i>Q4</i>	1.10 (1.03 to 1.17)	1.07 (0.99 to 1.16)	1.07 (0.96 to 1.18)	1.00 (0.93 to 1.08)	0.99 (0.90 to 1.09)	1.03 (0.91 to 1.16)
<i>Q5</i>	1.06 (0.99 to 1.13)	1.01 (0.94 to 1.09)	1.02 (0.93 to 1.14)	0.99 (0.91 to 1.07)	0.96 (0.87 to 1.06)	1.02 (0.89 to 1.16)
Alcohol focused outlet quintile***						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.98 (0.92 to 1.06)	0.97 (0.89 to 1.06)	0.94 (0.84 to 1.06)	0.89 (0.83 to 0.97)	0.89 (0.81 to 0.99)	0.90 (0.79 to 1.02)
<i>Q3</i>	1.15 (1.08 to 1.22)	1.11 (1.03 to 1.19)	1.11 (1.01 to 1.22)	1.01 (0.94 to 1.08)	0.99 (0.90 to 1.08)	1.04 (0.93 to 1.17)
<i>Q4</i>	1.12 (1.06 to 1.20)	1.09 (1.01 to 1.18)	1.06 (0.96 to 1.17)	1.00 (0.93 to 1.08)	0.98 (0.89 to 1.08)	1.01 (0.90 to 1.14)
<i>Q5</i>	1.07 (1.01 to 1.14)	1.01 (0.93 to 1.09)	1.05 (0.95 to 1.15)	0.90 (0.83 to 0.98)	0.85 (0.76 to 0.94)	0.98 (0.86 to 1.12)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as well as liquor and beer stores.

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Table 3. Risk of premature mortality among adults aged 20 to 59 years in relation to joint density of cheque cashing place (CCP) and alcohol outlet quintiles.

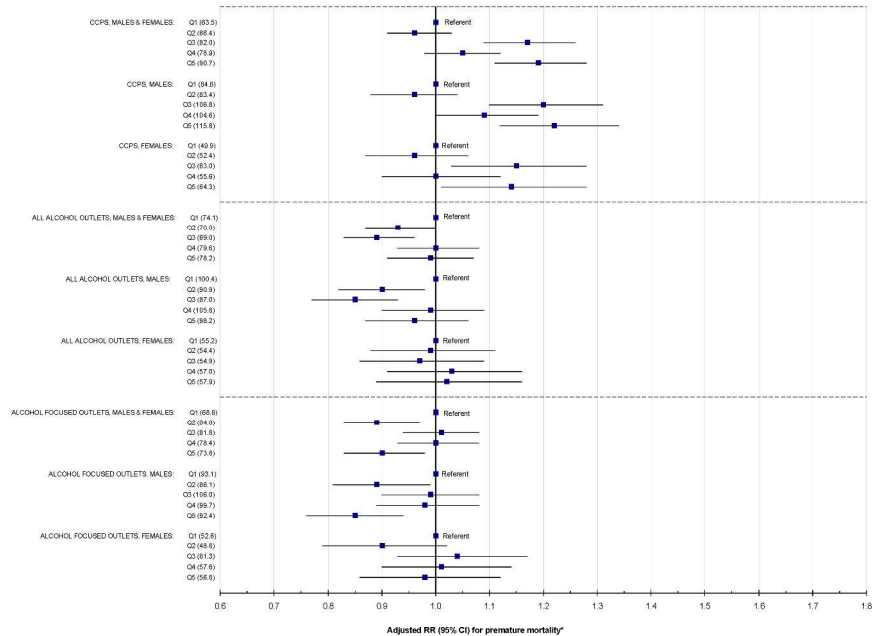
	Crude relative risk (95% confidence interval)				Adjusted relative risk (95% confidence interval)*		
	Overall	Males	Females		Overall	Males	Females
Joint CCP/All alcohol outlet quintiles**							
Q1&2/Q1&2	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q1&2/Q3	1.02 (0.94 to 1.10)	0.95 (0.86 to 1.05)	1.07 (0.95 to 1.20)		1.07 (0.99 to 1.16)	1.00 (0.91 to 1.11)	1.10 (0.98 to 1.25)
Q1&2/Q4&5	0.88 (0.82 to 0.94)	0.86 (0.79 to 0.94)	0.86 (0.77 to 0.96)		0.95 (0.87 to 1.04)	0.99 (0.89 to 1.10)	0.90 (0.79 to 1.03)
Q3/Q1&2	1.30 (1.20 to 1.41)	1.31 (1.18 to 1.45)	1.24 (1.09 to 1.41)		1.17 (1.08 to 1.28)	1.19 (1.07 to 1.32)	1.14 (1.00 to 1.31)
Q3/Q3	0.90 (0.75 to 1.07)	0.86 (0.69 to 1.08)	0.87 (0.65 to 1.15)		0.74 (0.62 to 0.89)	0.73 (0.58 to 0.92)	0.76 (0.57 to 1.02)
Q3/Q4&5	1.40 (1.28 to 1.52)	1.39 (1.25 to 1.55)	1.32 (1.15 to 1.52)		1.34 (1.22 to 1.48)	1.41 (1.25 to 1.60)	1.28 (1.09 to 1.50)
Q4&5/Q1&2	1.25 (1.14 to 1.38)	1.27 (1.13 to 1.43)	1.10 (0.94 to 1.28)		1.13 (1.02 to 1.25)	1.17 (1.03 to 1.33)	1.03 (0.87 to 1.22)
Q4&5/Q3	1.06 (0.98 to 1.15)	1.07 (0.96 to 1.18)	1.03 (0.90 to 1.17)		0.93 (0.85 to 1.02)	0.97 (0.86 to 1.08)	0.94 (0.82 to 1.07)
Q4&5/Q4&5	1.34 (1.27 to 1.42)	1.33 (1.25 to 1.43)	1.20 (1.10 to 1.31)		1.21 (1.13 to 1.30)	1.26 (1.15 to 1.38)	1.13 (1.00 to 1.26)
Joint CCP/Alcohol focused outlet quintiles***							
Q1&2/Q1&2	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q1&2/Q3	1.26 (1.17 to 1.36)	1.23 (1.12 to 1.35)	1.19 (1.06 to 1.33)		1.13 (1.04 to 1.23)	1.12 (1.01 to 1.25)	1.13 (0.99 to 1.29)
Q1&2/Q4&5	1.04 (0.97 to 1.12)	0.97 (0.88 to 1.06)	1.03 (0.92 to 1.15)		1.04 (0.95 to 1.13)	0.98 (0.88 to 1.10)	1.07 (0.93 to 1.22)
Q3/Q1&2	1.36 (1.24 to 1.48)	1.40 (1.25 to 1.56)	1.21 (1.05 to 1.39)		1.12 (1.02 to 1.24)	1.15 (1.02 to 1.30)	1.08 (0.93 to 1.27)
Q3/Q3	1.67 (1.52 to 1.83)	1.66 (1.48 to 1.86)	1.47 (1.27 to 1.71)		1.51 (1.37 to 1.67)	1.54 (1.36 to 1.75)	1.39 (1.18 to 1.64)
Q3/Q4&5	1.31 (1.17 to 1.46)	1.22 (1.05 to 1.41)	1.39 (1.17 to 1.65)		1.17 (1.03 to 1.32)	1.12 (0.95 to 1.31)	1.33 (1.10 to 1.61)
Q4&5/Q1&2	1.63 (1.49 to 1.79)	1.67 (1.50 to 1.87)	1.36 (1.17 to 1.58)		1.32 (1.19 to 1.46)	1.37 (1.20 to 1.55)	1.21 (1.02 to 1.43)
Q4&5/Q3	1.32 (1.22 to 1.42)	1.29 (1.17 to 1.43)	1.23 (1.09 to 1.39)		1.11 (1.02 to 1.22)	1.12 (1.00 to 1.26)	1.13 (0.98 to 1.30)
Q4&5/Q4&5	1.43 (1.35 to 1.52)	1.42 (1.31 to 1.52)	1.24 (1.13 to 1.36)		1.20 (1.11 to 1.30)	1.21 (1.09 to 1.34)	1.15 (1.01 to 1.31)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as well as liquor and beer stores

Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females together and separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as all liquor and beer stores.



*All Poisson regression models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females together and separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as all liquor and beer stores.

279x215mm (300 x 300 DPI)

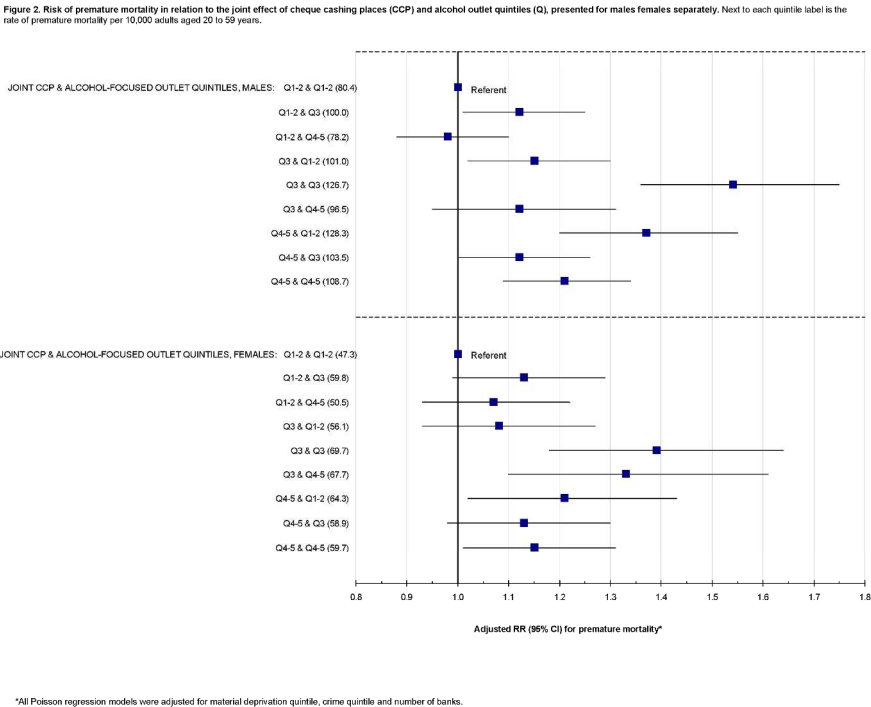


Figure 2. Risk of premature mortality in relation to the joint effect of cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years.
279x215mm (300 x 300 DPI)

Supplemental Table 1. Top five leading causes of death among residents of Toronto aged 20 to 59 years, 2005 to 2009.

Rank	Males	Females	Males and females
1	Ischemic heart disease	Breast cancer	Ischemic heart disease
2	Intentional self-harm	Lung cancer	Intentional self-harm
3	Lung cancer	Intentional self-harm	Lung cancer
4	Accidental poisoning	Ischemic heart disease	Breast cancer
5	Cirrhosis and other liver diseases	Colorectal cancer	Accidental poisoning

Source: Ontario Mortality Data 2005-09, Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO, Date Extracted, November, 2012.

Leading causes of death based on APHEO Leading Cause Groups for Mortality Tabulation

<http://www.apheo.ca/resources/indicators/APHEO%20Modifications%20to%20Lead%20CauseDeath%20Becker%20at%20al.,16Dec2008.pdf>

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Supplemental Table 2. Type of on-premise licensed alcohol outlets. Those in bolded italics were considered herein to be “alcohol focused”.

Type of Outlet
Restaurant
Bar/Sports Bar
Social Club
Hotel/Motel
Night Club
Bar /Tavern /Nightclub
Banquet Hall
Boat
Karaoke Bar/Restaurant
Billiard/Pool Hall
Live Theatre
Bowling Alley
Retirement Residence
Adult Entertainment
Educational Facility
Gaming Facility
Stadium
Golf Course
Motion Picture Theatre
Outdoor Area
Athletic Club
Military
Museum
Other
Railway Car

Supplemental Table 3. Risk of premature mortality among adults aged 20 to 49 years in relation to density of cheque cashing place (CCP) or alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)			Adjusted relative risk (95% confidence interval)*		
	All	Males	Females	All	Males	Females
CCP quintile						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	1.05 (0.96 to 1.15)	1.05 (0.94 to 1.18)	1.06 (0.91 to 1.22)	1.02 (0.93 to 1.12)	1.02 (0.91 to 1.16)	1.01 (0.87 to 1.18)
<i>Q3</i>	1.39 (1.26 to 1.52)	1.40 (1.24 to 1.57)	1.35 (1.16 to 1.57)	1.22 (1.10 to 1.35)	1.23 (1.08 to 1.41)	1.18 (0.99 to 1.39)
<i>Q4</i>	1.28 (1.18 to 1.40)	1.33 (1.19 to 1.49)	1.19 (1.03 to 1.37)	1.11 (1.00 to 1.23)	1.16 (1.02 to 1.32)	1.02 (0.87 to 1.21)
<i>Q5</i>	1.43 (1.32 to 1.55)	1.50 (1.35 to 1.66)	1.29 (1.12 to 1.47)	1.24 (1.11 to 1.38)	1.29 (1.13 to 1.48)	1.14 (0.95 to 1.36)
All alcohol outlets**						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.93 (0.84 to 1.02)	0.91 (0.81 to 1.03)	0.95 (0.81 to 1.12)	0.88 (0.79 to 0.98)	0.87 (0.76 to 0.99)	0.91 (0.76 to 1.08)
<i>Q3</i>	0.88 (0.79 to 0.97)	0.83 (0.73 to 0.95)	0.95 (0.81 to 1.11)	0.84 (0.76 to 0.94)	0.81 (0.70 to 0.92)	0.91 (0.76 to 1.09)
<i>Q4</i>	0.99 (0.90 to 1.09)	0.98 (0.87 to 1.10)	1.01 (0.87 to 1.18)	0.89 (0.80 to 1.00)	0.88 (0.77 to 1.02)	0.91 (0.76 to 1.09)
<i>Q5</i>	0.98 (0.89 to 1.07)	0.98 (0.87 to 1.09)	0.94 (0.81 to 1.10)	0.89 (0.79 to 1.00)	0.88 (0.75 to 1.01)	0.88 (0.73 to 1.08)
Alcohol focused outlets***						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	1.03 (0.92 to 1.14)	1.00 (0.87 to 1.14)	1.07 (0.90 to 1.26)	0.95 (0.84 to 1.06)	0.92 (0.80 to 1.07)	0.99 (0.82 to 1.19)
<i>Q3</i>	1.11 (1.01 to 1.21)	1.13 (1.01 to 1.27)	1.06 (0.91 to 1.22)	0.99 (0.89 to 1.10)	1.02 (0.89 to 1.17)	0.94 (0.79 to 1.12)
<i>Q4</i>	1.10 (1.01 to 1.21)	1.12 (1.00 to 1.27)	1.06 (0.91 to 1.23)	1.00 (0.89 to 1.12)	1.02 (0.88 to 1.17)	0.97 (0.81 to 1.17)
<i>Q5</i>	1.04 (0.95 to 1.14)	1.03 (0.92 to 1.16)	1.02 (0.88 to 1.18)	0.89 (0.79 to 1.00)	0.86 (0.74 to 1.01)	0.91 (0.75 to 1.11)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as as well as liquor and beer stores.

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Supplemental Table 4. Risk of premature mortality among adults aged 20 to 49 years in relation to joint density of cheque cashing place (CCP) and alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)				Adjusted relative risk (95% confidence interval)*		
	Overall	Males	Females		Overall	Males	Females
Joint CCP/All alcohol outlet quintiles**							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.01 (0.90 to 1.13)	0.93 (0.81 to 1.08)	1.11 (0.93 to 1.33)		1.06 (0.94 to 1.19)	1.00 (0.86 to 1.17)	1.14 (0.95 to 1.38)
<i>Q1&2/Q4&5</i>	0.86 (0.78 to 0.96)	0.85 (0.74 to 0.97)	0.88 (0.74 to 1.04)		0.94 (0.83 to 1.07)	0.94 (0.80 to 1.10)	0.93 (0.76 to 1.14)
<i>Q3/Q1&2</i>	1.35 (1.20 to 1.51)	1.35 (1.16 to 1.57)	1.33 (1.10 to 1.61)		1.22 (1.08 to 1.39)	1.23 (1.05 to 1.44)	1.19 (0.97 to 1.46)
<i>Q3/Q3</i>	0.98 (0.76 to 1.26)	1.02 (0.75 to 1.39)	0.89 (0.58 to 1.36)		0.81 (0.62 to 1.05)	0.83 (0.61 to 1.14)	0.75 (0.48 to 1.17)
<i>Q3/Q4&5</i>	1.32 (1.17 to 1.50)	1.26 (1.07 to 1.49)	1.38 (1.13 to 1.70)		1.28 (1.10 to 1.48)	1.26 (1.05 to 1.52)	1.26 (1.00 to 1.60)
<i>Q4&5/Q1&2</i>	1.43 (1.25 to 1.62)	1.45 (1.24 to 1.71)	1.34 (1.08 to 1.66)		1.27 (1.10 to 1.46)	1.34 (1.12 to 1.60)	1.14 (0.90 to 1.44)
<i>Q4&5/Q3</i>	1.09 (0.97 to 1.23)	1.09 (0.94 to 1.27)	1.10 (0.91 to 1.33)		0.97 (0.85 to 1.10)	0.98 (0.83 to 1.15)	0.96 (0.78 to 1.18)
<i>Q4&5/Q4&5</i>	1.30 (1.20 to 1.41)	1.33 (1.20 to 1.47)	1.20 (1.05 to 1.37)		1.17 (1.05 to 1.30)	1.20 (1.05 to 1.37)	1.08 (0.91 to 1.28)
Joint CCP/Alcohol focused outlet quintiles***							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.27 (1.14 to 1.42)	1.31 (1.14 to 1.51)	1.21 (1.01 to 1.44)		1.15 (1.01 to 1.31)	1.19 (1.01 to 1.40)	1.09 (0.89 to 1.34)
<i>Q1&2/Q4&5</i>	1.01 (0.91 to 1.13)	1.01 (0.88 to 1.16)	1.00 (0.84 to 1.18)		1.02 (0.90 to 1.16)	1.02 (0.86 to 1.20)	1.03 (0.84 to 1.26)
<i>Q3/Q1&2</i>	1.45 (1.27 to 1.64)	1.44 (1.22 to 1.70)	1.43 (1.17 to 1.76)		1.20 (1.04 to 1.38)	1.17 (0.98 to 1.40)	1.23 (0.99 to 1.54)
<i>Q3/Q3</i>	1.54 (1.34 to 1.78)	1.71 (1.44 to 2.04)	1.26 (0.99 to 1.61)		1.40 (1.20 to 1.63)	1.60 (1.32 to 1.94)	1.09 (0.84 to 1.41)
<i>Q3/Q4&5</i>	1.35 (1.15 to 1.59)	1.26 (1.02 to 1.56)	1.46 (1.14 to 1.88)		1.24 (1.03 to 1.48)	1.16 (0.92 to 1.47)	1.34 (1.02 to 1.77)
<i>Q4&5/Q1&2</i>	1.75 (1.54 to 1.99)	1.86 (1.58 to 2.19)	1.57 (1.26 to 1.94)		1.42 (1.22 to 1.64)	1.50 (1.25 to 1.81)	1.28 (1.00 to 1.63)
<i>Q4&5/Q3</i>	1.29 (1.15 to 1.45)	1.35 (1.16 to 1.56)	1.18 (0.98 to 1.43)		1.11 (0.97 to 1.27)	1.17 (0.98 to 1.39)	1.02 (0.82 to 1.27)
<i>Q4&5/Q4&5</i>	1.42 (1.30 to 1.55)	1.50 (1.34 to 1.67)	1.25 (1.08 to 1.44)		1.22 (1.08 to 1.37)	1.27 (1.08 to 1.48)	1.11 (0.92 to 1.35)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as as well as liquor and beer stores.

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Comments	Page in manuscript
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Completed	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Completed	2
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Completed	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	Completed	5
Methods				
Study design	4	Present key elements of study design early in the paper	Completed	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Completed	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Not applicable	
		(b) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Completed	5-6
Data sources/measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Completed	5-6
Bias	9	Describe any efforts to address potential sources of bias	Completed	8-9
Study size	10	Explain how the study size was arrived at	Completed	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Completed	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Completed	6

		(b) Describe any methods used to examine subgroups and interactions	Completed	6
		(c) Explain how missing data were addressed	Not applicable	
		(d) If applicable, explain how loss to follow-up was addressed	Not applicable	
		(e) Describe any sensitivity analyses	Completed	6 & 7
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Not applicable	
		(b) Give reasons for non-participation at each stage	Not applicable	
		(c) Consider use of a flow diagram	Not applicable	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Completed	5 & 7
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable	
		(c) Summarise follow-up time (eg, average and total amount)	Not applicable	
Outcome data	15*	Report numbers of outcome events or summary measures over time	Completed	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Completed	7
		(b) Report category boundaries when continuous variables were categorized	Completed	6-7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Completed	7
Discussion				
Key results	18	Summarise key results with reference to study objectives	Completed	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Completed	8-9

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Completed	9-10
Generalisability	21	Discuss the generalisability (external validity) of the study results	Completed	9
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Completed	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

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A Population-based Study of Premature mortality in relation to neighbourhood density of alcohol sales and cheque cashing outlets.

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A Population-based study of premature mortality in relation to neighbourhood density of alcohol sales and cheque cashing outlets

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Abstract

Objective: Alcohol overuse and poverty, each associated with premature death, often co-exist within socially disorganized neighborhoods. Cheque cashing places (CCPs) may be opportunistically placed in socially disorganized neighbourhoods, where customers abound. We explored whether neighbourhood density of CCPs and alcohol outlets are, individually, and in combination, related to premature mortality among adults.

Design: Retrospective population-based study.

Setting: 140 neighbourhoods in Toronto, Ontario, 2005-2009.

Participants: Adults aged 20-59 years.

Measures: Our primary outcome was premature all-cause mortality among adults aged 20-59 years. Across neighbourhoods we explored, separately and jointly, neighbourhood density of CCPs and alcohol outlets and their relation to premature mortality. Poisson regression provided relative risks (aRRs) and 95% confidence intervals (CIs), adjusting for material deprivation quintile, crime quintile and number of banks. A separate analysis examined alcohol-focused establishments, namely, on-premise establishments like bars and nightclubs, retail liquor and beer stores.

Results: Intentional self-harm, accidental poisoning and liver disease were among the top-five causes of premature death among males aged 20-59 years. The premature mortality rate was 96.3 per 10,000 males and 55.9 per 10,000 females. Comparing the highest vs. lowest CCP quintiles (Q), the aRR for death was 1.22 (95% CI 1.12-1.34) in men and 1.14 (95% CI 1.01-1.28) in women. The association between alcohol outlet density and premature mortality was U-shaped, CCP Q3 and alcohol-focused outlet Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36-1.75) and females (1.39, 95% CI 1.18-1.64).

Conclusion: There is a non-linear synergistic effect of CCP and alcohol outlet density on premature mortality, even upon controlling for conventional measures of poverty. In socially disorganized neighbourhoods, formal banking and alcohol reduction strategies might be added to health promotion policies aimed at reducing premature mortality.

Keywords: Premature mortality, cheque cashing places, cheque cashing outlets, ethanol, alcohol sales, bars, gender, poverty.

Strengths and Limitations of the Study

- Premature death among young and middle-aged adults has received little attention, despite the fact that many deaths are accidental and potentially highly preventable.
- This study was done within a universal health setting in which all residents have full access to primary and hospital care services, and where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing.
- We evaluated a novel marker of neighbourhood social disorganization -- cheque cashing outlet density -- and its impact on premature mortality, alone, and in combination with alcohol outlet density.
- We did not capture alcohol consumption at the individual level, nor did we consider race/ethnicity, a potentially important confounder between low income status and premature mortality.

Background

Preventing untimely or premature death is a major goal of healthcare and public health programs. Current definitions of “premature mortality” differ, but most studies use an age range of birth to 75 years.¹⁻⁴ While this broad age range may identify potential years of life lost,^{4,5} it may obscure our understanding of those factors that are preventable in adulthood. The reason is that most deaths among children are from events arising around or in the perinatal period, while most seniors succumb to cancer or cardiovascular disease. Indeed, the top causes of death in young and middle aged adults are very different from those that claim the lives of older adults. For example, in Canada, accidents and self-harm are leading causes of death among those aged 25 to 44 years. After age 64 years, accidents are no longer in the top three, displaced by cancer and heart disease.⁶

Most premature deaths among young and middle-aged adults are potentially highly preventable. In many nations, alcohol use is an important risk factor for mortality.^{5,7} About 6.0% of all deaths among Canadians are alcohol-related – twice that for men than for women -- resulting in 144,142 potential years of life lost.⁵ In other areas of the world, including Russia, where alcohol consumption has emerged as a major public health concern, it is estimated that 43% of reported deaths among males aged 25 to 54 are attributed to hazardous drinking⁸. In early and middle adulthood, alcohol leads to accidental death through impaired functioning and a higher propensity for risky behavior among males.^{9,10} We recently showed a higher risk for injury due to serious assault in association with alcohol sales, especially among young urban men.¹¹ Stockwell found that rates of alcohol-related death in British Columbia, Canada increased by 3.25% for each 20% increase in the density of private alcohol outlets.¹² Greater alcohol outlet density is associated with increased alcohol consumption and ensuing medical disease, injury, crime and violence.¹³

Studies suggest that the greater presence of chronic stressors at the residential level is associated with poorer health. Recent research on material deprivation, socioeconomic disadvantage, neighbourhood disorder and instability points to the negative impact of chronic stressors on health. Neighbourhood stress is most pronounced in low-income areas, and areas where mental and physical illness is more prevalent. Latkin and Curry¹⁴ and Matheson et al¹⁵ argue that social disorganization is also an important contributor to chronic stress among residents living in such disadvantaged neighbourhoods.

Evidence suggests that poverty – a known marker of socially disorganized neighbourhoods -- is also a driver of premature mortality.^{16 17} For example, there is a doubling in death due to homicide among residents living in low-income versus high-income neighbourhoods¹⁸. But beyond direct measures of income status, there may be additive benefit to using other area indicators of economic and neighbourhood social disorganization, such as the presence of cheque cashing places (CCPs).¹⁹ Previous research suggests that CCPs are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations²⁰. We and others have shown that there is a linear relation between the density of CCP and crime, independent of classic indicators of poverty.^{19 21}

What is not well understood is the nature of the individual and joint relation between CCP (as an indicator of neighbourhood social disorganization) and premature mortality, density of alcohol sales outlets (as a neighbourhood indicator of alcohol availability) and premature mortality. We explored this question in a setting where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing, and in which there is detailed information on CCP density and premature mortality.

Methods

This population based study was conducted in the City of Toronto, Canada using its 140 pre-defined neighbourhoods as the geographic units for analysis. These neighbourhoods, created by the Social Policy Analysis and Research unit in the City's Social Development & Administration Division, with assistance from Toronto Public Health, contain an average of 7,000-10,000 residents (<http://www.toronto.ca/demographics/neighbourhoods.htm>). Toronto is the largest city in the province of Ontario, where universal health care is available to virtually all residents.

The study outcome was premature mortality, defined as the number of deaths among adults aged 20-59 years per 10,000 people. Mortality data were extracted from the Ontario Mortality Data from 2005 to 2009 (Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO). Data were also available by sex. We pooled the data across all five years due to the low annual number of premature deaths in each neighbourhood.

We explored two exposure variables, separately, and in combination. The first was the neighbourhood density of **CCPs**. The second was the neighbourhood density of **alcohol outlets**. Toronto CCPs were identified through online Google and Yellow Pages directory Internet

searches, using the terms “cheque cashing”, “payday loans” and “cash”, as described elsewhere.¹¹ All alcohol outlets comprised all retail liquor¹¹ and beer stores, as well as all on-premise licenced facilities, including restaurants, bars, pubs, social clubs and hotels. We used lists of licenced on-premise and retail outlets provided by the Ontario Ministry of the Attorney General and the Liquor Control Board of Ontario as well as the Ontario Beer Stores. Thus, since all retail and on-premise alcohol sales in Ontario are governmentally licenced and regulated, this approach captures nearly all places where alcohol can be purchased by the public.

Using the address postal code, a CCP or alcohol outlet was assigned to a given Toronto neighbourhood. The density of CCPs and alcohol outlets were each expressed as a number per 10,000 residents per neighbourhood, and then further assigned to a quintile based on ranking neighbourhoods from lowest density (quintile 1) to highest (quintile 5). Quintiles were calculated using the RANK procedure in SAS.

Based on previous work,²¹ as covariates, we assigned to each neighbourhood all-cause police-reported crime from the 2006 Uniform Crime Reporting Survey (<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3302>) and number of full-access main bank branches ([http://en.wikipedia.org/wiki/Big_Five_\(banks\)](http://en.wikipedia.org/wiki/Big_Five_(banks))) – each per 10,000 residents, further transformed into quintiles. Neighbourhood prosperity, another covariate, was expressed as a material deprivation index quintile, based on the 2006 Ontario Marginalization Index²²; <http://www.torontohealthprofiles.ca/onmarg.php>. Material deprivation includes six census measures expressed as percentages: aged ≥ 20 years without high school graduation, lone parent families, population receiving government transfer payments, aged ≥ 15 and unemployed, living below the low income cut-off, and homes needing major repairs.

Data analysis

The association between premature mortality and the quintile-defined density of CCPs was examined using Poisson regression, with the natural log of the number of residents in each neighbourhood as the offset variable, based on the 2006 Canada Census (http://en.wikipedia.org/wiki/Canada_2006_Census). An unadjusted relative risk (RR) and 95% confidence interval (CI) expressed the relation between premature mortality and increasing CCP density, with the lowest CCP quintile as the referent. Adjusted RRs (aRR) were calculated by adding quintiles of crime, banks and material deprivation to the model, for males and females combined, as well as individually by sex.

The same unadjusted and adjusted models were used to explore the relation between alcohol outlet quintiles and premature mortality. We performed a separate analysis restricting the alcohol outlets to those not typically associated with food service or accommodation (called “**alcohol focused outlets**” herein), namely, on-premise establishments designated for adult entertainment, bars, taverns, nightclubs, billiard/pool halls, gaming facilities, lounges, and stadiums, in addition to retail liquor and beer stores (Supplemental Table 2). Hence, the density of **alcohol focused outlets** was used as a more specific measure of alcohol-seeking behavior at the neighbourhood level.

The **joint effect** (i.e., co-presence) of CCPs and alcohol outlets and their relation to premature mortality was analyzed by cross-categorizing neighbourhoods according to both CCP quintile and alcohol outlet quintile. Due insufficient cell sizes, it was necessary to collapse the lowest two quintiles (Q1 and Q2) and highest two quintiles (Q4 and Q5) for each individual variable before cross-categorizing them, resulting in 9 categories, with CCPs Q1 and Q2/Alcohol outlets Q1 and Q2 as the referent. We ran the same multivariable Poisson regression models as above, separately for males and females. All statistical analyses were performed using SAS Version 9.3 (SAS Institute Inc., Cary, North Carolina, USA). We calculated Moran’s I to assess spatial autocorrelation.²³ All I values ranged from 0.07 to 0.10, suggesting very low levels of spatial autocorrelation. The study was approved by the Research Ethics Board of St. Michael’s Hospital.

Results

In 2006, Toronto’s 140 neighbourhoods together had a population of 2,493,125 residents, of whom 1,478,610 were aged 20 to 59 years, and 48% were male (Table 1). Overall, the density of **all alcohol outlets** was 19.4 per 10,000, **alcohol focused outlets** 1.8 per 10,000, and CCPs 1.3 per 10,000 persons. The average crime rate was 425.9 per 10,000 residents.

Among adult males aged 20 to 59 years, intentional self-harm, accidental poisoning and liver disease were among the top-five causes of death (Supplemental Table 1). For females, cancer was the dominant cause of death, and intentional self-harm was among the top-five causes. The premature mortality rate among all persons aged 20 to 59 years was 74.1 per 10,000 residents, and was much higher for males (96.3 per 10,000) than females (55.9 per 10,000) (Table 1).

There was a relation between CCP density and premature mortality (Table 2 and Figure 1). This was seen for males and females, and after adjusting for certain covariates. For example, the RR between CCP Q5 vs. 1 was 1.22 (95% CI 1.12 to 1.34) for men and 1.14 (95% CI 1.01 to 1.28) for women.

The relation between the density of **all alcohol outlets** and premature mortality was U-shaped, with the lowest risk at Q3, especially among males (Figure 1). Upon limiting the analysis to **alcohol focused outlets**, the adjusted RR was significantly lower in Q2 and Q5 among men (Table 2 and Figure 1).

In the joint analysis of the density of CCPs and **all alcohol outlets**, there was a significantly increased risk of premature mortality for Q3 CCP with either Q1&2 or Q4&5 (Table 3, Figure 2). Neighbourhoods with joint CCP Q3 and **alcohol-focused outlet** Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36 to 1.75) and females (1.39, 95% CI 1.18 to 1.64).

Upon repeating the above analyses, but restricting the definition of premature mortality to deaths between ages 20 and 49 years, the results were generally the same (Supplemental Tables 3 and 4).

In the aforementioned analyses, adding neighbourhood area (in square kilometers) to the multivariable models did not significantly alter the study results (data not shown).

Discussion

Intentional self-harm, accidental poisoning and liver disease rank within the top-five causes of premature death among males aged 20 to 59 years, who are nearly twice as likely as females to die prematurely. Moderate to high neighbourhood density of CCPs was significantly associated with a higher risk of premature mortality for both men and women, even after adjusting for material deprivation, crime, and number of banks. Alcohol outlet density had a U-shaped relation to premature mortality. In neighbourhoods with a low density of CCPs, the co-presence of either low (Q1 and Q2), moderate (Q3) or high (Q4 and Q5) density of alcohol outlets had virtually no relation to premature mortality.

Stockwell showed that the density of private liquor stores is independently associated with local rates of alcohol-related death.¹² Alcohol impairs cognitive functioning, and, when combined with a higher propensity for risk-taking behaviors among males, increases their likelihood of intentional and unintentional injury and death.^{9 10} In a study of hospitalizations for

serious assault, we previously found that victimization increased with alcohol sales, especially among young urban men.¹¹ For **all alcohol outlets**, at low to moderate density (Q2 and Q3), the risk of premature mortality among males was at its lowest (Figure 1, middle panel). This association was not evident for **alcohol focused outlets**, however (Figure 1, lower panel). Unlike **alcohol focused outlets**, other licenced facilities, including restaurants and social clubs, function as gathering places less centered on alcohol consumption (Supplemental Table 2), where intoxication is usually not tolerated and the hours of operation are limited.^{24 25} In the current study, we attempted to clarify the relation between CCPs, with and without density of alcohol sales outlets, and premature mortality.

Density of CCPs is certainly a proxy for poverty, itself an established risk factor for premature mortality.^{1 2 25-29} However, in our analyses, we accounted for a complex measure of poverty, namely, material deprivation. Previous research on CCPs suggests that they are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations.²⁰ We established a rationale early in the paper to suggest that CCPs are another measure of social disorganization with an independent effect on premature mortality.

Previous research has observed an association between location of CCPs and violent crime,^{19 21} as well as alcohol sales and serious assault.^{11 30 31} There is growing evidence about the negative effects of CCPs and pay day loan services on health and welfare of communities.^{19 32 33} Moreover, the link between alcohol sales and premature mortality is well established,^{2 8 28 34} as is that between poverty and increased morbidity and mortality.³⁵⁻³⁸ However, little attention has focused on premature death among young and middle-aged adults, despite the fact that many deaths are from intentional and unintentional self-harm, and thus, are potentially highly preventable. Most studies considered premature mortality from birth to aged 75 years,¹⁻⁴ but the differing age-related causes of death across this broad group obscures our deeper understanding of why young and middle-aged adults die. Furthermore, these latter populations constitute the majority of the workforce, who are sensitive to the economic conditions that may contribute to CCP density. Hence, it was both logical and novel for us to assess whether CCP density and alcohol outlet density – both individually and together – impact on premature mortality at the neighbourhood level, especially among young and middle-aged adults. This study was done within a universal health setting in which all Ontario residents have full access to primary and hospital care services.

Study limitations

To reduce data suppression due to small cell sizes, we aggregated our data at the neighbourhood level. Accordingly, the presence of an on-premise or retail alcohol sales outlet did not necessarily reflect alcohol consumption by those who reside in a given neighbourhood. Herein, we did not consider race/ethnicity, a potentially important confounder between low income status and premature mortality. In the US, victims of violent crime are more likely to be of Black or Hispanic ancestry³⁹ and assault-related premature mortality is four-fold higher in the US than in Canada (<http://www.conferenceboard.ca/hcp/details/health/premature-mortality-rate.aspx>). While CCPs are more concentrated in US ethnic minority enclaves⁴⁰, Toronto's neighbourhoods tend to be more ethnically diverse, and homicide is not a leading cause of death (Supplemental Table 1). Given the cross-sectional nature of the data we could not assess when CCPs or alcohol outlets were first introduced to each neighbourhood. We also could not assign a neighbourhood postal code to persons of no fixed address. Future studies might examine changes in mortality patterns with the opening and closing of CCPs or alcohol outlets, as well as creating a category for persons without a residential address.

It is challenging to conduct large population-based studies on alcohol-related harm using individual-level data on alcohol consumption.⁴¹⁻⁴³ Certainly, persons most apt to overuse alcohol may be least likely to respond to household surveys,^{44 45} for example. Rather, a "birds-eye" view like ours is often necessary, wherein individual alcohol consumption cannot be measured. In Ontario, alcohol is completely regulated,¹¹ enabling us to account for all places where alcohol is sold, unlike in other Canadian provinces or US states, where private retail outlets exist.^{12 46 47} Hence, in our study, where both retail in-store and on-premise alcohol sales were documented, it was possible to evaluate the general availability of alcohol within the population.

Conclusion and implications

Our findings suggest that there may be a synergistic effect between alcohol outlets and CCPs on premature mortality. Moderate to high saturation of CCPs, in combination with higher presence of alcohol-focused outlets, was a particularly bad combination, in terms of the risk of premature mortality. Thus, strategic placement of CCPs and alcohol-focused outlets in certain areas may provide local residents with ready access to quick cash and the purchase of alcohol. A provoking question that we cannot answer is whether economic bankruptcy foretells "health bankruptcy", which in turn may result in premature death? We can generally identify economic

bankruptcy at the individual level, and even at the area level, if it affects enough local residents. A high density of CCPs may be an economic signpost that health interventions are needed within a community, including strategies that address the causes of premature death among men and women, such as intentional self-harm, poisoning and alcohol-related liver disease (Supplemental Table 1). Future research might explore the experiences of people faced with financial bankruptcy and its impact on their overall mental and physical health.

Solving the problem of alcohol-related harm at the community level is not easy.⁴⁸ As alcohol and CCP industries are each often government regulated, should there be a restriction on the number of CCPs and/or the type of alcohol outlets in neighbourhoods with high rates of premature death? While there is some compelling evidence for limiting alcohol sales⁴⁹ – both by number of outlets and hours of operation^{12 46 50} – less is known about that for CCPs. One approach to the latter would be to offer money management services for people at risk of alcohol overuse, in whom addiction overwhelms all aspects of their lives, including financial instability⁵¹. In terms of CCPs themselves, we and others have argued that they are strategically placed where customers abound,^{19 21 52} and where mental illness and self-neglect are more prevalent. This has implications for how we shape health improvement strategies among people living in such neighbourhoods. For example, offering support to these individuals, in terms of formal banking, budget management and addiction counseling all seem sensible as part of a strategy to reduce premature mortality. Moreover, physicians, nurses, addiction counselors and social workers who help persons with alcohol problems might use an individual's neighbourhood as an indicator of their risk for health decline, and even recommend relocation to an area with few CCPs and alcohol outlets. For example, residential relocation has been associated with greater cessation of injection drug use, especially moving from a highly deprived to less deprived neighbourhood.⁵³ For alcohol addiction, recovery is less likely among those who dwell in disadvantaged neighbourhoods.⁵¹ Certainly, the place where one lives partly determines health behaviors and opportunities for health improvement.

In conclusion, in neighbourhoods with higher than expected rates of premature mortality, lessening social disorganization might be achieved through encouraging use of formal banking methods and better money handling, alongside alcohol reduction strategies. One can then assess whether there follows a decline in the rate of fatal and non-fatal intentional self-harm, poisoning and acute liver disease.

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None.

Authors' contributions

JR, FIM, and MC conceived and designed the study. FIM, JR, MC and PG were involved in data collection. FIM, PG and AP performed data preparation and analysis. JR and FIM wrote manuscript. MC and AP helped revised manuscript. All authors read and approved the final manuscript.

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Competing interest

The authors declare that they have no competing interest.

Data Sharing Statement

There are no unpublished data related to the current study.

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Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females together and separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as all liquor and beer stores.

Figure 2. Risk of premature mortality in relation to the joint effect of cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as all liquor and beer stores.

Table 1. Description of study variables for all 140 neighbourhoods in Toronto, Canada.

Variable	Value for that variable
Population of Toronto (2006)	
<i>Total size of population studied for all ages, across all neighbourhoods</i>	2 493 125
<i>Total number of residents aged 20-59 years, across all neighbourhoods</i>	1 478 610
<i>% male of residents aged 20-59 years, across all neighbourhoods</i>	48.4
<i>Mean (SD) number of residents per neighbourhood aged 20-59 years</i>	10 562 (5115)
<i>Mean (SD) number of residents per neighbourhood aged 20-49 years</i>	8307 (4149)
<i>Mean (SD) number of males aged 20-59 years per 10 000 residents</i>	5113 (2520)
<i>Mean (SD) number of females aged 20-59 years per 10 000 residents</i>	5448 (2623)
<i>Mean (SD) number of males aged 20-49 years per 10 000 residents</i>	4042 (2061)
<i>Mean (SD) number of females aged 20-49 years per 10 000 residents</i>	4264 (2110)
All alcohol outlets*	
<i>Total number for all neighbourhoods</i>	4626
<i>Mean (SD) number per 10 000 residents</i>	19.4 (23.7)
<i>Number (%) of neighbourhoods with no outlets</i>	1 (0.7)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	139 (99.3)
Alcohol focused outlets**	
<i>Total number for all neighbourhoods</i>	428
<i>Mean (SD) number per 10 000 residents</i>	1.8 (2.4)
<i>Number (%) of neighbourhoods with no outlets</i>	34 (24.3)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	106 (75.7)
Median (IQR) material deprivation index	4 (3)
Banks	
<i>Total number for all neighbourhoods</i>	472
<i>Mean (SD) number per 10 000 residents</i>	1.9 (1.6)
<i>Number (%) of neighbourhoods with no banks</i>	14 (10.0)
<i>Number (%) of neighbourhoods with ≥ 1 banks</i>	126 (90.0)
All crime (2006)	
<i>Mean (SD) number of all crimes per 10 000 residents</i>	425.9 (255.6)
<i>Mean (SD) number of violent crimes per 10 000 residents</i>	103.5 (54.3)
Cheque cashing places	
<i>Total number for all neighbourhoods</i>	310
<i>Mean (SD) number of cheque cashing places per 10 000 residents</i>	1.3 (1.4)
<i>Number (%) of neighbourhoods with no cheque cashing places</i>	42 (30.0)
<i>Number (%) of neighbourhoods with ≥ 1 cheque cashing places</i>	98 (70.0)
Premature deaths among adults aged 20-59 years	
<i>Total number for all neighbourhoods</i>	10 862
<i>Total number among males for all neighbourhoods</i>	6 831
<i>Total number among females for all neighbourhoods</i>	4 181
<i>Mean (SD) number of deaths per 10 000 residents aged 20-59 years</i>	74.1 (27.7)
<i>Mean (SD) number of deaths per 10 000 male residents aged 20-59 years</i>	96.3 (36.7)

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<i>Mean (SD) number of female deaths per 10 000 female residents aged 20-59 years</i>	55.9 (18.1)
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* Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.
** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

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Table 2. Risk of premature mortality among adults aged 20 to 59 years in relation to density of cheque cashing place (CCP) or alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)			Adjusted relative risk (95% confidence interval)*		
	All	Males	Females	All	Males	Females
CCP quintile						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	1.01 (0.95 to 1.07)	0.99 (0.92 to 1.07)	0.98 (0.90 to 1.08)	0.96 (0.91 to 1.03)	0.96 (0.88 to 1.04)	0.96 (0.87 to 1.06)
<i>Q3</i>	1.34 (1.26 to 1.43)	1.36 (1.26 to 1.48)	1.26 (1.14 to 1.39)	1.17 (1.09 to 1.26)	1.20 (1.10 to 1.31)	1.15 (1.03 to 1.28)
<i>Q4</i>	1.23 (1.16 to 1.31)	1.26 (1.17 to 1.36)	1.10 (1.00 to 1.21)	1.05 (0.98 to 1.12)	1.09 (1.00 to 1.19)	1.00 (0.90 to 1.12)
<i>Q5</i>	1.41 (1.33 to 1.49)	1.42 (1.32 to 1.52)	1.25 (1.14 to 1.36)	1.19 (1.11 to 1.28)	1.22 (1.12 to 1.34)	1.14 (1.01 to 1.28)
All alcohol outlet quintile**						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.96 (0.90 to 1.03)	0.93 (0.85 to 1.01)	1.00 (0.90 to 1.11)	0.93 (0.87 to 1.00)	0.90 (0.82 to 0.98)	0.99 (0.88 to 1.11)
<i>Q3</i>	0.92 (0.86 to 0.98)	0.86 (0.78 to 0.93)	0.98 (0.88 to 1.09)	0.89 (0.83 to 0.96)	0.85 (0.77 to 0.93)	0.97 (0.86 to 1.09)
<i>Q4</i>	1.10 (1.03 to 1.17)	1.07 (0.99 to 1.16)	1.07 (0.96 to 1.18)	1.00 (0.93 to 1.08)	0.99 (0.90 to 1.09)	1.03 (0.91 to 1.16)
<i>Q5</i>	1.06 (0.99 to 1.13)	1.01 (0.94 to 1.09)	1.02 (0.93 to 1.14)	0.99 (0.91 to 1.07)	0.96 (0.87 to 1.06)	1.02 (0.89 to 1.16)
Alcohol focused outlet quintile***						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.98 (0.92 to 1.06)	0.97 (0.89 to 1.06)	0.94 (0.84 to 1.06)	0.89 (0.83 to 0.97)	0.89 (0.81 to 0.99)	0.90 (0.79 to 1.02)
<i>Q3</i>	1.15 (1.08 to 1.22)	1.11 (1.03 to 1.19)	1.11 (1.01 to 1.22)	1.01 (0.94 to 1.08)	0.99 (0.90 to 1.08)	1.04 (0.93 to 1.17)
<i>Q4</i>	1.12 (1.06 to 1.20)	1.09 (1.01 to 1.18)	1.06 (0.96 to 1.17)	1.00 (0.93 to 1.08)	0.98 (0.89 to 1.08)	1.01 (0.90 to 1.14)
<i>Q5</i>	1.07 (1.01 to 1.14)	1.01 (0.93 to 1.09)	1.05 (0.95 to 1.15)	0.90 (0.83 to 0.98)	0.85 (0.76 to 0.94)	0.98 (0.86 to 1.12)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

Table 3. Risk of premature mortality among adults aged 20 to 59 years in relation to joint density of cheque cashing place (CCP) and alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)				Adjusted relative risk (95% confidence interval)*		
	Overall	Males	Females		Overall	Males	Females
Joint CCP/All alcohol outlet quintiles**							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.02 (0.94 to 1.10)	0.95 (0.86 to 1.05)	1.07 (0.95 to 1.20)		1.07 (0.99 to 1.16)	1.00 (0.91 to 1.11)	1.10 (0.98 to 1.25)
<i>Q1&2/Q4&5</i>	0.88 (0.82 to 0.94)	0.86 (0.79 to 0.94)	0.86 (0.77 to 0.96)		0.95 (0.87 to 1.04)	0.99 (0.89 to 1.10)	0.90 (0.79 to 1.03)
<i>Q3/Q1&2</i>	1.30 (1.20 to 1.41)	1.31 (1.18 to 1.45)	1.24 (1.09 to 1.41)		1.17 (1.08 to 1.28)	1.19 (1.07 to 1.32)	1.14 (1.00 to 1.31)
<i>Q3/Q3</i>	0.90 (0.75 to 1.07)	0.86 (0.69 to 1.08)	0.87 (0.65 to 1.15)		0.74 (0.62 to 0.89)	0.73 (0.58 to 0.92)	0.76 (0.57 to 1.02)
<i>Q3/Q4&5</i>	1.40 (1.28 to 1.52)	1.39 (1.25 to 1.55)	1.32 (1.15 to 1.52)		1.34 (1.22 to 1.48)	1.41 (1.25 to 1.60)	1.28 (1.09 to 1.50)
<i>Q4&5/Q1&2</i>	1.25 (1.14 to 1.38)	1.27 (1.13 to 1.43)	1.10 (0.94 to 1.28)		1.13 (1.02 to 1.25)	1.17 (1.03 to 1.33)	1.03 (0.87 to 1.22)
<i>Q4&5/Q3</i>	1.06 (0.98 to 1.15)	1.07 (0.96 to 1.18)	1.03 (0.90 to 1.17)		0.93 (0.85 to 1.02)	0.97 (0.86 to 1.08)	0.94 (0.82 to 1.07)
<i>Q4&5/Q4&5</i>	1.34 (1.27 to 1.42)	1.33 (1.25 to 1.43)	1.20 (1.10 to 1.31)		1.21 (1.13 to 1.30)	1.26 (1.15 to 1.38)	1.13 (1.00 to 1.26)
Joint CCP/Alcohol focused outlet quintiles***							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.26 (1.17 to 1.36)	1.23 (1.12 to 1.35)	1.19 (1.06 to 1.33)		1.13 (1.04 to 1.23)	1.12 (1.01 to 1.25)	1.13 (0.99 to 1.29)
<i>Q1&2/Q4&5</i>	1.04 (0.97 to 1.12)	0.97 (0.88 to 1.06)	1.03 (0.92 to 1.15)		1.04 (0.95 to 1.13)	0.98 (0.88 to 1.10)	1.07 (0.93 to 1.22)
<i>Q3/Q1&2</i>	1.36 (1.24 to 1.48)	1.40 (1.25 to 1.56)	1.21 (1.05 to 1.39)		1.12 (1.02 to 1.24)	1.15 (1.02 to 1.30)	1.08 (0.93 to 1.27)
<i>Q3/Q3</i>	1.67 (1.52 to 1.83)	1.66 (1.48 to 1.86)	1.47 (1.27 to 1.71)		1.51 (1.37 to 1.67)	1.54 (1.36 to 1.75)	1.39 (1.18 to 1.64)
<i>Q3/Q4&5</i>	1.31 (1.17 to 1.46)	1.22 (1.05 to 1.41)	1.39 (1.17 to 1.65)		1.17 (1.03 to 1.32)	1.12 (0.95 to 1.31)	1.33 (1.10 to 1.61)
<i>Q4&5/Q1&2</i>	1.63 (1.49 to 1.79)	1.67 (1.50 to 1.87)	1.36 (1.17 to 1.58)		1.32 (1.19 to 1.46)	1.37 (1.20 to 1.55)	1.21 (1.02 to 1.43)
<i>Q4&5/Q3</i>	1.32 (1.22 to 1.42)	1.29 (1.17 to 1.43)	1.23 (1.09 to 1.39)		1.11 (1.02 to 1.22)	1.12 (1.00 to 1.26)	1.13 (0.98 to 1.30)
<i>Q4&5/Q4&5</i>	1.43 (1.35 to 1.52)	1.42 (1.31 to 1.52)	1.24 (1.13 to 1.36)		1.20 (1.11 to 1.30)	1.21 (1.09 to 1.34)	1.15 (1.01 to 1.31)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores

A Population-based study of premature mortality in relation to neighbourhood density of alcohol sales and cheque cashing outlets

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Abstract

Objective: Alcohol overuse and poverty, each associated with premature death, often co-exist within socially disorganized neighborhoods. Cheque cashing places (CCPs) may be opportunistically placed in socially disorganized neighbourhoods, where customers abound. We explored whether neighbourhood density of CCPs and alcohol outlets are, individually, and in combination, related to premature mortality among adults.

Design: Retrospective population-based study.

Setting: ~~All~~ 140 neighbourhoods in Toronto, Ontario, 2005-2009.

Participants: Adults aged 20-59 years.

Measures: Our primary outcome was premature all-cause mortality among adults aged 20-59 years. Across ~~all~~ neighbourhoods we explored, separately and jointly, neighbourhood density of CCPs and alcohol outlets and their relation to premature mortality. Poisson regression provided was used to generate relative risks (aRRs) and 95% confidence intervals (CIs), adjusting for material deprivation quintile, crime quintile and number of banks. A separate analysis examined alcohol-focused establishments, namely, on-premise establishments like bars and nightclubs, retail liquor and beer stores.

Results: Intentional self-harm, accidental poisoning and liver disease were among the top-five causes of premature death among males aged 20-59 years. The premature mortality rate was 96.3 per 10,000 males and 55.9 per 10,000 females. Comparing the highest vs. lowest CCP quintiles (Q), the aRR for death was 1.22 (95% CI 1.12-1.34) in men and 1.14 (95% CI 1.01-1.28) in women. The association between alcohol outlet density and premature mortality was U-shaped, CCP Q3 and alcohol-focused outlet Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36-1.75) and females (1.39, 95% CI 1.18-1.64).

Conclusion: There is a non-linear synergistic effect of CCP and alcohol outlet density on premature mortality, even upon controlling for conventional measures of poverty. In socially disorganized neighbourhoods, formal banking and alcohol reduction strategies might be added to health promotion policies aimed at reducing premature mortality.

Keywords: Premature mortality, cheque cashing places, cheque cashing outlets, ethanol, alcohol sales, bars, gender, poverty.

Strengths and Limitations of the Study

- Premature death among young and middle-aged adults has received little attention, despite the fact that many deaths are accidental and potentially highly preventable.
- This study was done within a universal health setting in which all residents have full access to primary and hospital care services, and where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing.
- We evaluated a novel marker of neighbourhood social disorganization --- cheque cashing outlet density -- and its impact on premature mortality, alone, and in combination with alcohol outlet density.
- We did not capture alcohol consumption at the individual level, nor did we consider race/ethnicity, a potentially important confounder between low income status and premature mortality.

Background

Preventing untimely or premature death is a major goal of healthcare and public health programs. Current definitions of “premature mortality” differ, but most studies use an age range of birth to 75 years.¹⁻⁴ While this broad age range may identify potential years of life lost,^{4,5} it may obscure our understanding of those factors that are preventable in adulthood. The reason is that most deaths among children are from events arising around or in the perinatal period, while most seniors succumb to cancer or cardiovascular disease. Indeed, the top causes of death in young and middle aged adults are very different from those that claim the lives of older adults. For example, in Canada, accidents and self-harm are leading causes of death among those aged 25 to 44 years. After age 64 years, accidents are no longer in the top three, displaced by cancer and heart disease.⁶

Most premature deaths among young and middle-aged adults are potentially highly preventable. In many nations, alcohol use is an important risk factor for mortality.^{5,7} About 6.0% of all deaths among Canadians are alcohol-related – twice that for men than for women -- resulting in 144,142 potential years of life lost.⁵ In other areas of the world, including Russia, where alcohol consumption has emerged as a major public health concern, it is estimated that 43% of reported deaths among males aged 25 to 54 are attributed to hazardous drinking⁸. In early and middle adulthood, alcohol leads to accidental death through impaired functioning and a higher propensity for risky behavior among males.^{9,10} We recently showed a higher risk for injury due to serious assault in association with alcohol sales, especially among young urban men.¹¹ Stockwell found that rates of alcohol-related death in British Columbia, Canada increased by 3.25% for each 20% increase in the density of private alcohol outlets.¹² Greater alcohol outlet density is associated with increased alcohol consumption and ensuing medical disease, injury, crime, and violence.¹³

Studies suggest that the greater presence of chronic stressors at the residential level is associated with poorer health. Recent research on material deprivation, socioeconomic disadvantage, neighbourhood disorder and instability points to the negative impact of chronic stressors on health. Neighbourhood stress is most pronounced in low-income areas, and areas where mental and physical illness is more prevalent. Latkin and Curry¹⁴ and Matheson et al¹⁵ argue that social disorganization is also an important contributor to chronic stress among residents living in such disadvantaged neighbourhoods.

Evidence suggests that poverty – a known marker of socially disorganized neighbourhoods -- is also a driver of premature mortality.^{16 17} For example, there is a doubling in death due to homicide among residents living in low-income versus high-income neighbourhoods¹⁸. But beyond direct measures of income status, there may be additive benefit to using other area indicators of economic and neighbourhood social disorganization, such as the presence of cheque cashing places (CCPs).¹⁹ Previous research suggests that CCPs are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations²⁰. We and others have shown that there is a linear relation between the density of CCP and crime, independent of classic indicators of poverty.^{19 21}

What is not well understood is the nature of the individual and joint relation between CCP (as an indicator of neighbourhood social disorganization) and premature mortality, density of alcohol sales outlets (as a neighbourhood indicator of alcohol availability) and premature mortality. We explored this question in a setting where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing, and in which there is detailed information on CCP density and premature mortality.

Methods

This population based study was conducted in the City of Toronto, Canada using its 140 pre-defined neighbourhoods as the geographic units for analysis. These neighbourhoods, created by the Social Policy Analysis and Research unit in the City's Social Development & Administration Division, with assistance from Toronto Public Health, contain an average of 7,000-10,000 residents (<http://www.toronto.ca/demographics/neighbourhoods.htm>). Toronto is the largest city in the province of Ontario, where universal health care is available to virtually all residents.

The study outcome was premature mortality, defined as the number of deaths among adults aged 20-59 years per 10,000 people. Mortality data were extracted from the Ontario Mortality Data from 2005 to 2009 (Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO). Data were also available by sex. We pooled the data across all five years due to the low annual number of premature deaths in each neighbourhood.

We explored two exposure variables, separately, and in combination. The first was the neighbourhood density of CCPs. The second was the neighbourhood density of alcohol outlets. Toronto CCPs were identified through online Google and Yellow Pages directory Internet

searches, using the terms “cheque cashing”, “payday loans” and “cash”, as described elsewhere.¹¹ All alcohol outlets comprised all retail liquor¹¹ and beer stores, as well as all on-premise licenced facilities, including restaurants, bars, pubs, social clubs and hotels. We used lists of licenced on-premise and retail outlets provided by the Ontario Ministry of the Attorney General and the Liquor Control Board of Ontario as well as the Ontario Beer Stores. Thus, since all retail and on-premise alcohol sales in Ontario are governmentally licenced and regulated, this approach captures nearly all places where alcohol can be purchased by the public.

Using the address postal code, a CCP or alcohol outlet was assigned to a given Toronto neighbourhood. The density of CCPs and alcohol outlets were each expressed as a number per 10,000 residents per neighbourhood, and then further assigned to a quintile based on ranking neighbourhoods from lowest density (quintile 1) to highest (quintile 5). Quintiles were calculated using the RANK procedure in SAS.

Based on previous work,²¹ as covariates, we assigned to each neighbourhood all-cause police-reported crime from the 2006 Uniform Crime Reporting Survey (<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3302>) and number of full-access main bank branches ([http://en.wikipedia.org/wiki/Big_Five_\(banks\)](http://en.wikipedia.org/wiki/Big_Five_(banks))) – each per 10,000 residents, further transformed into quintiles. Neighbourhood prosperity, another covariate, was expressed as a material deprivation index quintile, based on the 2006 Ontario Marginalization Index²²; <http://www.torontohealthprofiles.ca/onmarg.php>. Material deprivation includes six census measures expressed as percentages: aged ≥ 20 years without high school graduation, lone parent families, population receiving government transfer payments, aged ≥ 15 and unemployed, living below the low income cut-off, and homes needing major repairs.

Data analysis

The association between premature mortality and the quintile-defined density of CCPs was examined using Poisson regression, with the natural log of the number of residents in each neighbourhood as the offset variable, based on the 2006 Canada Census (http://en.wikipedia.org/wiki/Canada_2006_Census). An unadjusted relative risk (RR) and 95% confidence interval (CI) expressed the relation between premature mortality and increasing CCP density, with the lowest CCP quintile as the referent. Adjusted RRs (aRR) were calculated by adding quintiles of crime, banks and material deprivation to the model, for males and females combined, as well as individually by sex.

The same unadjusted and adjusted models were used to explore the relation between alcohol outlet quintiles and premature mortality. We performed a [separate](#) analysis restricting the alcohol outlets to those not typically associated with food service or accommodation (called “**alcohol focused outlets**” herein), namely, on-premise establishments designated for adult entertainment, bars, taverns, nightclubs, billiard/pool halls, gaming facilities, lounges, and stadiums, in addition to retail liquor and beer stores (Supplemental Table 2). [Hence, the density of alcohol focused outlets was used as a more specific measure of alcohol-seeking behavior at the neighbourhood level.](#)

The **joint effect** (i.e., co-presence) of CCPs and alcohol outlets and their relation to premature mortality was [analyzed by cross-categorizing neighbourhoods according to both CCP quintile and alcohol outlet quintile. Due insufficient cell sizes, it was necessary to collapse the lowest two quintiles \(Q1 and Q2\) and highest two quintiles \(Q4 and Q5\) for each individual variable before cross-categorizing them, resulting in 9 categories, with CCPs Q1 and Q2/Alcohol outlets Q1 and Q2 as the referent.](#) We ran the same multivariable Poisson regression models as above, separately for males and females. All statistical analyses were performed using SAS Version 9.3 (SAS Institute Inc., Cary, North Carolina, USA). [We calculated Moran’s I to assess spatial autocorrelation.](#)²³ [All I values ranged from 0.07 to 0.10, suggesting very low levels of spatial autocorrelation.](#) The study was approved by the Research Ethics Board of St. Michael’s Hospital.

Results

In 2006, Toronto’s 140 neighbourhoods together had a population of 2,493,125 residents, of whom 1,478,610 were aged 20 to 59 years, and 48% were male (Table 1). Overall, the density of **all alcohol outlets** was 19.4 per 10,000, **alcohol focused outlets** 1.8 per 10,000, and CCPs 1.3 per 10,000 persons. The average crime rate was 425.9 per 10,000 residents.

Among adult males aged 20 to 59 years, intentional self-harm, accidental poisoning and liver disease were [among](#) the top-five causes of death (Supplemental Table 1). For females, cancer was the dominant cause of death, and intentional self-harm was among the top-five causes. The [premature mortality rate among all persons aged 20 to 59 years was 74.1 per 10,000 residents, and was much higher for males \(96.3 per 10,000\) than females \(55.9 per 10,000\) \(Table 1\).](#)

There was a relation between CCP density and premature mortality (Table 2 and Figure 1). This was seen for males and females, and after adjusting for certain covariates. For example, the RR between CCP Q5 vs. 1 was 1.22 (95% CI 1.12 to 1.34) for men and 1.14 (95% CI 1.01 to 1.28) for women.

The relation between the density of **all alcohol outlets** and premature mortality was U-shaped, with the lowest risk at Q3, especially among males (Figure 1). Upon limiting the analysis to **alcohol focused outlets**, the adjusted RR was significantly lower in Q2 and Q5 among men (Table 2 and Figure 1).

In the joint analysis of the density of CCPs and **all alcohol outlets**, there was a significantly increased risk of premature mortality for Q3 CCP with either Q1&2 or Q4&5 (Table 3, Figure 2). Neighbourhoods with joint CCP Q3 and **alcohol-focused outlet** Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36 to 1.75) and females (1.39, 95% CI 1.18 to 1.64).

Upon repeating the above analyses, but restricting the definition of premature mortality to deaths between ages 20 and 49 years, the results were generally the same (Supplemental Tables 3 and 4).

In the aforementioned analyses, adding neighbourhood area (in square kilometers) to the multivariable models did not significantly alter the study results (data not shown).

Discussion

Intentional self-harm, accidental poisoning and liver disease rank within the top-five causes of premature death among males aged 20 to 59 years, who are nearly twice as likely as females to die prematurely. Moderate to high neighbourhood density of CCPs was significantly associated with a higher risk of premature mortality for both men and women, even after adjusting for material deprivation, crime, and number of banks. Alcohol outlet density had a U-shaped relation to premature mortality. In neighbourhoods with a low density of CCPs, the co-presence of either low (Q1 and Q2), moderate (Q3) or high (Q4 and Q5) density of alcohol outlets had virtually no relation to premature mortality.

Stockwell showed that the density of private liquor stores is independently associated with local rates of alcohol-related death.¹² Alcohol impairs cognitive functioning, and, when combined with a higher propensity for risk-taking behaviors among males, increases their likelihood of intentional and unintentional injury and death.^{9 10} In a study of hospitalizations for

serious assault, we previously found that victimization increased with alcohol sales, especially among young urban men.¹¹ For all alcohol outlets, at low to moderate density (Q2 and Q3), the risk of premature mortality among males was at its lowest (Figure 1, middle panel). This association was not evident for alcohol focused outlets, however (Figure 1, lower panel). Unlike alcohol focused outlets, other licenced facilities, including restaurants and social clubs, function as gathering places less centered on alcohol consumption (Supplemental Table 2), where intoxication is usually not tolerated and the hours of operation are limited.^{24 25} In the current study, we attempted to clarify the relation between CCPs, with and without density of alcohol sales outlets, and premature mortality.

Density of CCPs is certainly a proxy for poverty, itself an established risk factor for premature mortality.^{1 2 25-29} However, in our analyses, we accounted for a complex measure of poverty, namely, material deprivation. Previous research on CCPs suggests that they are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations.²⁰ We established a rationale early in the paper to suggest that CCPs are another measure of social disorganization with an independent effect on premature mortality.

Previous research has observed an association between location of CCPs and violent crime,^{19 21} as well as alcohol sales and serious assault.^{11 30 31} There is growing evidence about the negative effects of CCPs and pay day loan services on health and welfare of communities.^{19 32 33} Moreover, the link between alcohol sales and premature mortality is well established,^{2 8 28 34} as is that between poverty and increased morbidity and mortality.³⁵⁻³⁸ However, little attention has focused on premature death among young and middle-aged adults, despite the fact that many deaths are from intentional and unintentional self-harm, and thus, are potentially highly preventable. Most studies considered premature mortality from birth to aged 75 years,¹⁻⁴ but the differing age-related causes of death across this broad group obscures our deeper understanding of why young and middle-aged adults die. Furthermore, these latter populations constitutes the majority of the workforce, who are sensitive to the economic conditions that may contribute to CCP density. Hence, it was both logical and novel for us to assess whether CCP density and alcohol outlet density – both individually and together – impact on premature mortality at the neighbourhood level, especially among young and middle-aged adults. This study was done within a universal health setting in which all Ontario residents have full access to primary and hospital care services.

Study limitations

To reduce data suppression due to small cell sizes, we aggregated our data at the neighbourhood level. Accordingly, the presence of an on-premise or retail alcohol sales outlet did not necessarily reflect alcohol consumption by those who reside in a given neighbourhood. Herein, we did not consider race/ethnicity, a potentially important confounder between low income status and premature mortality. In the US, victims of violent crime are more likely to be of Black or Hispanic ancestry³⁹ and assault-related premature mortality is four-fold higher in the US than in Canada (<http://www.conferenceboard.ca/hcp/details/health/premature-mortality-rate.aspx>). While CCPs are more concentrated in US ethnic minority enclaves⁴⁰, Toronto's neighbourhoods tend to be more ethnically diverse, and homicide is not a leading cause of death (Supplemental Table 1). Given the cross-sectional nature of the data we could not assess when CCPs or alcohol outlets were first introduced to each neighbourhood. We also could not assign a neighbourhood postal code to persons of no fixed address. Future studies might examine changes in mortality patterns with the opening and closing of CCPs or alcohol outlets, as well as creating a category for persons without a residential address.

It is challenging to conduct large population-based studies on alcohol-related harm using individual-level data on alcohol consumption.⁴¹⁻⁴³ Certainly, persons most apt to overuse alcohol may be least likely to respond to household surveys,^{44 45} for example. Rather, a "birds-eye" view like ours is often necessary, wherein individual alcohol consumption cannot be measured. In Ontario, alcohol is completely regulated,¹¹ enabling us to account for all places where alcohol is sold, unlike in other Canadian provinces or US states, where private retail outlets exist.^{12 46 47} Hence, in our study, where both retail in-store and on-premise alcohol sales were documented, it was possible to evaluate the general availability of alcohol within the population.

Conclusion and implications

Our findings suggest that there may be a synergistic effect between alcohol outlets and CCPs on premature mortality. Moderate to high saturation of CCPs, in combination with higher presence of alcohol-focused outlets, was a particularly bad combination, in terms of the risk of premature mortality. Thus, strategic placement of CCPs and alcohol-focused outlets in certain areas may provide local residents with ready access to quick cash and the purchase of alcohol. A provoking question that we cannot answer is whether economic bankruptcy foretells "health bankruptcy", which in turn may result in premature death? We can generally identify economic

bankruptcy at the individual level, and even at the area level, if it affects enough local residents. A high density of CCPs may be an economic signpost that health interventions are needed within a community, including strategies that address the causes of premature death among men and women, such as intentional self-harm, poisoning and alcohol-related liver disease (Supplemental Table 1). [Future research might explore the experiences of people faced with financial bankruptcy and its impact on their overall mental and physical health.](#)

Solving the problem of alcohol-related harm at the community level is not easy.⁴⁸ As alcohol and CCP industries are each often government regulated, should there be a restriction on the number of CCPs and/or the type of alcohol outlets in neighbourhoods with high rates of premature death? While there is some compelling evidence for limiting alcohol sales⁴⁹ – both by number of outlets and hours of operation^{12 46 50} – less is known about that for CCPs. One approach to the latter would be to offer money management services for people at risk of alcohol overuse, in whom addiction overwhelms all aspects of their lives, including financial instability⁵¹. In terms of CCPs themselves, we and others have argued that they are strategically placed where customers abound,^{19 21 52} and where mental illness and self-neglect are more prevalent. [This has implications for how we shape health improvement strategies among people living in such](#) neighbourhoods. [For example, offering](#) support to these individuals, in terms of formal banking, budget management and addiction counseling all seem sensible as part of a strategy to reduce premature mortality. Moreover, physicians, nurses, addiction counselors and social workers who help persons with alcohol problems might use an individual's neighbourhood as an indicator of their risk for health decline, and even recommend relocation to an area with few CCPs and alcohol outlets. For example, residential relocation has been associated with greater cessation of injection drug use, especially moving from a highly deprived to less deprived neighbourhood.⁵³ For alcohol addiction, recovery is less likely among those who dwell in disadvantaged neighbourhoods.⁵¹ Certainly, the place where one lives partly determines health behaviors and opportunities for health improvement.

[In conclusion, in](#) neighbourhoods with higher than expected rates of premature mortality, lessening social disorganization might be achieved through encouraging use of formal banking methods and better money handling, alongside alcohol reduction strategies. One can then assess whether there follows a decline in the rate of fatal and non-fatal intentional self-harm, poisoning and acute liver disease.

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None.

Authors' contributions

JR, FIM, and MC conceived and designed the study. FIM, JR, MC and PG were involved in data collection. FIM, PG and AP performed data preparation and analysis. JR and FIM wrote manuscript. MC and AP helped revised manuscript. All authors read and approved the final manuscript.

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Competing interest

The authors declare that they have no competing interest.

Data Sharing Statement

There are no unpublished data related to the current study.

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Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females together and separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as all liquor and beer stores.

Figure 2. Risk of premature mortality in relation to the joint effect of cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as all liquor and beer stores.

Table 1. Description of study variables for all 140 neighbourhoods in Toronto, Canada.

Variable	Value for that variable
Population of Toronto (2006)	
<i>Total size of population studied for all ages, across all neighbourhoods</i>	2 493 125
<i>Total number of residents aged 20-59 years, across all neighbourhoods</i>	1 478 610
<i>% male of residents aged 20-59 years, across all neighbourhoods</i>	48.4
<i>Mean (SD) number of residents per neighbourhood aged 20-59 years</i>	10 562 (5115)
<i>Mean (SD) number of residents per neighbourhood aged 20-49 years</i>	8307 (4149)
<i>Mean (SD) number of males aged 20-59 years per 10 000 residents</i>	5113 (2520)
<i>Mean (SD) number of females aged 20-59 years per 10 000 residents</i>	5448 (2623)
<i>Mean (SD) number of males aged 20-49 years per 10 000 residents</i>	4042 (2061)
<i>Mean (SD) number of females aged 20-49 years per 10 000 residents</i>	4264 (2110)
All alcohol outlets*	
<i>Total number for all neighbourhoods</i>	4626
<i>Mean (SD) number per 10 000 residents</i>	19.4 (23.7)
<i>Number (%) of neighbourhoods with no outlets</i>	1 (0.7)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	139 (99.3)
Alcohol focused outlets**	
<i>Total number for all neighbourhoods</i>	428
<i>Mean (SD) number per 10 000 residents</i>	1.8 (2.4)
<i>Number (%) of neighbourhoods with no outlets</i>	34 (24.3)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	106 (75.7)
Median (IQR) material deprivation index	4 (3)
Banks	
<i>Total number for all neighbourhoods</i>	472
<i>Mean (SD) number per 10 000 residents</i>	1.9 (1.6)
<i>Number (%) of neighbourhoods with no banks</i>	14 (10.0)
<i>Number (%) of neighbourhoods with ≥ 1 banks</i>	126 (90.0)
All crime (2006)	
<i>Mean (SD) number of all crimes per 10 000 residents</i>	425.9 (255.6)
<i>Mean (SD) number of violent crimes per 10 000 residents</i>	103.5 (54.3)
Cheque cashing places	
<i>Total number for all neighbourhoods</i>	310
<i>Mean (SD) number of cheque cashing places per 10 000 residents</i>	1.3 (1.4)
<i>Number (%) of neighbourhoods with no cheque cashing places</i>	42 (30.0)
<i>Number (%) of neighbourhoods with ≥ 1 cheque cashing places</i>	98 (70.0)
<u>Premature deaths among adults aged 20-59 years</u>	
<u><i>Total number for all neighbourhoods</i></u>	<u>10 862</u>
<u><i>Total number among males for all neighbourhoods</i></u>	<u>6 831</u>
<u><i>Total number among females for all neighbourhoods</i></u>	<u>4 181</u>
<u><i>Mean (SD) number of deaths per 10 000 residents aged 20-59 years</i></u>	<u>74.1 (27.7)</u>
<u><i>Mean (SD) number of deaths per 10 000 male residents aged 20-59 years</i></u>	<u>96.3 (36.7)</u>

Mean (SD) number of female deaths per 10 000 female residents aged 20-59 years

55.9 (18.1)

* Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

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Table 2. Risk of premature mortality among adults aged 20 to 59 years in relation to density of cheque cashing place (CCP) or alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)			Adjusted relative risk (95% confidence interval)*		
	All	Males	Females	All	Males	Females
CCP quintile						
Q1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q2	1.01 (0.95 to 1.07)	0.99 (0.92 to 1.07)	0.98 (0.90 to 1.08)	0.96 (0.91 to 1.03)	0.96 (0.88 to 1.04)	0.96 (0.87 to 1.06)
Q3	1.34 (1.26 to 1.43)	1.36 (1.26 to 1.48)	1.26 (1.14 to 1.39)	1.17 (1.09 to 1.26)	1.20 (1.10 to 1.31)	1.15 (1.03 to 1.28)
Q4	1.23 (1.16 to 1.31)	1.26 (1.17 to 1.36)	1.10 (1.00 to 1.21)	1.05 (0.98 to 1.12)	1.09 (1.00 to 1.19)	1.00 (0.90 to 1.12)
Q5	1.41 (1.33 to 1.49)	1.42 (1.32 to 1.52)	1.25 (1.14 to 1.36)	1.19 (1.11 to 1.28)	1.22 (1.12 to 1.34)	1.14 (1.01 to 1.28)
All alcohol outlet quintile**						
Q1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q2	0.96 (0.90 to 1.03)	0.93 (0.85 to 1.01)	1.00 (0.90 to 1.11)	0.93 (0.87 to 1.00)	0.90 (0.82 to 0.98)	0.99 (0.88 to 1.11)
Q3	0.92 (0.86 to 0.98)	0.86 (0.78 to 0.93)	0.98 (0.88 to 1.09)	0.89 (0.83 to 0.96)	0.85 (0.77 to 0.93)	0.97 (0.86 to 1.09)
Q4	1.10 (1.03 to 1.17)	1.07 (0.99 to 1.16)	1.07 (0.96 to 1.18)	1.00 (0.93 to 1.08)	0.99 (0.90 to 1.09)	1.03 (0.91 to 1.16)
Q5	1.06 (0.99 to 1.13)	1.01 (0.94 to 1.09)	1.02 (0.93 to 1.14)	0.99 (0.91 to 1.07)	0.96 (0.87 to 1.06)	1.02 (0.89 to 1.16)
Alcohol focused outlet quintile***						
Q1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q2	0.98 (0.92 to 1.06)	0.97 (0.89 to 1.06)	0.94 (0.84 to 1.06)	0.89 (0.83 to 0.97)	0.89 (0.81 to 0.99)	0.90 (0.79 to 1.02)
Q3	1.15 (1.08 to 1.22)	1.11 (1.03 to 1.19)	1.11 (1.01 to 1.22)	1.01 (0.94 to 1.08)	0.99 (0.90 to 1.08)	1.04 (0.93 to 1.17)
Q4	1.12 (1.06 to 1.20)	1.09 (1.01 to 1.18)	1.06 (0.96 to 1.17)	1.00 (0.93 to 1.08)	0.98 (0.89 to 1.08)	1.01 (0.90 to 1.14)
Q5	1.07 (1.01 to 1.14)	1.01 (0.93 to 1.09)	1.05 (0.95 to 1.15)	0.90 (0.83 to 0.98)	0.85 (0.76 to 0.94)	0.98 (0.86 to 1.12)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

Table 3. Risk of premature mortality among adults aged 20 to 59 years in relation to joint density of cheque cashing place (CCP) and alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)				Adjusted relative risk (95% confidence interval)*		
	Overall	Males	Females		Overall	Males	Females
Joint CCP/All alcohol outlet quintiles**							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.02 (0.94 to 1.10)	0.95 (0.86 to 1.05)	1.07 (0.95 to 1.20)		1.07 (0.99 to 1.16)	1.00 (0.91 to 1.11)	1.10 (0.98 to 1.25)
<i>Q1&2/Q4&5</i>	0.88 (0.82 to 0.94)	0.86 (0.79 to 0.94)	0.86 (0.77 to 0.96)		0.95 (0.87 to 1.04)	0.99 (0.89 to 1.10)	0.90 (0.79 to 1.03)
<i>Q3/Q1&2</i>	1.30 (1.20 to 1.41)	1.31 (1.18 to 1.45)	1.24 (1.09 to 1.41)		1.17 (1.08 to 1.28)	1.19 (1.07 to 1.32)	1.14 (1.00 to 1.31)
<i>Q3/Q3</i>	0.90 (0.75 to 1.07)	0.86 (0.69 to 1.08)	0.87 (0.65 to 1.15)		0.74 (0.62 to 0.89)	0.73 (0.58 to 0.92)	0.76 (0.57 to 1.02)
<i>Q3/Q4&5</i>	1.40 (1.28 to 1.52)	1.39 (1.25 to 1.55)	1.32 (1.15 to 1.52)		1.34 (1.22 to 1.48)	1.41 (1.25 to 1.60)	1.28 (1.09 to 1.50)
<i>Q4&5/Q1&2</i>	1.25 (1.14 to 1.38)	1.27 (1.13 to 1.43)	1.10 (0.94 to 1.28)		1.13 (1.02 to 1.25)	1.17 (1.03 to 1.33)	1.03 (0.87 to 1.22)
<i>Q4&5/Q3</i>	1.06 (0.98 to 1.15)	1.07 (0.96 to 1.18)	1.03 (0.90 to 1.17)		0.93 (0.85 to 1.02)	0.97 (0.86 to 1.08)	0.94 (0.82 to 1.07)
<i>Q4&5/Q4&5</i>	1.34 (1.27 to 1.42)	1.33 (1.25 to 1.43)	1.20 (1.10 to 1.31)		1.21 (1.13 to 1.30)	1.26 (1.15 to 1.38)	1.13 (1.00 to 1.26)
Joint CCP/Alcohol focused outlet quintiles***							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.26 (1.17 to 1.36)	1.23 (1.12 to 1.35)	1.19 (1.06 to 1.33)		1.13 (1.04 to 1.23)	1.12 (1.01 to 1.25)	1.13 (0.99 to 1.29)
<i>Q1&2/Q4&5</i>	1.04 (0.97 to 1.12)	0.97 (0.88 to 1.06)	1.03 (0.92 to 1.15)		1.04 (0.95 to 1.13)	0.98 (0.88 to 1.10)	1.07 (0.93 to 1.22)
<i>Q3/Q1&2</i>	1.36 (1.24 to 1.48)	1.40 (1.25 to 1.56)	1.21 (1.05 to 1.39)		1.12 (1.02 to 1.24)	1.15 (1.02 to 1.30)	1.08 (0.93 to 1.27)
<i>Q3/Q3</i>	1.67 (1.52 to 1.83)	1.66 (1.48 to 1.86)	1.47 (1.27 to 1.71)		1.51 (1.37 to 1.67)	1.54 (1.36 to 1.75)	1.39 (1.18 to 1.64)
<i>Q3/Q4&5</i>	1.31 (1.17 to 1.46)	1.22 (1.05 to 1.41)	1.39 (1.17 to 1.65)		1.17 (1.03 to 1.32)	1.12 (0.95 to 1.31)	1.33 (1.10 to 1.61)
<i>Q4&5/Q1&2</i>	1.63 (1.49 to 1.79)	1.67 (1.50 to 1.87)	1.36 (1.17 to 1.58)		1.32 (1.19 to 1.46)	1.37 (1.20 to 1.55)	1.21 (1.02 to 1.43)
<i>Q4&5/Q3</i>	1.32 (1.22 to 1.42)	1.29 (1.17 to 1.43)	1.23 (1.09 to 1.39)		1.11 (1.02 to 1.22)	1.12 (1.00 to 1.26)	1.13 (0.98 to 1.30)
<i>Q4&5/Q4&5</i>	1.43 (1.35 to 1.52)	1.42 (1.31 to 1.52)	1.24 (1.13 to 1.36)		1.20 (1.11 to 1.30)	1.21 (1.09 to 1.34)	1.15 (1.01 to 1.31)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores

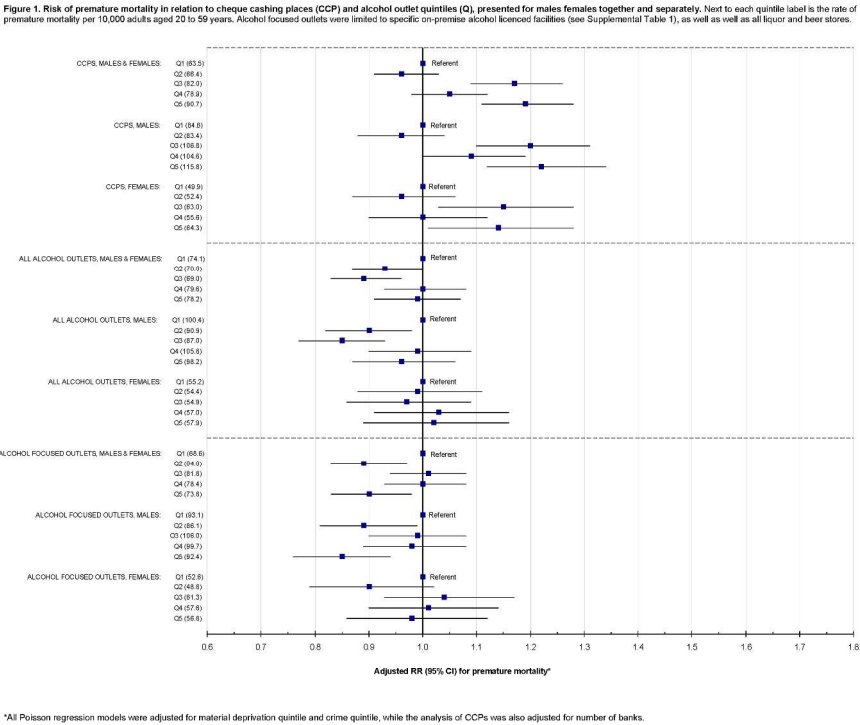
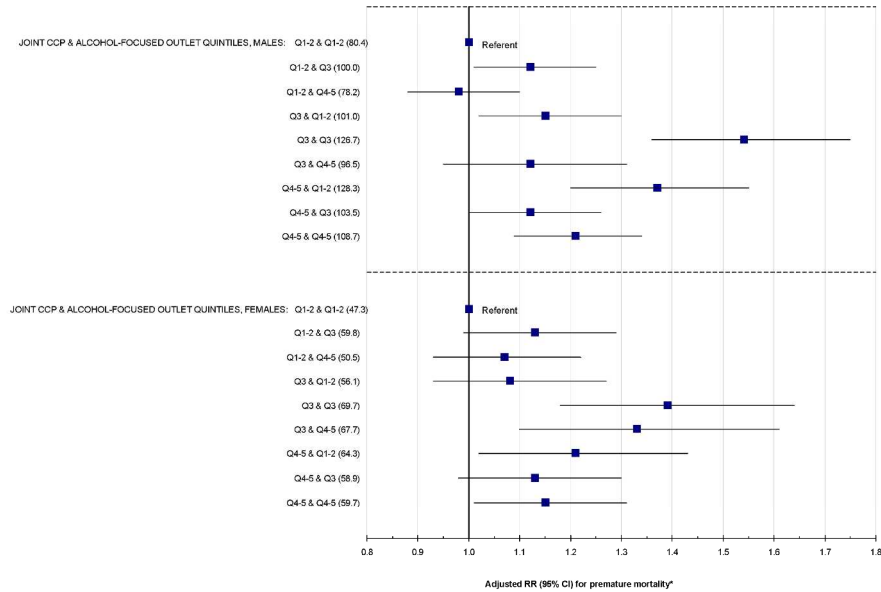


Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females together and separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as all liquor and beer stores.

Figure 2. Risk of premature mortality in relation to the joint effect of cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years.



*All Poisson regression models were adjusted for material deprivation quintile, crime quintile and number of banks.

Figure 2. Risk of premature mortality in relation to the joint effect of cheque cashing places (CCP) and alcohol outlet quintiles (Q), presented for males females separately. Next to each quintile label is the rate of premature mortality per 10,000 adults aged 20 to 59 years.
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Supplemental Table 1. Top five leading causes of death among residents of Toronto aged 20 to 59 years, 2005 to 2009.

Rank	Males	Females	Males and females
1	Ischemic heart disease	Breast cancer	Ischemic heart disease
2	Intentional self-harm	Lung cancer	Intentional self-harm
3	Lung cancer	Intentional self-harm	Lung cancer
4	Accidental poisoning	Ischemic heart disease	Breast cancer
5	Cirrhosis and other liver diseases	Colorectal cancer	Accidental poisoning

Source: Ontario Mortality Data 2005-09, Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO, Date accessed, November, 2012.
Leading causes of death based on APHEO Leading Cause Groups for Mortality Tabulation
<http://www.apheo.ca/resources/indicators/APHEO%20Modifications%20to%20Lead%20CauseDeath%20Becker%20at%20a%20glance%20Dec2008.pdf>

Supplemental Table 2. Type of on-premise licensed alcohol outlets. Those in bolded italics were considered herein to be “alcohol focused”.

Type of Outlet
Restaurant
<i>Bar/Sports Bar</i>
Social Club
Hotel/Motel
<i>Night Club</i>
<i>Bar /Tavern /Nightclub</i>
Banquet Hall
Boat
<i>Karaoke Bar/Restaurant</i>
<i>Billiard/Pool Hall</i>
Live Theatre
Bowling Alley
Retirement Residence
<i>Adult Entertainment</i>
Educational Facility
<i>Gaming Facility</i>
<i>Stadium</i>
Golf Course
Motion Picture Theatre
Outdoor Area
Athletic Club
Military
Museum
Other
Railway Car

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Supplemental Table 3. Risk of premature mortality among adults aged 20 to 49 years in relation to density of cheque cashing place (CCP) or alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)			Adjusted relative risk (95% confidence interval)*		
	All	Males	Females	All	Males	Females
CCP quintile						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	1.05 (0.96 to 1.15)	1.05 (0.94 to 1.18)	1.06 (0.91 to 1.22)	1.02 (0.93 to 1.12)	1.02 (0.91 to 1.16)	1.01 (0.87 to 1.18)
<i>Q3</i>	1.39 (1.26 to 1.52)	1.40 (1.24 to 1.57)	1.35 (1.16 to 1.57)	1.22 (1.10 to 1.35)	1.22 (1.08 to 1.41)	1.18 (0.99 to 1.39)
<i>Q4</i>	1.28 (1.18 to 1.40)	1.33 (1.19 to 1.49)	1.19 (1.03 to 1.37)	1.11 (1.00 to 1.23)	1.11 (1.02 to 1.32)	1.02 (0.87 to 1.21)
<i>Q5</i>	1.43 (1.32 to 1.55)	1.50 (1.35 to 1.66)	1.29 (1.12 to 1.47)	1.24 (1.11 to 1.38)	1.24 (1.13 to 1.48)	1.14 (0.95 to 1.36)
All alcohol outlets**						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.93 (0.84 to 1.02)	0.91 (0.81 to 1.03)	0.95 (0.81 to 1.12)	0.88 (0.79 to 0.98)	0.88 (0.76 to 0.99)	0.91 (0.76 to 1.08)
<i>Q3</i>	0.88 (0.79 to 0.97)	0.83 (0.73 to 0.95)	0.95 (0.81 to 1.11)	0.84 (0.76 to 0.94)	0.84 (0.70 to 0.92)	0.91 (0.76 to 1.09)
<i>Q4</i>	0.99 (0.90 to 1.09)	0.98 (0.87 to 1.10)	1.01 (0.87 to 1.18)	0.89 (0.80 to 1.00)	0.88 (0.77 to 1.02)	0.91 (0.76 to 1.09)
<i>Q5</i>	0.98 (0.89 to 1.07)	0.98 (0.87 to 1.09)	0.94 (0.81 to 1.10)	0.89 (0.79 to 1.00)	0.88 (0.75 to 1.01)	0.88 (0.73 to 1.08)
Alcohol focused outlets***						
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	1.03 (0.92 to 1.14)	1.00 (0.87 to 1.14)	1.07 (0.90 to 1.26)	0.95 (0.84 to 1.06)	0.92 (0.80 to 1.07)	0.99 (0.82 to 1.19)
<i>Q3</i>	1.11 (1.01 to 1.21)	1.13 (1.01 to 1.27)	1.06 (0.91 to 1.22)	0.99 (0.89 to 1.10)	1.02 (0.89 to 1.17)	0.94 (0.79 to 1.12)
<i>Q4</i>	1.10 (1.01 to 1.21)	1.12 (1.00 to 1.27)	1.06 (0.91 to 1.23)	1.00 (0.89 to 1.12)	1.02 (0.88 to 1.17)	0.97 (0.81 to 1.17)
<i>Q5</i>	1.04 (0.95 to 1.14)	1.03 (0.92 to 1.16)	1.02 (0.88 to 1.18)	0.89 (0.79 to 1.00)	0.86 (0.74 to 1.01)	0.91 (0.75 to 1.11)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as as well as liquor and beer stores.

Supplemental Table 4. Risk of premature mortality among adults aged 20 to 49 years in relation to joint density of cheque cashing place (CCP) and alcohol outlet quintiles.

	Crude relative risk (95% confidence interval)				Adjusted relative risk (95% confidence interval)*		
	Overall	Males	Females		Overall	Males	Females
Joint CCP/All alcohol outlet quintiles**							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.01 (0.90 to 1.13)	0.93 (0.81 to 1.08)	1.11 (0.93 to 1.33)		1.06 (0.94 to 1.19)	0.86 (0.86 to 1.17)	1.14 (0.95 to 1.38)
<i>Q1&2/Q4&5</i>	0.86 (0.78 to 0.96)	0.85 (0.74 to 0.97)	0.88 (0.74 to 1.04)		0.94 (0.83 to 1.07)	0.80 (0.80 to 1.10)	0.93 (0.76 to 1.14)
<i>Q3/Q1&2</i>	1.35 (1.20 to 1.51)	1.35 (1.16 to 1.57)	1.33 (1.10 to 1.61)		1.22 (1.08 to 1.39)	1.05 (1.05 to 1.44)	1.19 (0.97 to 1.46)
<i>Q3/Q3</i>	0.98 (0.76 to 1.26)	1.02 (0.75 to 1.39)	0.89 (0.58 to 1.36)		0.81 (0.62 to 1.05)	0.61 (0.61 to 1.14)	0.75 (0.48 to 1.17)
<i>Q3/Q4&5</i>	1.32 (1.17 to 1.50)	1.26 (1.07 to 1.49)	1.38 (1.13 to 1.70)		1.28 (1.10 to 1.48)	1.05 (1.05 to 1.52)	1.26 (1.00 to 1.60)
<i>Q4&5/Q1&2</i>	1.43 (1.25 to 1.62)	1.45 (1.24 to 1.71)	1.34 (1.08 to 1.66)		1.27 (1.10 to 1.46)	1.12 (1.12 to 1.60)	1.14 (0.90 to 1.44)
<i>Q4&5/Q3</i>	1.09 (0.97 to 1.23)	1.09 (0.94 to 1.27)	1.10 (0.91 to 1.33)		0.97 (0.85 to 1.10)	0.83 (0.83 to 1.15)	0.96 (0.78 to 1.18)
<i>Q4&5/Q4&5</i>	1.30 (1.20 to 1.41)	1.33 (1.20 to 1.47)	1.20 (1.05 to 1.37)		1.17 (1.05 to 1.30)	1.05 (1.05 to 1.37)	1.08 (0.91 to 1.28)
Joint CCP/Alcohol focused outlet quintiles***							
<i>Q1&2/Q1&2</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q1&2/Q3</i>	1.27 (1.14 to 1.42)	1.31 (1.14 to 1.51)	1.21 (1.01 to 1.44)		1.15 (1.01 to 1.31)	1.01 (1.01 to 1.40)	1.09 (0.89 to 1.34)
<i>Q1&2/Q4&5</i>	1.01 (0.91 to 1.13)	1.01 (0.88 to 1.16)	1.00 (0.84 to 1.18)		1.02 (0.90 to 1.16)	0.86 (0.86 to 1.20)	1.03 (0.84 to 1.26)
<i>Q3/Q1&2</i>	1.45 (1.27 to 1.64)	1.44 (1.22 to 1.70)	1.43 (1.17 to 1.76)		1.20 (1.04 to 1.38)	1.09 (0.98 to 1.40)	1.23 (0.99 to 1.54)
<i>Q3/Q3</i>	1.54 (1.34 to 1.78)	1.71 (1.44 to 2.04)	1.26 (0.99 to 1.61)		1.40 (1.20 to 1.63)	1.32 (1.32 to 1.94)	1.09 (0.84 to 1.41)
<i>Q3/Q4&5</i>	1.35 (1.15 to 1.59)	1.26 (1.02 to 1.56)	1.46 (1.14 to 1.88)		1.24 (1.03 to 1.48)	0.92 (0.92 to 1.47)	1.34 (1.02 to 1.77)
<i>Q4&5/Q1&2</i>	1.75 (1.54 to 1.99)	1.86 (1.58 to 2.19)	1.57 (1.26 to 1.94)		1.42 (1.22 to 1.64)	1.25 (1.25 to 1.81)	1.28 (1.00 to 1.63)
<i>Q4&5/Q3</i>	1.29 (1.15 to 1.45)	1.35 (1.16 to 1.56)	1.18 (0.98 to 1.43)		1.11 (0.97 to 1.27)	0.98 (0.98 to 1.39)	1.02 (0.82 to 1.27)
<i>Q4&5/Q4&5</i>	1.42 (1.30 to 1.55)	1.50 (1.34 to 1.67)	1.25 (1.08 to 1.44)		1.22 (1.08 to 1.37)	1.08 (1.08 to 1.48)	1.11 (0.92 to 1.35)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 1), as well as as well as liquor and beer stores.

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Comments	Page in manuscript
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	Completed	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Completed	2
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Completed	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	Completed	5
Methods				
Study design	4	Present key elements of study design early in the paper	Completed	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Completed	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Not applicable	
		(b) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Completed	5-6
Data sources/measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Completed	5-6
Bias	9	Describe any efforts to address potential sources of bias	Completed	8-9
Study size	10	Explain how the study size was arrived at	Completed	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Completed	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Completed	6

		(b) Describe any methods used to examine subgroups and interactions	Completed	6
		(c) Explain how missing data were addressed	Not applicable	
		(d) If applicable, explain how loss to follow-up was addressed	Not applicable	
		(e) Describe any sensitivity analyses	Completed	6 & 7
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Not applicable	
		(b) Give reasons for non-participation at each stage	Not applicable	
		(c) Consider use of a flow diagram	Not applicable	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Completed	5 & 7
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable	
		(c) Summarise follow-up time (eg, average and total amount)	Not applicable	
Outcome data	15*	Report numbers of outcome events or summary measures over time	Completed	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Completed	7
		(b) Report category boundaries when continuous variables were categorized	Completed	6-7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Completed	7
Discussion				
Key results	18	Summarise key results with reference to study objectives	Completed	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Completed	8-9

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Completed	9-10
Generalisability	21	Discuss the generalisability (external validity) of the study results	Completed	9
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Completed	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

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A Population-based study of premature mortality in relation to neighbourhood density of alcohol sales and cheque cashing outlets, Toronto, Canada

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A Population-based study of premature mortality in relation to neighbourhood density of alcohol sales and cheque cashing outlets, Toronto, Canada

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Abstract

Objective: Alcohol overuse and poverty, each associated with premature death, often exist within disadvantaged neighborhoods. Cheque cashing places (CCPs) may be opportunistically placed in disadvantaged neighbourhoods, where customers abound. We explored whether neighbourhood density of CCPs and alcohol outlets are each related to premature mortality among adults.

Design: Retrospective population-based study.

Setting: 140 neighbourhoods in Toronto, Ontario, 2005-2009.

Participants: Adults aged 20-59 years.

Measures: Our primary outcome was premature all-cause mortality among adults aged 20-59 years. Across neighbourhoods we explored neighbourhood density, in km², of CCPs and alcohol outlets, and the relation of each to premature mortality. Poisson regression provided relative risks (aRRs) and 95% confidence intervals (CIs), adjusting for material deprivation quintile, crime quintile and number of banks.

Results: Intentional self-harm, accidental poisoning and liver disease were among the top-five causes of premature death among males aged 20-59 years. The overall premature mortality rate was 96.3 per 10,000 males and 55.9 per 10,000 females. Comparing the highest vs. lowest CCP density quintiles (Q), the aRR for death was 1.25 (95% CI 1.15-1.36) among males and 1.11 (95% CI 0.99-1.24) among females. The corresponding aRR comparing the highest Q vs. lowest Q alcohol outlet density in relation to premature mortality was 1.36 (95% CI 1.25-1.48) for males and 1.11 (95% CI 1.00-1.24) for females. The pattern of the relation between either CCPs or alcohol outlet density and premature mortality was typically J-shaped.

Conclusion: There is J-shaped relation between CCP or alcohol outlet density and premature mortality, even upon controlling for conventional measures of poverty. Formal banking and alcohol reduction strategies might be added to health promotion policies aimed at reducing premature mortality in highly affected neighbourhoods.

Keywords: Premature mortality, cheque cashing places, cheque cashing outlets, ethanol, alcohol sales, bars, gender, poverty.

Strengths and Limitations of the Study

- Premature death among young and middle-aged adults has received little attention, despite the fact that many deaths are accidental and potentially highly preventable.
- This study was done within a universal health insurance setting in which all residents have full access to primary and hospital care services, and where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing.
- We evaluated alcohol outlet density, as well as a novel marker of neighbourhood disadvantage -- cheque cashing outlet density -- and the impact of each on premature mortality.
- We did not capture alcohol consumption at the individual level, nor did we consider race/ethnicity, a potentially important confounder between low income status and premature mortality.

Background

Preventing untimely or premature death is a major goal of healthcare and public health programs. Current definitions of “premature mortality” differ, but most studies use an age range of birth to 75 years.¹⁻⁴ While this broad age range can identify potential years of life lost,⁴ it may obscure our understanding of those factors that are specifically preventable in adulthood. The reason is that most deaths among children are from events arising around or in the perinatal period, while most seniors succumb to cancer or cardiovascular disease. Indeed, the top causes of death in young and middle aged adults are very different from those that claim the lives of older adults. For example, in Canada, accidents and self-harm are leading causes of death among those aged 25 to 44 years. After age 64 years, accidents are no longer in the top three, displaced by cancer and heart disease.⁵

Most premature deaths among young and middle-aged adults are potentially highly preventable. In many nations, alcohol use is an important risk factor for mortality.^{6,7} About 6.0% of all deaths among Canadians are alcohol-related – twice that for men than for women -- resulting in 144,142 potential years of life lost.⁷ In other areas of the world, including Russia, where alcohol consumption has emerged as a major public health concern, it is estimated that 43% of reported deaths among males aged 25 to 54 are attributed to hazardous drinking.⁸ In early and middle adulthood, alcohol leads to accidental death through impaired functioning and a higher propensity for risky behavior among males.^{9,10} We recently showed a higher risk for injury due to serious assault in association with alcohol sales, especially among young urban men.¹¹ Stockwell found that rates of alcohol-related death in British Columbia, Canada increased by 3.25% for each 20% increase in the density of private alcohol outlets.¹² Greater alcohol outlet density is associated with increased alcohol consumption and ensuing medical disease, injury, crime and violence.¹³

There is a substantial body of research on neighbourhoods and health: neighbourhood disadvantage is associated with poor psychological and physical health.¹⁴⁻¹⁶ Neighbourhood disadvantage may reflect a structural lack of access to opportunities, available alternatives or choices.^{17,18} Recent research on neighbourhood disadvantage -- material deprivation, social disorder and instability -- points to its negative impact on health, including higher rates of all-cause mortality.^{14-16,19}

Evidence suggests that poverty is also a driver of premature mortality.^{20,21} For example, there is a doubling in death due to homicide among residents living in low-income versus high-

income neighbourhoods.²² But beyond the direct economic measures of neighbourhood disadvantage there may be further benefit to using other area indicators, such as the presence of cheque cashing places (CCPs).²³ Previous research suggests that CCPs are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations.²⁴ We and others have shown that there is a linear relation between the density of CCP and violent crime, independent of classic indicators of poverty.^{23 25}

What is not well understood is the nature of the individual relation between density of CCPs and premature mortality, as well as density of alcohol sales outlets (as a neighbourhood indicator of alcohol availability) and premature mortality. We explored this question in a setting where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing, and in which there is detailed information on CCP density and premature mortality.

Methods

This population based study was conducted in the City of Toronto, Canada using its 140 pre-defined neighbourhoods as the geographic units for analysis. These neighbourhoods, created by the Social Policy Analysis and Research unit in the City's Social Development & Administration Division, with assistance from Toronto Public Health, contain an average of 7,000-10,000 residents (<http://www.toronto.ca/demographics/neighbourhoods.htm>) with an average area of 4.5 km² (range 0.4-37.5). Toronto is the largest city in the province of Ontario, where universal health care is available to virtually all residents.

The study outcome was premature mortality, defined as the number of deaths per 10,000 adults aged 20-59 years. Mortality data were extracted from the Ontario Mortality Data from 2005 to 2009 (Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO). Data were also available by sex. We pooled the data across all five years due to the low annual number of premature deaths in each neighbourhood.

We explored two exposure variables separately. The first was the neighbourhood density of CCPs per km². The second was the neighbourhood density of **alcohol outlets** per km². Toronto CCPs were identified through online Google and Yellow Pages directory Internet searches, using the terms “cheque cashing”, “payday loans” and “cash”, as described elsewhere.¹¹ **All alcohol outlets** comprised all retail liquor¹¹ and beer stores, as well as all on-premise licenced facilities, including restaurants, bars, pubs, social clubs and hotels. We used lists of licenced on-premise and retail outlets provided by the Ontario Ministry of the Attorney

General and the Liquor Control Board of Ontario as well as the Ontario Beer Stores. Thus, since all retail and on-premise alcohol sales in Ontario are governmentally licenced and regulated, this approach captures nearly all places where alcohol can be purchased by the public.

Using the address postal code, a CCP or alcohol outlet was assigned to a given Toronto neighbourhood. The density of CCPs and alcohol outlets were each expressed as a number per neighbourhood area, in km², and then further assigned to a quintile based on ranking neighbourhoods from lowest density (quintile 1) to highest (quintile 5). Quintiles were calculated using the RANK procedure in SAS.

Based on previous work,²⁵ as covariates, we assigned to each neighbourhood all-cause police-reported crime per 10,000 residents from the 2006 Uniform Crime Reporting Survey (<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3302>), and number of full-access main bank branches per km² ([http://en.wikipedia.org/wiki/Big_Five_\(banks\)](http://en.wikipedia.org/wiki/Big_Five_(banks))) – each expressed as quintiles. We also included a more standard measure of neighbourhood disadvantage as another covariate which was expressed as a material deprivation index quintile, based on the 2006 Ontario Marginalization Index²⁶; <http://www.torontohealthprofiles.ca/onmarg.php>. Material deprivation includes six census measures expressed as percentages: aged ≥ 20 years without high school graduation, lone parent families, population receiving government transfer payments, aged ≥ 15 and unemployed, living below the low income cut-off, and homes needing major repairs.

Data analysis

The association between premature mortality and the quintile-defined density of CCPs was examined using Poisson regression, with the natural log of the number of residents aged 20 to 59 years in each neighbourhood as the offset variable, based on the 2006 Canada Census (http://en.wikipedia.org/wiki/Canada_2006_Census). An unadjusted relative risk (RR) and 95% confidence interval (CI) expressed the relation between premature mortality and increasing CCP density, with the lowest CCP quintile as the referent. Adjusted RRs (aRR) were calculated by adding quintiles of crime, banks and material deprivation to the model, for males and females combined, as well as individually by sex.

The same unadjusted and adjusted models were used to explore the relation between alcohol outlet quintiles and premature mortality. We performed a separate analysis restricting the alcohol outlets to those not typically associated with food service or accommodation (called

“**alcohol focused outlets**” herein), namely, on-premise establishments designated for adult entertainment, bars, taverns, nightclubs, billiard/pool halls, gaming facilities, lounges, and stadiums, in addition to retail liquor and beer stores (Supplemental Table 2). Hence, the density of **alcohol focused outlets** was used as a more specific measure of alcohol-seeking behavior at the neighbourhood level.

All statistical analyses were performed using SAS Version 9.3 (SAS Institute Inc., Cary, North Carolina, USA). We calculated Moran’s I to assess spatial autocorrelation.²⁷ All I values ranged from 0.07 to 0.10, suggesting very low levels of spatial autocorrelation. The study was approved by the Research Ethics Board of St. Michael’s Hospital.

Results

In 2006, Toronto’s 140 neighbourhoods together had a population of 2,493,125 residents, of whom 1,478,610 were aged 20 to 59 years, and 48% were male (Table 1). Overall, the density of **all alcohol outlets** was 12.9 per km², **alcohol focused outlets** 1.2 per km², and CCPs 0.8 per km². The average crime rate was 425.9 per 10,000 residents.

Among adult males aged 20 to 59 years, intentional self-harm, accidental poisoning and liver disease were among the top-five causes of death (Supplemental Table 1). For females, cancer was the dominant cause of death, and intentional self-harm was among the top-five causes. The premature mortality rate among all persons aged 20 to 59 years was 74.1 per 10,000 residents, and was much higher for males (96.3 per 10,000) than females (55.9 per 10,000) (Table 1).

There was a J-shaped relation between CCP density and premature mortality (Table 2 and Figure 1). This was seen for especially males, and less so for females, after adjusting for certain covariates. For example, the aRR between CCP Q5 vs. Q1 was 1.25 (95% CI 1.15-1.36) for males and 1.11 (95% CI 0.99-1.24) for females.

The corresponding aRR for premature mortality comparing all alcohol outlet density Q5 vs. Q1 was 1.36 (95% CI 1.25-1.48) for males and 1.11 (95% CI 1.00-1.24) for females (Table 2 and Figure 1). For alcohol-focused establishments, the relation was not significant, but like all alcohol outlet density, the pattern of the relation was typically J-shaped (Figure 1).

Discussion

Intentional self-harm, accidental poisoning and liver disease rank within the top-five causes of premature death among males aged 20 to 59 years, who are nearly twice as likely as females to die prematurely. Moderate to high neighbourhood density of CCPs was significantly associated with a higher risk of premature mortality for men and women, even after adjusting for material deprivation, crime, and number of banks. Like CCPs, alcohol outlet density had a J-shaped relation to premature mortality.

Stockwell showed that the density of private liquor stores is independently associated with local rates of alcohol-related death.¹² Alcohol impairs cognitive functioning, and, when combined with a higher propensity for risk-taking behaviors among males, increases their likelihood of intentional and unintentional injury and death.^{9 10} In a study of hospitalizations for serious assault, we previously found that victimization increased with alcohol sales, especially among young urban men.¹¹ In the current study, neighbourhoods with a high density (Q4 and Q5) of **all alcohol outlets** exhibited a higher risk of premature mortality among males (Figure 1, middle panel), an association not evident for **alcohol focused outlets** (Figure 1, lower panel). Why this is so, is unclear, since, unlike **alcohol focused outlets**, other licenced facilities, including restaurants and social clubs, function as gathering places less centered on alcohol consumption (Supplemental Table 2), where intoxication is usually not tolerated and the hours of operation are limited.^{28 29}

Density of CCPs is certainly a proxy for poverty, itself an established risk factor for premature mortality.^{1 2 29-33} However, in our analyses, we accounted for a complex measure of poverty, namely, material deprivation. Previous research on CCPs suggests that they are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations.²⁴ We established a rationale early in the paper to suggest that CCPs are another measure of disadvantaged neighbourhoods with an independent effect on premature mortality.

Previous research has observed an association between location of CCPs and violent crime,^{23 25} as well as alcohol sales and serious assault.^{11 34 35} There is growing evidence about the negative effects of CCPs and pay day loan services on health and welfare of communities.^{23 36 37} Moreover, the link between alcohol sales and premature mortality is well established,^{2 8 32 38} as is that between poverty and increased morbidity and mortality.³⁹⁻⁴² However, little attention has focused on premature death among young and middle-aged adults, despite the fact that many deaths are from intentional and unintentional self-harm, and thus, are potentially preventable. Most studies considered premature mortality from birth to aged 75 years,¹⁻⁴ but the differing age-

related causes of death across this broad group obscures our deeper understanding of why young and middle-aged adults die. Furthermore, these latter populations constitute the majority of the workforce, who are sensitive to the economic conditions that may contribute to CCP density. Hence, it was both logical and novel for us to assess whether CCP density and alcohol outlet density each impact on premature mortality at the neighbourhood level. This study was done within a universal health insurance setting in which all Ontario residents have full access to primary and hospital care services.

Study limitations

To reduce data suppression due to small cell sizes, we aggregated our data at the neighbourhood level. Accordingly, the presence of an on-premise or retail alcohol sales outlet did not necessarily reflect alcohol consumption by those who reside in a given neighbourhood. We used administrative boundaries for each neighbourhood. While such boundaries may underestimate the influence of CCPs or alcohol outlets on adjacent neighbourhoods, Stafford et al⁴³ found that administrative boundaries are a suitable substitute for neighbourhoods otherwise defined by socioeconomic homogeneity or physical boundaries. However, we could not determine the degree of clustering (i.e., proximity to each other) of CCPs or alcohol outlets within a specific zone of a given neighbourhood.

Herein, we did not consider race/ethnicity, a potentially important confounder between low income status and premature mortality. In the US, victims of violent crime are more likely to be of Black or Hispanic ancestry⁴⁴ and assault-related premature mortality is four-fold higher in the US than in Canada (<http://www.conferenceboard.ca/hcp/details/health/premature-mortality-rate.aspx>). While CCPs are more concentrated in US ethnic minority enclaves,⁴⁵ Toronto's neighbourhoods tend to be more ethnically diverse, and homicide is not a leading cause of death (Supplemental Table 1). Given the cross-sectional nature of our data we could not assess when CCPs or alcohol outlets were first introduced to each neighbourhood or the lag in premature mortality following their introduction. We also could not assign a neighbourhood postal code to persons of no fixed address. Hence, future studies might examine changes in morbidity (e.g., severe intoxication, injury or acute mental illness) and mortality patterns with the opening and closing of CCPs or alcohol outlets, as well as creating a category for persons without a residential address.

It is challenging to conduct large population-based studies on alcohol-related harm using individual-level data on alcohol consumption.⁴⁶⁻⁴⁸ Certainly, persons most apt to overuse alcohol may be least likely to respond to household surveys,^{49 50} for example. Rather, a “birds-eye” view like ours is often necessary, wherein individual alcohol consumption cannot be measured. In Ontario, alcohol is completely regulated,¹¹ enabling us to account for all places where alcohol is sold, unlike in other Canadian provinces or US states, where private retail outlets exist.^{12 51 52} Hence, in our study, where both retail in-store and on-premise alcohol sales were documented, it was possible to evaluate the general availability of alcohol within the population.

Conclusion and implications

Our findings suggest that there may be J-shaped relation between both alcohol outlet and CCP density and premature mortality, especially among males. Thus, strategic placement of CCPs or alcohol-focused outlets in certain areas may provide local residents with ready access to quick cash and/or the purchase of alcohol. We can generally identify economic disadvantage at the individual level, and even at the area level, if it affects enough local residents. A high density of CCPs may be an economic signpost that health interventions are needed within a neighbourhood, including strategies that address the causes of premature death, such as intentional self-harm, poisoning and alcohol-related liver disease (Supplemental Table 1). Future research might explore the experiences of people faced with financial bankruptcy and its impact on their overall mental and physical health.

Solving the problem of alcohol-related harm at the neighbourhood level is not easy.⁵³ As alcohol and CCP industries are each often government regulated, should there be a restriction on the number of CCPs and/or the type of alcohol outlets in neighbourhoods with high rates of premature death? While there is some compelling evidence for limiting alcohol sales⁵⁴ -- both by number of outlets and hours of operation^{12 51 55} -- less is known about that for CCPs. One approach to the latter would be to offer money management services for people at risk of alcohol overuse, in whom addiction overwhelms all aspects of their lives, including financial instability.⁵⁶ In terms of CCPs themselves, we and others have argued that they are strategically placed where customers abound,^{23 25 57} and where mental illness and self-neglect are more prevalent. This has implications for how we shape health improvement strategies among people living in such neighbourhoods. For example, offering support to these individuals, in terms of formal banking, budget management and addiction counseling all seem sensible as part of a

strategy to reduce premature mortality. Moreover, physicians, nurses, addiction counselors and social workers who help persons with alcohol problems might use an individual’s neighbourhood as an indicator of their risk for health decline, and even recommend relocation to an area with few CCPs and alcohol outlets. For example, residential relocation has been associated with greater cessation of injection drug use, especially moving from a highly deprived to less deprived neighbourhood.⁵⁸ For alcohol addiction, recovery is less likely among those who dwell in disadvantaged neighbourhoods.⁵⁶ Certainly, the place where one lives partly determines health behaviors and opportunities for health improvement.

In conclusion, in neighbourhoods with higher than expected rates of premature mortality, lessening social disadvantage might be achieved through encouraging use of formal banking methods and better money handling, alongside alcohol reduction strategies. One can then assess whether there follows a decline in the rate of non-fatal and fatal intentional self-harm, poisoning and acute liver disease.

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None.

Authors’ contributions

JR, FIM, and MC conceived and designed the study. FIM, JR, MC and PG were involved in data collection. AP, PG and FIM performed data preparation and analysis. JR and FIM wrote the manuscript. MC and AP helped revise the manuscript. All authors read and approved the final manuscript.

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Competing interest

The authors declare that they have no competing interest.

Data Sharing Statement

There are no unpublished data related to the current study.

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Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet density quintiles (Q), presented for males females together and separately. Next to each exposure quintile label is the corresponding rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as all liquor and beer stores.

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Table 1. Description of study variables for all 140 neighbourhoods in Toronto, Canada.

Variable	Value for that variable
Population of Toronto (2006)	
<i>Total size of population studied for all ages, across all neighbourhoods</i>	2 493 125
<i>Total number of residents aged 20-59 years, across all neighbourhoods</i>	1 478 610
<i>% male of residents aged 20-59 years, across all neighbourhoods</i>	48.4
<i>Mean (SD) number of residents per neighbourhood aged 20-59 years</i>	10 562 (5115)
<i>Mean (SD) number of residents per neighbourhood aged 20-49 years</i>	8307 (4149)
<i>Mean (SD) number of males aged 20-59 years per 10 000 residents</i>	5113 (2520)
<i>Mean (SD) number of females aged 20-59 years per 10 000 residents</i>	5448 (2623)
<i>Mean (SD) number of males aged 20-49 years per 10 000 residents</i>	4042 (2061)
<i>Mean (SD) number of females aged 20-49 years per 10 000 residents</i>	4264 (2110)
Neighbourhood area, km ²	
<i>Mean (SD); Min; Max</i>	4.5 (4.6); 0.4; 37.5
All alcohol outlets*	
<i>Total number for all neighbourhoods</i>	4626
<i>Mean (SD) number per km²</i>	12.9 (22.2)
<i>Number (%) of neighbourhoods with no outlets</i>	1 (0.7)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	139 (99.3)
Alcohol focused outlets**	
<i>Total number for all neighbourhoods</i>	428
<i>Mean (SD) number per km²</i>	1.2 (1.9)
<i>Number (%) of neighbourhoods with no outlets</i>	34 (24.3)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	106 (75.7)
Median (IQR) material deprivation index	4 (3)
Banks	
<i>Total number for all neighbourhoods</i>	472
<i>Mean (SD) number per km²</i>	1.1 (1.3)
<i>Number (%) of neighbourhoods with no banks</i>	14 (10.0)
<i>Number (%) of neighbourhoods with ≥ 1 banks</i>	126 (90.0)
All crime (2006)	
<i>Mean (SD) number of all crimes per 10 000 residents</i>	425.9 (255.6)
<i>Mean (SD) number of violent crimes per 10 000 residents</i>	103.5 (54.3)
Cheque cashing places	
<i>Total number for all neighbourhoods</i>	310
<i>Mean (SD) number of cheque cashing places per km²</i>	0.8 (1.2)
<i>Number (%) of neighbourhoods with no cheque cashing places</i>	42 (30.0)
<i>Number (%) of neighbourhoods with ≥ 1 cheque cashing places</i>	98 (70.0)

* Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

Table 2. Risk of premature mortality among adults aged 20 to 59 years in relation to density of cheque cashing place (CCP) or alcohol outlet quintiles.

Exposure variable	Crude relative risk (95% confidence interval)				Adjusted relative risk (95% confidence interval)*		
	All	Males	Females		All	Males	Females
CCP density quintile							
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.96 (0.89, 1.03)	0.91 (0.83, 1.00)	0.94 (0.84, 1.05)		0.91 (0.84, 0.98)	0.88 (0.80, 0.98)	0.92 (0.81, 1.03)
<i>Q3</i>	1.21 (1.14, 1.28)	1.19 (1.10, 1.28)	1.14 (1.04, 1.24)		1.04 (0.98, 1.11)	1.03 (0.94, 1.12)	1.05 (0.95, 1.17)
<i>Q4</i>	1.24 (1.17, 1.32)	1.25 (1.17, 1.35)	1.16 (1.06, 1.27)		1.07 (1.00, 1.14)	1.07 (0.98, 1.16)	1.08 (0.97, 1.20)
<i>Q5</i>	1.46 (1.38, 1.54)	1.52 (1.42, 1.63)	1.24 (1.13, 1.36)		1.20 (1.12, 1.29)	1.25 (1.15, 1.36)	1.11 (0.99, 1.24)
All alcohol outlet density quintile**							
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	1.13 (1.06, 1.20)	1.16 (1.07, 1.25)	1.08 (0.99, 1.19)		1.03 (0.96, 1.09)	1.04 (0.96, 1.13)	1.03 (0.93, 1.13)
<i>Q3</i>	1.01 (0.95, 1.08)	1.06 (0.98, 1.15)	0.96 (0.87, 1.06)		0.99 (0.93, 1.06)	1.04 (0.96, 1.13)	0.95 (0.86, 1.05)
<i>Q4</i>	1.18 (1.11, 1.26)	1.21 (1.11, 1.31)	1.11 (1.00, 1.22)		1.18 (1.10, 1.26)	1.21 (1.11, 1.32)	1.11 (0.99, 1.23)
<i>Q5</i>	1.28 (1.20, 1.35)	1.35 (1.26, 1.46)	1.10 (1.00, 1.21)		1.26 (1.18, 1.35)	1.36 (1.25, 1.48)	1.11 (1.00, 1.24)
Alcohol focused outlet density quintile***							
<i>Q1</i>	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)		1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
<i>Q2</i>	0.99 (0.93, 1.05)	0.93 (0.86, 1.01)	0.99 (0.89, 1.09)		0.85 (0.79, 0.92)	0.82 (0.74, 0.90)	0.91 (0.80, 1.02)
<i>Q3</i>	1.08 (1.01, 1.15)	1.03 (0.95, 1.11)	1.06 (0.96, 1.17)		0.95 (0.88, 1.03)	0.93 (0.85, 1.02)	0.98 (0.88, 1.10)
<i>Q4</i>	1.12 (1.05, 1.20)	1.08 (1.00, 1.17)	1.08 (0.98, 1.20)		1.04 (0.96, 1.12)	1.03 (0.94, 1.13)	1.05 (0.93, 1.18)
<i>Q5</i>	1.20 (1.12, 1.27)	1.17 (1.08, 1.26)	1.08 (0.98, 1.20)		1.06 (0.98, 1.14)	1.06 (0.96, 1.17)	1.02 (0.90, 1.15)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

A Population-based study of premature mortality in relation to neighbourhood density of alcohol sales and cheque cashing outlets, Toronto, Canada

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Abstract

Objective: Alcohol overuse and poverty, each associated with premature death, often co-exist within ~~disadvantaged socially disorganized~~ neighborhoods. Cheque cashing places (CCPs) may be opportunistically placed in ~~disadvantaged socially disorganized~~ neighbourhoods, where customers abound. We explored whether neighbourhood density of CCPs and alcohol outlets are ~~, individually, and in combination, each~~ related to premature mortality among adults.

Design: Retrospective population-based study.

Setting: 140 neighbourhoods in Toronto, Ontario, 2005-2009.

Participants: Adults aged 20-59 years.

Measures: Our primary outcome was premature all-cause mortality among adults aged 20-59 years. Across neighbourhoods we explored ~~, separately and jointly,~~ neighbourhood density, in km²-~~o~~, of CCPs and alcohol outlets, and their relation of each to premature mortality. Poisson regression provided relative risks (aRRs) and 95% confidence intervals (CIs), adjusting for material deprivation quintile, crime quintile and number of banks. ~~A separate analysis examined alcohol-focused establishments, namely, on-premise establishments like bars and nightclubs, retail liquor and beer stores.~~

Results: Intentional self-harm, accidental poisoning and liver disease were among the top-five causes of premature death among males aged 20-59 years. The overall premature mortality rate was 96.3 per 10,000 males and 55.9 per 10,000 females. Comparing the highest vs. lowest CCP density quintiles (Q), the aRR for death was 1.252 (95% CI 1.125-1.3634) among males in men and 1.114 (95% CI 0.991-1.248) among women females. The corresponding aRR comparing the highest Q vs. lowest Q for all alcohol outlet density in relation to association between alcohol outlet density and premature mortality was 1.36 (95% CI 1.25-1.48) for males and 1.11 (95% CI 1.00-1.24) U-shaped, CCP Q3 and alcohol-focused outlet Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36-1.75) and females (1.39, 95% CI 1.18-1.64) for females. For alcohol-focused establishments, the relation was not significant. The pattern of the relation between either CCPs or alcohol outlet density and premature mortality, was typically J-shaped.

Conclusion: There is J-shaped a relation between non-linear synergistic effect of both CCP or and alcohol outlet density and on premature mortality, even upon controlling for conventional measures of poverty. In socially disorganized neighbourhoods, formal banking and alcohol

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reduction strategies might be added to health promotion policies aimed at reducing premature mortality in highly affected neighbourhoods.

Keywords: Premature mortality, cheque cashing places, cheque cashing outlets, ethanol, alcohol sales, bars, gender, poverty.

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Strengths and Limitations of the Study

- Premature death among young and middle-aged adults has received little attention, despite the fact that many deaths are accidental and potentially highly preventable.
- This study was done within a universal health [insurance](#) setting in which all residents have full access to primary and hospital care services, and where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing.
- We evaluated [alcohol outlet density, as well as](#) a novel marker of neighbourhood ~~disadvantagesocial disorganization~~ -- cheque cashing outlet density -- [and the ir separate](#) ~~and its impact~~ [of each](#) on premature mortality; ~~alone, and in combination with alcohol outlet density.~~
- We did not capture alcohol consumption at the individual level, nor did we consider race/ethnicity, a potentially important confounder between low income status and premature mortality.

Background

Preventing untimely or premature death is a major goal of healthcare and public health programs. Current definitions of “premature mortality” differ, but most studies use an age range of birth to 75 years.¹⁻⁴ While this broad age range can may identify potential years of life lost,⁴ it may obscure our understanding of those factors that are specifically preventable in adulthood. The reason is that most deaths among children are from events arising around or in the perinatal period, while most seniors succumb to cancer or cardiovascular disease. Indeed, the top causes of death in young and middle aged adults are very different from those that claim the lives of older adults. For example, in Canada, accidents and self-harm are leading causes of death among those aged 25 to 44 years. After age 64 years, accidents are no longer in the top three, displaced by cancer and heart disease.⁵

Most premature deaths among young and middle-aged adults are potentially highly preventable. In many nations, alcohol use is an important risk factor for mortality.^{6,7} About 6.0% of all deaths among Canadians are alcohol-related – twice that for men than for women -- resulting in 144,142 potential years of life lost.⁷ In other areas of the world, including Russia, where alcohol consumption has emerged as a major public health concern, it is estimated that 43% of reported deaths among males aged 25 to 54 are attributed to hazardous drinking.⁸ In early and middle adulthood, alcohol leads to accidental death through impaired functioning and a higher propensity for risky behavior among males.^{9,10} We recently showed a higher risk for injury due to serious assault in association with alcohol sales, especially among young urban men.¹¹ Stockwell found that rates of alcohol-related death in British Columbia, Canada increased by 3.25% for each 20% increase in the density of private alcohol outlets.¹² Greater alcohol outlet density is associated with increased alcohol consumption and ensuing medical disease, injury, crime and violence.¹³

There is a substantial body of research on neighbourhoods and health: Studies suggest that the greater presence of neighbourhood disadvantage chronic stressors at the residential level is associated with poor psychological and physical health.¹⁴⁻¹⁶ Neighbourhood disadvantage may reflect a structural lack of access to opportunities, available alternatives or choices.^{17,18} Recent research on neighbourhood disadvantage -- material deprivation, social disorder and instability --- points to its negative impact of chronic stressors on health, including higher rates of all-cause mortality.^{14-16,19} Neighbourhood stress most pronounced in low income areas, and areas where mental and physical illness is more prevalent. Latkin and Curry and Matheson et al

argue that social disorganization is also an important contributor to chronic stress among residents living in such disadvantaged neighbourhoods.

Evidence suggests that poverty—a known marker of socially disorganized neighbourhoods—is also a driver of premature mortality.^{20 21} For example, there is a doubling in death due to homicide among residents living in low-income versus high-income neighbourhoods.²² But beyond the direct economic measures of neighbourhood disadvantage income status, there may be further additive benefit to using other area indicators of economic and neighbourhood social disorganization, such as the presence of cheque cashing places (CCPs).²³ Previous research suggests that CCPs are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations.²⁴ We and others have shown that there is a linear relation between the density of CCP and violent crime, independent of classic indicators of poverty.^{23 25}

What is not well understood is the nature of the individual and joint relation between density of CCPs (as an indicator of neighbourhood social disorganization) and premature mortality, as well as and density of alcohol sales outlets (as a neighbourhood indicator of alcohol availability) and premature mortality. We explored this question in a setting where both retail in-store and on-premise alcohol sales are completely regulated by provincial licencing, and in which there is detailed information on CCP density and premature mortality.

Methods

This population based study was conducted in the City of Toronto, Canada using its 140 pre-defined neighbourhoods as the geographic units for analysis. These neighbourhoods, created by the Social Policy Analysis and Research unit in the City's Social Development & Administration Division, with assistance from Toronto Public Health, contain an average of 7,000-10,000 residents (<http://www.toronto.ca/demographics/neighbourhoods.htm>) with an average area size of 4.5 km² (range 0.4-37.5). Toronto is the largest city in the province of Ontario, where universal health care is available to virtually all residents.

The study outcome was premature mortality, defined as the number of deaths per 10,000 adults aged 20-59 years. Mortality data were extracted from the Ontario Mortality Data from 2005 to 2009 (Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO). Data were also available by sex. We pooled the data across all five years due to the low annual number of premature deaths in each neighbourhood.

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We explored two exposure variables separately. The first was the neighbourhood density of **CCPs per km²**. The second was the neighbourhood density of **alcohol outlets per km²**. Toronto CCPs were identified through online Google and Yellow Pages directory Internet searches, using the terms “cheque cashing”, “payday loans” and “cash”, as described elsewhere.¹¹ **All alcohol outlets** comprised all retail liquor¹¹ and beer stores, as well as all on-premise licenced facilities, including restaurants, bars, pubs, social clubs and hotels. We used lists of licenced on-premise and retail outlets provided by the Ontario Ministry of the Attorney General and the Liquor Control Board of Ontario as well as the Ontario Beer Stores. Thus, since all retail and on-premise alcohol sales in Ontario are governmentally licenced and regulated, this approach captures nearly all places where alcohol can be purchased by the public.

Using the address postal code, a CCP or alcohol outlet was assigned to a given Toronto neighbourhood. The density of CCPs and alcohol outlets were each expressed as a number per **neighbourhood area, in km²**, and then further assigned to a quintile based on ranking neighbourhoods from lowest density (quintile 1) to highest (quintile 5). Quintiles were calculated using the RANK procedure in SAS.

Based on previous work,²⁵ as covariates, we assigned to each neighbourhood all-cause police-reported crime **per 10,000 residents** from the 2006 Uniform Crime Reporting Survey (<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3302>), and number of full-access main bank branches **per km²** ([http://en.wikipedia.org/wiki/Big_Five_\(banks\)](http://en.wikipedia.org/wiki/Big_Five_(banks))) – each **expressed as** quintiles. **We also included a more standard measure of neighbourhood disadvantage as prosperity**, another covariate **which**, was expressed as a material deprivation index quintile, based on the 2006 Ontario Marginalization Index²⁶; <http://www.torontohealthprofiles.ca/onmarg.php>. Material deprivation includes six census measures expressed as percentages: aged ≥ 20 years without high school graduation, lone parent families, population receiving government transfer payments, aged ≥ 15 and unemployed, living below the low income cut-off, and homes needing major repairs.

Data analysis

The association between premature mortality and the quintile-defined density of CCPs was examined using Poisson regression, with the natural log of the number of residents **aged 20 to 59 years** in each neighbourhood as the offset variable, based on the 2006 Canada Census (http://en.wikipedia.org/wiki/Canada_2006_Census). An unadjusted relative risk (RR) and 95%

confidence interval (CI) expressed the relation between premature mortality and increasing CCP density, with the lowest CCP quintile as the referent. Adjusted RRs (aRR) were calculated by adding quintiles of crime, banks and material deprivation to the model, for males and females combined, as well as individually by sex.

The same unadjusted and adjusted models were used to explore the relation between alcohol outlet quintiles and premature mortality. We performed a separate analysis restricting the alcohol outlets to those not typically associated with food service or accommodation (called “**alcohol focused outlets**” herein), namely, on-premise establishments designated for adult entertainment, bars, taverns, nightclubs, billiard/pool halls, gaming facilities, lounges, and stadiums, in addition to retail liquor and beer stores (Supplemental Table 2). Hence, the density of **alcohol focused outlets** was used as a more specific measure of alcohol-seeking behavior at the neighbourhood level.

~~The joint effect (i.e., co-presence) of CCPs and alcohol outlets and their relation to premature mortality was analyzed by cross-categorizing neighbourhoods according to both CCP quintile and alcohol outlet quintile. Due insufficient cell sizes, it was necessary to collapse the lowest two quintiles (Q1 and Q2) and highest two quintiles (Q4 and Q5) for each individual variable before cross-categorizing them, resulting in 9 categories, with CCPs Q1 and Q2/Alcohol outlets Q1 and Q2 as the referent. We ran the same multivariable Poisson regression models as above, separately for males and females.~~ All statistical analyses were performed using SAS Version 9.3 (SAS Institute Inc., Cary, North Carolina, USA). We calculated Moran’s I to assess spatial autocorrelation.²⁷ All I values ranged from 0.07 to 0.10, suggesting very low levels of spatial autocorrelation. The study was approved by the Research Ethics Board of St. Michael’s Hospital.

Results

In 2006, Toronto’s 140 neighbourhoods together had a population of 2,493,125 residents, of whom 1,478,610 were aged 20 to 59 years, and 48% were male (Table 1). Overall, the density of **all alcohol outlets** was ~~19.4~~ **12.9** per ~~km²10,000~~², **alcohol focused outlets** ~~1.2~~ **1.8** per ~~km²10,000~~, and CCPs ~~0.8~~ **1.3** per ~~km²10,000 persons~~. The average crime rate was 425.9 per 10,000 residents.

Among adult males aged 20 to 59 years, intentional self-harm, accidental poisoning and liver disease were among the top-five causes of death (Supplemental Table 1). For females,

cancer was the dominant cause of death, and intentional self-harm was among the top-five causes. The premature mortality rate among all persons aged 20 to 59 years was 74.1 per 10,000 residents, and was much higher for males (96.3 per 10,000) than females (55.9 per 10,000) (Table 1).

There was a J-shaped relation between CCP density and premature mortality (Table 2 and Figure 1). This was seen for especially males, and less so for females, ~~females, and~~ after adjusting for certain covariates. For example, the aRR between CCP Q5 vs. Q1 was 1.22 (95% CI 1.12 to 1.34) for men and 1.14 (95% CI 1.01 to 1.28) for women. 1.25 (95% CI 1.15-1.36) for males and 1.11 (95% CI 0.99-1.24) for females.

The corresponding aRR for premature mortality comparing for all alcohol outlet density Q5 vs. Q1 and premature mortality was 1.36 (95% CI 1.25-1.48) for males and 1.11 (95% CI 1.00-1.24) for females (Table 2 and Figure 1). For alcohol-focused establishments, the relation was not significant, but like all alcohol outlet density, the ~~The pattern of the relation between either CCPs or alcohol outlet density and premature mortality was typically J-shaped (Figure 1).~~

~~The relation between the density of all alcohol outlets and premature mortality was U-shaped, with the lowest risk at Q3, especially among males (Figure 1). Upon limiting the analysis to alcohol focused outlets, the adjusted RR was significantly lower in Q2 and Q5 among men (Table 2 and Figure 1).~~

~~In the joint analysis of the density of CCPs and all alcohol outlets, there was a significantly increased risk of premature mortality for Q3 CCP with either Q1&2 or Q4&5 (Table 3, Figure 2). Neighbourhoods with joint CCP Q3 and alcohol focused outlet Q3 density had the highest aRR for death among males (1.54, 95% CI 1.36 to 1.75) and females (1.39, 95% CI 1.18 to 1.64).~~

~~Upon repeating the above analyses, but restricting the definition of premature mortality to deaths between ages 20 and 49 years, the results were generally the same (Supplemental Tables 3 and 4).~~

~~In the aforementioned analyses, adding neighbourhood area (in square kilometers), as a covariate, to the multivariable models did not significantly alter the study results (data not shown).~~

Discussion

Intentional self-harm, accidental poisoning and liver disease rank within the top-five causes of premature death among males aged 20 to 59 years, who are nearly twice as likely as females to die prematurely. Moderate to high neighbourhood density of CCPs was significantly associated with a higher risk of premature mortality for ~~both~~ men and women, even after adjusting for material deprivation, crime, and number of banks. Like CCPs, a Alcohol outlet density had a JU-shaped relation to premature mortality. ~~In neighbourhoods with a low density of CCPs, the co-presence of either low (Q1 and Q2), moderate (Q3) or high (Q4 and Q5) density of alcohol outlets had virtually no relation to premature mortality.~~

Stockwell showed that the density of private liquor stores is independently associated with local rates of alcohol-related death.¹² Alcohol impairs cognitive functioning, and, when combined with a higher propensity for risk-taking behaviors among males, increases their likelihood of intentional and unintentional injury and death.^{9 10} In a study of hospitalizations for serious assault, we previously found that victimization increased with alcohol sales, especially among young urban men.¹¹ In the current study, neighbourhoods with a high density (Q4 and Q5) of ~~For all alcohol outlets, at high low to moderate density (Q42 and Q53), exhibited a~~ higher ~~the~~ risk of premature mortality among males ~~was at its highest~~ lowest (Figure 1, middle panel), an ~~This~~ association ~~was~~ not evident for **alcohol focused outlets**, ~~however~~ (Figure 1, lower panel). Why this is so, is unclear, since, ~~Unlike~~ **alcohol focused outlets**, other licenced facilities, including restaurants and social clubs, function as gathering places less centered on alcohol consumption (Supplemental Table 2), where intoxication is usually not tolerated and the hours of operation are limited.^{28 29} ~~In the current study, we attempted to clarify the relation between CCPs, with and without density of alcohol sales outlets, and premature mortality.~~

Density of CCPs is certainly a proxy for poverty, itself an established risk factor for premature mortality.^{1 2 29-33} However, in our analyses, we accounted for a complex measure of poverty, namely, material deprivation. Previous research on CCPs suggests that they are opportunistically placed in low income neighbourhoods to meet the needs of more vulnerable populations.²⁴ We established a rationale early in the paper to suggest that CCPs are another measure of disadvantaged social disorganization neighbourhoods with an independent effect on premature mortality.

Previous research has observed an association between location of CCPs and violent crime,^{23 25} as well as alcohol sales and serious assault.^{11 34 35} There is growing evidence about the negative effects of CCPs and pay day loan services on health and welfare of communities.^{23 36 37}

Moreover, the link between alcohol sales and premature mortality is well established,^{2 8 32 38} as is that between poverty and increased morbidity and mortality.³⁹⁻⁴² However, little attention has focused on premature death among young and middle-aged adults, despite the fact that many deaths are from intentional and unintentional self-harm, and thus, are potentially highly preventable. Most studies considered premature mortality from birth to aged 75 years,¹⁻⁴ but the differing age-related causes of death across this broad group obscures our deeper understanding of why young and middle-aged adults die. Furthermore, these latter populations constitute the majority of the workforce, who are sensitive to the economic conditions that may contribute to CCP density. Hence, it was both logical and novel for us to assess whether CCP density and alcohol outlet density ~~each —both individually and together—~~ impact on premature mortality at the neighbourhood level, ~~especially among young and middle-aged adults~~. This study was done within a universal health insurance setting in which all Ontario residents have full access to primary and hospital care services.

Study limitations

To reduce data suppression due to small cell sizes, we aggregated our data at the neighbourhood level. Accordingly, the presence of an on-premise or retail alcohol sales outlet did not necessarily reflect alcohol consumption by those who reside in a given neighbourhood. We used administrative boundaries for each neighbourhood. While such boundaries may underestimate the influence of CCPs or alcohol outlets on adjacent neighbourhoods, Stafford et al⁴³ found that administrative boundaries are a suitable substitute for neighbourhoods otherwise defined by socioeconomic homogeneity or physical boundaries. However, we could not determine the degree of clustering (i.e., proximity to each other) of CCPs or alcohol outlets within a specific zone of a given neighbourhood.

Herein, we did not consider race/ethnicity, a potentially important confounder between low income status and premature mortality. In the US, victims of violent crime are more likely to be of Black or Hispanic ancestry⁴⁴ and assault-related premature mortality is four-fold higher in the US than in Canada (<http://www.conferenceboard.ca/hcp/details/health/premature-mortality-rate.aspx>). While CCPs are more concentrated in US ethnic minority enclaves,⁴⁵ Toronto's neighbourhoods tend to be more ethnically diverse, and homicide is not a leading cause of death (Supplemental Table 1). Given the cross-sectional nature of our data we could not assess when CCPs or alcohol outlets were first introduced to each neighbourhood or the lag in premature

mortality following their introduction. We also could not assign a neighbourhood postal code to persons of no fixed address. Hence, future studies might examine changes in morbidity (e.g., severe intoxication, injury, or acute mental illness) and mortality patterns with the opening and closing of CCPs or alcohol outlets, as well as creating a category for persons without a residential address.

It is challenging to conduct large population-based studies on alcohol-related harm using individual-level data on alcohol consumption.⁴⁶⁻⁴⁸ Certainly, persons most apt to overuse alcohol may be least likely to respond to household surveys,^{49 50} for example. Rather, a “birds-eye” view like ours is often necessary, wherein individual alcohol consumption cannot be measured. In Ontario, alcohol is completely regulated,¹¹ enabling us to account for all places where alcohol is sold, unlike in other Canadian provinces or US states, where private retail outlets exist.^{12 51 52} Hence, in our study, where both retail in-store and on-premise alcohol sales were documented, it was possible to evaluate the general availability of alcohol within the population.

Conclusion and implications

Our findings suggest that there may be J-shaped relation between both alcohol outlets and CCPs density and ~~on~~ premature mortality, especially among males. Moderate to high saturation of CCPs, in combination with higher presence of alcohol focused outlets, was a particularly bad combination, in terms of the risk of premature mortality. Thus, strategic placement of CCPs or and alcohol-focused outlets in certain areas may provide local residents with ready access to quick cash and or the purchase of alcohol. ~~A provoking question that we cannot answer is whether economic bankruptcy foretells “health bankruptcy”, which in turn may result in premature death?~~ We can generally identify economic disadvantage bankruptcy at the individual level, and even at the area level, if it affects enough local residents. A high density of CCPs may be an economic signpost that health interventions are needed within a communityneighbourhood, including strategies that address the causes of premature death among men and women, such as intentional self-harm, poisoning and alcohol-related liver disease (Supplemental Table 1). Future research might explore the experiences of people faced with financial bankruptcy and its impact on their overall mental and physical health.

Solving the problem of alcohol-related harm at the communityneighbourhood level is not easy.⁵³ As alcohol and CCP industries are each often government regulated, should there be a restriction on the number of CCPs and/or the type of alcohol outlets in neighbourhoods with high

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rates of premature death? While there is some compelling evidence for limiting alcohol sales⁵⁴ -- both by number of outlets and hours of operation^{12 51 55} -- less is known about that for CCPs. One approach to the latter would be to offer money management services for people at risk of alcohol overuse, in whom addiction overwhelms all aspects of their lives, including financial instability.⁵⁶ In terms of CCPs themselves, we and others have argued that they are strategically placed where customers abound,^{23 25 57} and where mental illness and self-neglect are more prevalent. This has implications for how we shape health improvement strategies among people living in such neighbourhoods. For example, offering support to these individuals, in terms of formal banking, budget management and addiction counseling all seem sensible as part of a strategy to reduce premature mortality. Moreover, physicians, nurses, addiction counselors and social workers who help persons with alcohol problems might use an individual's neighbourhood as an indicator of their risk for health decline, and even recommend relocation to an area with few CCPs and alcohol outlets. For example, residential relocation has been associated with greater cessation of injection drug use, especially moving from a highly deprived to less deprived neighbourhood.⁵⁸ For alcohol addiction, recovery is less likely among those who dwell in disadvantaged neighbourhoods.⁵⁶ Certainly, the place where one lives partly determines health behaviors and opportunities for health improvement.

In conclusion, in neighbourhoods with higher than expected rates of premature mortality, lessening social ~~disadvantage disorganization~~ might be achieved through encouraging use of formal banking methods and better money handling, alongside alcohol reduction strategies. One can then assess whether there follows a decline in the rate of ~~fatal and non-fatal~~ and fatal intentional self-harm, poisoning and acute liver disease.

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None.

Authors' contributions

JR, FIM, and MC conceived and designed the study. FIM, JR, MC and PG were involved in data collection. AP, PG and FIM performed data preparation and analysis. JR and FIM wrote the manuscript. MC and AP helped revise the manuscript. All authors read and approved the final manuscript.

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Competing interest

The authors declare that they have no competing interest.

Data Sharing Statement

There are no unpublished data related to the current study.

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Figure 1. Risk of premature mortality in relation to cheque cashing places (CCP) and alcohol outlet density quintiles (Q), presented for males females together and separately. Next to each exposure quintile label is the corresponding rate of premature mortality per 10,000 adults aged 20 to 59 years. Alcohol focused outlets were limited to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as all liquor and beer stores.

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Table 1. Description of study variables for all 140 neighbourhoods in Toronto, Canada.

Variable	Value for that variable
Population of Toronto (2006)	
<i>Total size of population studied for all ages, across all neighbourhoods</i>	2 493 125
<i>Total number of residents aged 20-59 years, across all neighbourhoods</i>	1 478 610
<i>% male of residents aged 20-59 years, across all neighbourhoods</i>	48.4
<i>Mean (SD) number of residents per neighbourhood aged 20-59 years</i>	10 562 (5115)
<i>Mean (SD) number of residents per neighbourhood aged 20-49 years</i>	8307 (4149)
<i>Mean (SD) number of males aged 20-59 years per 10 000 residents</i>	5113 (2520)
<i>Mean (SD) number of females aged 20-59 years per 10 000 residents</i>	5448 (2623)
<i>Mean (SD) number of males aged 20-49 years per 10 000 residents</i>	4042 (2061)
<i>Mean (SD) number of females aged 20-49 years per 10 000 residents</i>	4264 (2110)
<u>Neighbourhood area, km²</u>	
<u>Mean (SD); Min; Max</u>	<u>4.5 (4.6); 0.4; 37.5</u>
All alcohol outlets*	
<i>Total number for all neighbourhoods</i>	4626
<u>Mean (SD) number per km²</u>	<u>12.9 (22.2)</u>
<i>Number (%) of neighbourhoods with no outlets</i>	1 (0.7)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	139 (99.3)
Alcohol focused outlets**	
<i>Total number for all neighbourhoods</i>	428
<u>Mean (SD) number per km²</u>	<u>1.2 (1.9)</u>
<i>Number (%) of neighbourhoods with no outlets</i>	34 (24.3)
<i>Number (%) of neighbourhoods with ≥ 1 outlets</i>	106 (75.7)
Median (IQR) material deprivation index	4 (3)
Banks	
<i>Total number for all neighbourhoods</i>	472
<u>Mean (SD) number per km²</u>	<u>1.1 (1.3)</u>
<i>Number (%) of neighbourhoods with no banks</i>	14 (10.0)
<i>Number (%) of neighbourhoods with ≥ 1 banks</i>	126 (90.0)
All crime (2006)	
<i>Mean (SD) number of all crimes per 10 000 residents</i>	425.9 (255.6)
<i>Mean (SD) number of violent crimes per 10 000 residents</i>	103.5 (54.3)
Cheque cashing places	
<i>Total number for all neighbourhoods</i>	310
<u>Mean (SD) number of cheque cashing places per km²</u>	<u>0.8 (1.2)</u>
<i>Number (%) of neighbourhoods with no cheque cashing places</i>	42 (30.0)
<i>Number (%) of neighbourhoods with ≥ 1 cheque cashing places</i>	98 (70.0)

* Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

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Table 2. Risk of premature mortality among adults aged 20 to 59 years in relation to density of cheque cashing place (CCP) or alcohol outlet quintiles.

Exposure variable	Crude relative risk (95% confidence interval)			Adjusted relative risk (95% confidence interval)*		
	All	Males	Females	All	Males	Females
CCP density quintile						
Q1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q2	0.96 (0.89, 1.03)	0.91 (0.83, 1.00)	0.94 (0.84, 1.05)	0.91 (0.84, 0.98)	0.88 (0.80, 0.98)	0.92 (0.81, 1.03)
Q3	1.21 (1.14, 1.28)	1.19 (1.10, 1.28)	1.14 (1.04, 1.24)	1.04 (0.98, 1.11)	1.03 (0.94, 1.12)	1.05 (0.95, 1.17)
Q4	1.24 (1.17, 1.32)	1.25 (1.17, 1.35)	1.16 (1.06, 1.27)	1.07 (1.00, 1.14)	1.07 (0.98, 1.16)	1.08 (0.97, 1.20)
Q5	1.46 (1.38, 1.54)	1.52 (1.42, 1.63)	1.24 (1.13, 1.36)	1.20 (1.12, 1.29)	1.25 (1.15, 1.36)	1.11 (0.99, 1.24)
All alcohol outlet density quintile**						
Q1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q2	1.13 (1.06, 1.20)	1.16 (1.07, 1.25)	1.08 (0.99, 1.19)	1.03 (0.96, 1.09)	1.04 (0.96, 1.13)	1.03 (0.93, 1.13)
Q3	1.01 (0.95, 1.08)	1.06 (0.98, 1.15)	0.96 (0.87, 1.06)	0.99 (0.93, 1.06)	1.04 (0.96, 1.13)	0.95 (0.86, 1.05)
Q4	1.18 (1.11, 1.26)	1.21 (1.11, 1.31)	1.11 (1.00, 1.22)	1.18 (1.10, 1.26)	1.21 (1.11, 1.32)	1.11 (0.99, 1.23)
Q5	1.28 (1.20, 1.35)	1.35 (1.26, 1.46)	1.10 (1.00, 1.21)	1.26 (1.18, 1.35)	1.36 (1.25, 1.48)	1.11 (1.00, 1.24)
Alcohol focused outlet density quintile***						
Q1	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Q2	0.99 (0.93, 1.05)	0.93 (0.86, 1.01)	0.99 (0.89, 1.09)	0.85 (0.79, 0.92)	0.82 (0.74, 0.90)	0.91 (0.80, 1.02)
Q3	1.08 (1.01, 1.15)	1.03 (0.95, 1.11)	1.06 (0.96, 1.17)	0.95 (0.88, 1.03)	0.93 (0.85, 1.02)	0.98 (0.88, 1.10)
Q4	1.12 (1.05, 1.20)	1.08 (1.00, 1.17)	1.08 (0.98, 1.20)	1.04 (0.96, 1.12)	1.03 (0.94, 1.13)	1.05 (0.93, 1.18)
Q5	1.20 (1.12, 1.27)	1.17 (1.08, 1.26)	1.08 (0.98, 1.20)	1.06 (0.98, 1.14)	1.06 (0.96, 1.17)	1.02 (0.90, 1.15)

* All models were adjusted for material deprivation quintile and crime quintile, while the analysis of CCPs was also adjusted for number of banks.

** Includes all on-premise alcohol licenced facilities, as well as liquor and beer stores.

*** Restricted to specific on-premise alcohol licenced facilities (see Supplemental Table 2), as well as well as liquor and beer stores.

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

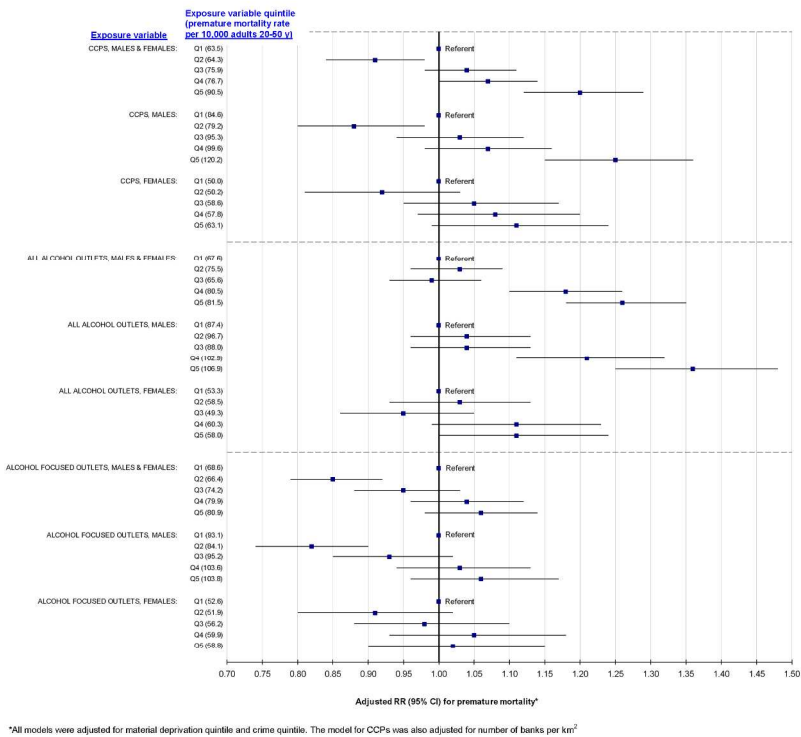
	Item No	Recommendation	Comments	Page in manuscript
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Completed	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Completed	2
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Completed	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	Completed	5
Methods				
Study design	4	Present key elements of study design early in the paper	Completed	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Completed	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Not applicable	
		(b) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Completed	5-6
Data sources/measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Completed	5-6
Bias	9	Describe any efforts to address potential sources of bias	Completed	8-9
Study size	10	Explain how the study size was arrived at	Completed	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Completed	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Completed	6

		(b) Describe any methods used to examine subgroups and interactions	Completed	6
		(c) Explain how missing data were addressed	Not applicable	
		(d) If applicable, explain how loss to follow-up was addressed	Not applicable	
		(e) Describe any sensitivity analyses	Completed	6 & 7
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Not applicable	
		(b) Give reasons for non-participation at each stage	Not applicable	
		(c) Consider use of a flow diagram	Not applicable	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Completed	5 & 7
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable	
		(c) Summarise follow-up time (eg, average and total amount)	Not applicable	
Outcome data	15*	Report numbers of outcome events or summary measures over time	Completed	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Completed	7
		(b) Report category boundaries when continuous variables were categorized	Completed	6-7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Completed	7
Discussion				
Key results	18	Summarise key results with reference to study objectives	Completed	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Completed	8-9

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Completed	9-10
Generalisability	21	Discuss the generalisability (external validity) of the study results	Completed	9
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Completed	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.



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Supplemental Table 1. Top five leading causes of death among residents of Toronto aged 20 to 59 years, 2005 to 2009.

Rank	Males	Females	Males and females
1	Ischemic heart disease	Breast cancer	Ischemic heart disease
2	Intentional self-harm	Lung cancer	Intentional self-harm
3	Lung cancer	Intentional self-harm	Lung cancer
4	Accidental poisoning	Ischemic heart disease	Breast cancer
5	Cirrhosis and other liver diseases	Colorectal cancer	Accidental poisoning

Source: Ontario Mortality Data 2005-09, Ontario Ministry of Health and Long -Term Care, IntelliHEALTH ONTARIO, Date accessed, November, 2012.

Leading causes of death based on APHEO Leading Cause Groups for Mortality Tabulation

<http://www.apheo.ca/resources/indicators/APHEO%20Modifications%20to%20Lead%20CauseDeath%20Becker%20at%20a%20glance.pdf>

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Supplemental Table 2. Type of on-premise licensed alcohol outlets. Those in bolded italics were considered herein to be “alcohol focused”.

Type of Outlet
Restaurant
<i>Bar/Sports Bar</i>
Social Club
Hotel/Motel
<i>Night Club</i>
<i>Bar /Tavern /Nightclub</i>
Banquet Hall
Boat
<i>Karaoke Bar/Restaurant</i>
<i>Billiard/Pool Hall</i>
Live Theatre
Bowling Alley
Retirement Residence
<i>Adult Entertainment</i>
Educational Facility
<i>Gaming Facility</i>
<i>Stadium</i>
Golf Course
Motion Picture Theatre
Outdoor Area
Athletic Club
Military
Museum
Other
Railway Car