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Feasibility of a community-centred approach to mapping alcohol outlet density and outlet trading times in two South African communities

Leane Ramsoomar[1,2], Aadielah Maker-Diedericks[2], Maureen Mtimkulu[1], Natashia Morris[3], Ishen Seocharan[4,5] and Esnat Chirwa[1,6]

[1] Gender and Health Research Unit, South African Medical Research Council
[2] School of Health Systems and Public Health, University of Pretoria
[3] Southern African Alcohol Policy Alliance (SAAPA)
[4] Health Geographic Information Systems (GIS) Centre, Biostatistics Research Unit, South African Medical Research Council
[5] Biostatistics Research Unit, South African Medical Research Council
[6] School of Public Health, Faculty of Health Sciences, University of Witwatersrand

Abstract

Background: South Africa has high levels of alcohol consumption, and the availability of alcohol outlets plays a significant role in shaping drinking patterns. Alcohol outlets are typically concentrated in specific small areas, and their density and trading hours can influence alcohol-related harm. Several studies have shown that greater outlet density and extended trading hours are linked to higher levels of alcohol consumption and associated harm. However, community-centred approaches to mapping these factors are less common, especially in low- to middle- income countries (LMICs) such as South Africa.

Aim: To test the feasibility of participatory mapping of alcohol availability, to map this availability and gain stakeholder and community views in selected South African communities.

Methods: This mixed-method study included desktop research to identify known data sources for licensed alcohol outlets; geo-location and mapping of alcohol outlets by local community mappers; and focus group discussions (FGDs) and key informant interviews (KIIs) with community representatives**.**

Study findings: Alcohol outlets were densely distributed within residential areas, a large proportion of surveyed alcohol outlets were unlicensed, several had long trading times, many opening seven days a week in contravention of municipal by-laws. Spatial analysis showed marked variation in alcohol outlet density across zones, with several high-density hotspots. Outlet density per 1,000 population was substantially higher in Thembalethu than in Ga-Rankuwa. Community voices revealed that alcohol accessibility, long outlet trading times, outlet density, and poor licensing and enforcement contributed to alcohol's ubiquitous availability.

Conclusion: Participatory, community-centred mapping is a feasible and valuable approach for mapping alcohol availability. Findings highlight high outlet density, widespread unlicensed and informal sales, and the need for stronger regulation and enforcement alongside community involvement in mapping, monitoring, and supporting alcohol regulations.

Introduction

Harmful alcohol use is a leading threat to public health globally, and a key barrier to the achievement of the Sustainable Development Goals. In South Africa, 31% of the population drinks, and among these drinkers, over 70% drink heavily (World Health Organization [WHO], 2019). Harmful alcohol use has been associated with a range of negative consequences, including high risk-taking behaviour, e.g., unprotected sex, sexual assault, drink driving (Bello et al., 2017; Vellios & Van Walbeek, 2018), school drop-out (Hayatbakhsh et al., 2011), injuries and disease (Matzopoulos, 2017), motor vehicle crashes, child neglect, and interpersonal violence, including gender-based violence (GBV; Ramsoomar et al., 2021; Rehm et al., 2021).

Given the magnitude of the physical, emotional, economic, and social consequences of harmful alcohol use and GBV in

Correspondence: Leane Ramsoomar, Gender and Health Research Unit, South African Medical Research Council**;** leane.ramsoomar@mrc.ac.za
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South Africa, the need to engage in multipronged and intersectional approaches to address these public health challenges is critical. The World Health Organisation's Global Strategy to Reduce Harmful Use of Alcohol recommends (among ten key areas of policy options and interventions) two action areas, namely, Area 3. Community Action and Area 5. Availability of Alcohol to Reduce Alcohol-Attributable Harm (WHO, 2010).

Alcohol availability refers but is not limited to the licensing system on retail alcohol sales, regulation of the number of on- and off-premise alcohol outlets, the days and hours of alcohol sales, outlet trading times, minimum drinking age, and outlet density. Extant literature, including systematic reviews of alcohol control interventions, found that higher alcohol outlet density is associated with a rise in alcohol consumption (Bryden et al., 2012; Centers for Disease Control & Prevention, 2017) and alcohol-related harms (Matzopoulos, 2017). A recent review of 30 studies found that reducing alcohol availability through direct and indirect means is an effective strategy to minimise excessive rates of alcohol consumption and interpersonal violence (Mair et al., 2022).

Consistent with this, alcohol outlet density has been strongly associated with increased consumption, risk for violence including interpersonal and gender based violence, and reduced quality of life (Sacks et al., 2020). However, most of the research evidence emerges from the Global North. For example, in their analysis of the association between spatial density, outlet type, and seriousness of assault, Pridemore and Grubesic (2013) found that alcohol outlet density was positively associated with assault, with off-premise outlets (e.g., liquor and convenience stores) showing the strongest link to both simple and serious assaults, while on-premise outlets such as bars and pubs had weaker effects (Pridemore & Grubesic, 2013). Similarly, Liang and Cherith (2011) investigated the relationship between alcohol outlet density, alcohol sales, and assault risk in Western Australia and found that average alcohol sales per off-premise outlet was strongly associated with all measures of assault, while the number of on-premise outlets predicted violence mainly in licensed settings. Alcohol sales from off-premise outlets also influenced violence at on-premise venues and in residential settings. Furthermore, data from longitudinal analysis of alcohol outlet density and domestic violence from three categories (general licenses both on-site and off-site, on-premise licenses [e.g., bars] and packaged liquor licenses – off-site sales only [e.g., liquor stores]) found that off-premise outlets only were more strongly associated with interpersonal violence (IPV) and domestic violence (Livingston, 2011), because home drinking enables private drinking settings where coercive control and violence happen.

Recognising these differences in outlet types is important for guiding prevention and policy interventions. For example, citing examples from New Zealand, Canada, United States, England and Wales, Wells and Turner highlighted that increased density of off-premise outlets in particular increased the risk for domestic violence, and argued that implementing policies such as zoning restrictions, population-based caps should be prioritised as part of domestic violence prevention efforts (Wells & Turner, 2016). Similarly, an evidence synthesis on how alcohol access policies (pricing, trading hours, and outlet density) impact violence found that high alcohol outlet density had the strongest association with violent outcomes and suggested that restricting alcohol availability (lower density, price increases, restricted trading hours) can significantly reduce violence (Fitterer et al., 2015). Notwithstanding the existing evidence and policy interventions the South African alcohol landscape is very complex and many sensitivities surround the collection of such data at community level. The associated practicalities of this type of research place very real constraints upon lines and levels of enquiry and investigation in an environment where the clear distinctions between outlet types are very blurred. In addition, enforcement challenges persist, particularly in informal or unlicensed outlets (Morojele et al., 2021; Walls et al., 2020).

The issue of alcohol availability in South Africa is multifaceted; the proliferation of alcohol outlets in residential areas results from a range of phenomena, including the socio-political history of South Africa, separatist spatial planning with the majority of the Black population forced into townships, the historical *dop* system (an illegal practice which paid farm workers alcohol in exchange for employment), the rise of migrant work in mines, the availability of cheap alcohol to workers to promote job retention, and the racialisation of liquor laws which made it illegal for Black Africans to purchase commercial alcohol (Parry & Bennetts, 1999; Walls et al., 2020). Post-Apartheid, the interference from the alcohol industry in alcohol policy-making, and overt marketing strategies to penetrate the African market coalesce with South Africa's socio-political history to result in high alcohol availability, particularly in local communities.

A high concentration of alcohol outlets in a small area can have many negative consequences for the health and well-being of communities and populations (Centers for Disease Control & Prevention, 2017), yet many studies do not engage local communities most affected by alcohol misuse in its regulation. Participatory mapping is one approach that reflects community-based participatory research which recognises that place-based research is enhanced by the involvement of community members. It is designed to collect actionable data that can guide system and policy change that is locally and contextually relevant (Jelks et al., 2018). However, the use of participatory mapping in health research is limited. One of the few resources developed for the African context, "Communities Taking Action, Reducing Alcohol Harm in Africa", emphasises community ownership through the involvement of local communities in the research and analysis of the alcohol-related problems they experience (Rendall-Mkosi, 2013). The very paucity of this type of research in South Africa prompted a feasibility study to assess what is possible, and what might be further required to render robust correlational investigation and results.

The overall aim of this study was to test the feasibility of participatory mapping of alcohol availability, to map this availability and gain stakeholder and community views in selected South African communities.

Specifically, the study aimed to:

1. Assess the feasibility of using a participatory mapping approach with community members and community-based organisations to identify licensed and unlicensed alcohol outlets and their trading times.
2. Map and describe alcohol availability, in terms of alcohol outlet density (AOD) and outlet trading times (OTT), within selected communities.
3. Explore community members' and key informants' views on alcohol availability and alcohol consumption in selected communities.

Study Setting

This study was conducted in two locations in South Africa: Ga-Rankuwa, in the Tshwane District, Pretoria, Gauteng, and Thembalethu, a peri-urban township located within the George Municipality in the Western Cape. Both sites were selected on the basis of them being disproportionately affected by alcohol problems, crime, and other social harms.

Ga-Rankuwa

Ga-Rankuwa is a large, densely populated township area located northwest of Pretoria in the Tshwane District of Gauteng province with a population of 90,945 and 28,147 households within an area of 62.18 square kilometres, and a resulting population and household density of 1,743 and 539.4 per square kilometre respectively. Setswana speakers account for an estimated 69% of the population (Lehohla, 2015), due largely to resettlement projects of the 1960s, with Northern Sotho and Xitsonga also widely spoken (Wagner et al., 2020). While the nearby Rosslyn industrial hub and the Zone 15 industrial park provide employment for residents, and small and informal businesses proliferate, unemployment rates remain high (Moos & Sambo, 2018). Ga-Rankuwa, Zone 15, also houses a large brewery, the South African Breweries (SAB), which produces, supplies and distributes alcohol.

Thembalethu

Thembalethu, located within the George Municipality in the Western Cape, is a township area covering some 6.49 square kilometres, including both formal and informal settlements, with a total population of 43,103 and a population and household density of 6,638 and 2,042 per square kilometre respectively. The population is predominantly Black African (93.4%), largely isiXhosa speaking (83.2%) and of a younger age profile (29% are 15 to 34 years old; 27% younger than 15 years old), and characterised by high rates of poverty and unemployment. An overall dependency ratio (dependents per working age individuals) of 45.2 was reported for the George Municipality (Lehohla, 2015). Population growth rates in the Western Cape have been reported to be 27.7% between the national censuses of 2011 and 2022 (Statistics South Africa, 2023)

Methods

This mixed-method study included different, but complementary research methods to meet the study aim including,

1. A desktop exercise to identify locations of licensed alcohol outlets in the two study sites to identify and verify the Global Positioning System (GPS) point data of alcohol outlets using Google Maps, Google Earth, OpenStreetMaps);
2. Outlet mapping and density analysis using geo-location of licensed and unlicensed alcohol outlets by local community mappers; and
3. Focus group discussions and key informant interviews (KIIs) with community representatives.

The GIS mapping was conducted to meet objectives 1 and 2 of the study, while the qualitative component was designed to address objective 3. The mapping did not inform the qualitative aspects of the study or vice versa. The qualitative component of the study was designed and executed separately within the same neighbourhood zones, and sought to explore community awareness and perceptions of alcohol availability, outlet density, access to alcohol, trading times and enforcement of regulations, The value of combining the GIS mapping and qualitative interviews was to enable us to quantitatively capture alcohol outlet density (AOD) and outlet trading times (OTT), while exploring the lived realities of community members and KIIs, and the broader context in which these spatial patterns exist.

Procedure

Desktop Research

Licensed outlets were identified through a search of the National Liquor Authority (NLA) register. In Thembalethu, we identified a list of licensed outlets from the NLA and Western Cape Liquor Authority (WCLA) database. In Ga-Rankuwa, we obtained licencing information from the database at the local police station, and from the NLA or Gauteng Liquor Board (GLB). Using data from these sources, we extracted outlets for Ga-Rankuwa and Thembalethu respectively. These outlets were geo-coded, de-duplicated and supplemented with a list of outlets for Ga-Rankuwa, sourced and geo-located primarily off Google Maps, amongst other online business listing sources. Similarly, we geo-located outlets from the National and Western Cape Liquor authority falling within the Thembalethu study area, and supplemented these with a list of outlets sourced and geo-located off Google Maps and other online sources. These verified data were used to create partially completed site maps to guide in-field mapping.

Training Community Members as Mappers

We collaborated with local community-based non-governmental organisations (NGOs) to identify, select and train nine community based fieldworkers in Thembalethu, and 10 field workers in Ga-Rankuwa. Fieldworkers were trained in research ethics, GPS-based data collection, map literacy, field safety, data collection processes, use of Research Electronic Data Capture (REDCap) software, questionnaire administration, field testing, and debriefing.

Fieldworkers were selected on the basis of them being resident in the local community, having intimate knowledge of the community, previous community-level work experience, fluency in local languages, and no relationship

with owners, managers, or servers at local alcohol outlets. The physical geo-mapping exercise was conducted over one week per site, specifically in July 2023 in Thembalethu and in August 2023 in Ga-Rankuwa. Fieldworkers held daily team debriefing sessions with appointed field coordinators, supported by the study investigators.

Zones were not selected based on probability proportional to population density, because the study aimed to assess methodological feasibility rather than population representativeness. In Thembalethu, we mapped all nine zones, while in Ga-Rankuwa, zones were selected in consultation with the local NGOs and selected community members by focusing on the more populous zones, accounting for zone type, and community perceptions of areas most affected by alcohol outlet density and trade. We excluded non-populous zones such as industrial areas and new residential developments.

We assessed licensing status of outlets using both official registry data and participatory mapping. Although we assumed the registry listed only licensed outlets, given the high prevalence of unlicensed alcohol outlets in South Africa registry data alone were insufficient to accurately describe the local alcohol environment. Participatory mapping was therefore employed to (a) verify the existence of outlets listed in the registry and their operational licensing status, and (b) enable direct field based observation of licensing signage at alcohol outlets.

Geo-location was conducted using Android-based mobile devices, employing REDCap software. Fieldworkers collected real-time data on the municipal zone type and number, the count of on- and off-premise alcohol outlets, days and hours of alcohol sale, trading times, outlet GPS coordinates (geographic latitude and longitude), and recorded qualitative comments on notable observations (e.g. outlet near a school). Data were synchronised with the central REDCap system, for processing and organising and exported to Excel and Stata 17 for analysis and reporting.

Spatial Data Plot: The coordinate location (latitude and longitude) of each outlet found during data collection was extracted from the REDCap database as comma-separated value (CSV) files, imported into Environmental Systems Research Institute (ESRI) ArcMap Geographic Information Systems (GIS) software, and plotted spatially to produce a shapefile of outlet locations with their associated survey data variables. We used census subplace boundaries sourced from the national census authority, Statistics South Africa (2011) in the case of GaRankuwa and suburb boundaries sourced from George Municipality (2023) in the case of Thembalethu as the base levels for aggregate mapping of key spatially relevant indicators. Smaller entities were merged with their larger containing or spatially contiguous neighbours. The resulting corrected GPS locational data with associated data variables were aggregated to the level of the municipal zone for both study areas.

Fieldworker Safety Procedures

Fieldwork was conducted in accordance with strict safety protocols to minimise risk to data collectors operating in community settings. Fieldworkers were required to work in pairs or small groups at all times and to remain vigilant to their surroundings. They were advised to exit the area immediately if they felt unsafe or at risk. All fieldworkers maintained continuous communication with the fieldwork coordinator and team members, with pre agreed meeting points and designated places of safety established in advance. They were instructed to ensure that mobile phones were fully operational and had sufficient data to enable emergency communication. To reduce visibility and risk, data collectors maintained discretion by using mobile phones, instead of handheld GPS devices, and dressed to blend into the surrounding community. If fieldworkers felt unsafe or believed they had drawn attention to themselves, they were instructed to leave the site and return at a safer time.

Focus Group Discussions and Key Informant Interviews

We conducted two Focus Group discussions (FGDs) with community members (eight participants in Thembalethu and nine participants in Ga-Rankuwa); and seven and four key informant interviews in Thembalethu and Ga-Rankuwa respectively, all of whom were identified through our local NGO partners and the study investigator networks. These represented the local liquor authority, health services, community representatives, GBV response services, local municipality non-profit organisations (NPOs) and the faith-based sector representatives. All key informants had official capacity/leadership status in their organisations, and did not have any relationship with owners/managers/servers at an alcohol outlet within the community which could have constituted a conflict of interest. A Key Informant Interview and FGD Guide covering the broad areas of community alcohol use and availability, alcohol's harm to others, and alcohol regulation was used to guide the interview process.

Ethical Considerations

Ethical approval for the study was obtained from the South African Medical Research Council's (SAMRC) Human Research Ethics Committee (EC051-11/2021). Permission was obtained from relevant institutional heads to access community information. All data were de-identified and stored in password-protected files. The FGDs and KIIs were held in private spaces, and following informed consent, all interviews were audio recorded, anonymised, and transcribed.

Analysis

Descriptive statistics (frequencies and percentages) were conducted in Stata 17 and are presented as graphs or tables. The data management and analysis for the spatial data plot, density calculations, and GPS mapping and qualitative processes are described below.

Density Calculations

Alcohol density was described by two separate measures, namely the number of outlets per square kilometre (km^2) and outlets per 1000 population. Population data was sourced from the national census conducted in 2011 at the small area and subplace boundary levels and aggregated up to the zone

level. Population per zone was projected forward using community and district-level growth rates as reported by the European Commission Joint Research Centre (Schiavina et al., 2019). Population estimates were available for both communities from this source for the 1975, 1990, 2000, and 2015 time points, and were combined with the national census population count for 2011 to estimate a growth rate of the population more representative of the study areas than a district level growth rate would afford. A flat annualised growth rate was calculated for the four years for Ga-Rankuwa and Thembalethu of 5.51% and 2.83% respectively and applied forward annually to achieve projected population estimates for 2023. This compares with the district-level growth rates for Tshwane and George Districts of 3.1% and 2.59% (2001-2011) respectively. Alcohol outlet densities were calculated per zone per km^2 and per 1000 population, and the distribution of values across the respective data ranges for each of the two study sites was used to establish meaningful quantiles per which to report these metrics spatially.

Map Production

Contextual maps depicting the community and relevant social structures (e.g. churches, clinics) and public facilities were generated using ArcMap 10.4 (ESRI, 2016), along with maps of population distribution, alcohol outlet density per km^2, alcohol density per 1000 population.

Qualitative Data

Qualitative data were analysed using inductive thematic analysis. Transcripts were read and re-read to ensure familiarity with the data (Braun & Clarke, 2021). Authors AMD and LR independently conducted hand coding without the use of qualitative analysis software. Codes were developed iteratively and compared through consensus discussions to achieve intercoder agreement. Discrepancies were resolved through discussion and reference to the data. Codes were then grouped into categories and refined into themes that captured patterns across the dataset. The research team agreed the final themes to ensure analytic rigour. We then refined and reviewed these themes and sub-themes following the processes of thematic analysis as outlined by Creswell (2013).

Study Findings

We identified a total of 383 alcohol outlets across the two sites: 178 in Ga-Rankuwa and 205 in Thembalethu. In Ga-Rankuwa, we identified 62 outlets from the National, Gauteng Liquor Board and police registers, supplemented with a further 21 outlets for Ga-Rankuwa from online searches. We identified 95 outlets through local participatory mapping. In Thembalethu, we identified 26 outlets from the National and Western Cape Liquor authority, supplemented with six outlets from online searches. (see Table 1). Most alcohol outlets were located in residential areas: 165 (92.7%) in Ga-Rankuwa and 197 (96%) in Thembalethu respectively. This was followed by six business (3%), and four industrial (2%) zones in Ga-Rankuwa, and six rural (3%) and one business zone (0.5%) in Thembalethu.

Table 1

Sources of Alcohol Outlet Identification Across Study Sites

Study sites	Liquor authority register	Online searches[1]	Local mapping data	Total outlets (all areas)
Ga-Rankuwa	62	21	95	178
Thembalethu	26	6	173	205
Total liquor authority outlets				**383**

[1]Supplementary online searches, e.g. Google Maps and online sources

Outlet Types

We found taverns, shebeens (an informal, licensed or unlicensed, drinking establishment commonly found in a township setting in South Africa), bottle stores and pubs, and take-away outlets. Most outlets at both sites were shebeens (43% in Ga-Rankuwa and 67% in Thembalethu), followed by taverns, (36% in Ga-Rankuwa and 23%) in Thembalethu. In Ga-Rankuwa 10% of outlets were bottle stores or pubs, with 2% in Thembalethu. Takeaways and informal outlets constituted 2% in Ga-Rankuwa, and 4% in Thembalethu respectively. The remaining 9% in Ga-Rankuwa and 3% in Thembalethu consisted of "other" types of alcohol outlets outside of the four main categories (See Table 2).

Table 2

Types of Main Alcohol Outlets: Ga-Rankuwa and Thembalethu

	Ga-Rankuwa *n* = 178	Thembalethu *n* = 205
Shebeen	77(43.3%)	138(67.3%)
Tavern	64(36.0%)	48(23.4%)
Bottle store/pub	18(10.1%)	5(2.4%)
Take-away (informal)	3(1.7%)	9(4.4%)
Other	16(9.0%)	5(2.5%)

Types of Alcohol

In Ga-Rankuwa, beer was the most widely sold type of alcohol (94%), followed by ciders (80%), wine (32%), spirits (21%), homebrews (15%), cocktails (10%) and all the listed beverages (2%). Similarly, in Thembalethu beer was the most frequently sold type of alcoholic beverage (99%) in the outlets, but unlike Ga-Rankuwa where ciders were the second most sold beverage, wine was the second most sold beverage (78%), followed by spirits (49%), ciders (42%), homebrews (18%) and cocktails (3.4%).

Outlet Trading Times

The surveyed outlets had long outlet trading times and the majority of outlets operated outside of scheduled times or by-laws and opened seven days a week: 87% in Ga-Rankuwa and 94% in Thembalethu respectively. It is worth noting that the majority of shebeens nationally are largely unlicensed and do not operate within scheduled times or by-laws. The average operating times were between 14 and 15 hours per day in Ga-Rankuwa and Thembalethu respectively. Between 5% (Ga-Rankuwa) and 6% (Thembalethu) they are open five to six days in the week.

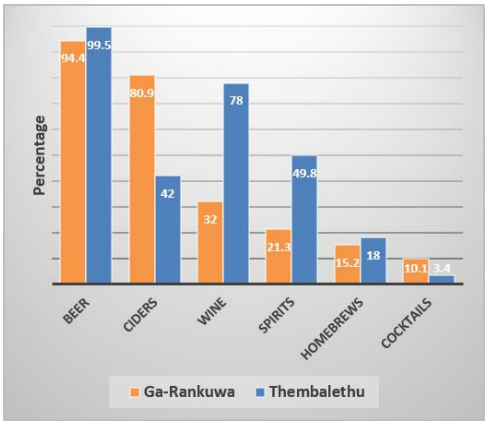
Table 3

Alcohol Outlet Densities (AOD) by Zone Reported in Ga-Rankuwa and Thembalethu

Zone	Outlets	Area (km^2)	Outlet density per area (km^2)	Population (2011)	Projected population (2023)	Outlet density per 1000 population (2023)
Ga-Rankuwa (Gauteng)						
Ga-Rankuwa Zone 1	20	3.76	5.32	11927	19819	1.01
Ga-Rankuwa Zone 2	10	1.95	5.13	5933	9859	1.01
Ga-Rankuwa Zone 3	6	1.38	4.35	4286	7122	0.84
Ga-Rankuwa Zone 4	20	2.05	9.76	7007	11643	1.72
Ga-Rankuwa Zone 5	8	2.8	2.86	2931	4870	1.64
Ga-Rankuwa Zone 6	7	0.9	7.78	4537	7539	0.93
Ga-Rankuwa Zone 7	10	1.59	6.29	7145	11873	0.84
Ga-Rankuwa Zone 14	18	12.81	1.41	6080	10103	1.78
Ga-Rankuwa Unit 15	6	3.8	1.58	28	47	-
Ga-Rankuwa Zone 16	8	1.36	5.88	6121	10171	0.79
Ga-Rankuwa Zone 20	1	2.15	0.47	4646	7720	0.13
Ga-Rankuwa Zone 21	10	1.11	9.01	3399	5648	1.77
Ga-Rankuwa Zones 17/23/24/25	42	5.31	7.91	13288	22080	1.90
Ga-Rankuwa View	12	1.09	11.01	7832	13014	0.92
Mean across all surveyed zones(95%CI)†	13	3.35	5.94(1.00,4.88)	6631	11018	1.18(0.85,1.50)
Thembalethu (Western Cape)						
Thembalethu Zone 1	12	0.64	18.79	1841	2467	4.86
Thembalethu Zone 2	5	0.30	16.58	1439	1928	2.59
Thembalethu Zone 3	4	0.50	8.04	3288	4406	0.91
Thembalethu Zone 4	26	0.31	83.89	2280	3055	8.51
Thembalethu Zone 5	16	0.66	24.23	4630	6204	2.58
Thembalethu Zone 6	68	1.12	60.90	10088	13517	5.03
Thembalethu Zone 7	15	0.63	23.92	4206	5636	2.66
Thembalethu Zone 8	28	0.60	46.92	3700	4958	5.65
Thembalethu Zone 9	31	2.26	13.75	11274	15106	2.05
Mean across all surveyed zones (95%CI)	23	0.78	33.00(13.43,52.57)	4750	6364	3.87(2.07,5.67)

Figure 1

Types of Alcohol Sold in Surveyed Zones in Ga-Rankuwa and Thembalethu



In Ga-Rankuwa, a comparison of outlet operating hours with provincial liquor legislation revealed that 31% of taverns opened earlier and 15% closed later than permitted, while 65% of shebeens opened earlier and 10.5% closed later. In Thembalethu, 27% of taverns opened earlier and 4% closed later than allowed, with nearly half (49.7%) of shebeens opening earlier and 19.7% closing later than the legal hours.

License Status of Outlets

In Ga-Rankuwa, 20% of surveyed alcohol outlets were licensed, 55% were unlicensed, and the licensing status of the remaining 25% was unknown. In Thembalethu, 19% of outlets were licensed, 76% unlicensed, and 5% had an unknown status. Licensing status was determined through both the NLA registers and through mapping of visible signage on walls, doors, or windows of the outlets. In Thembalethu, the fieldworkers' familiarity with the community and local alcohol outlets also informed these classifications. Additionally, fieldworkers noted that many outlets in Thembalethu sold food as a means to attract customers to purchase alcohol.

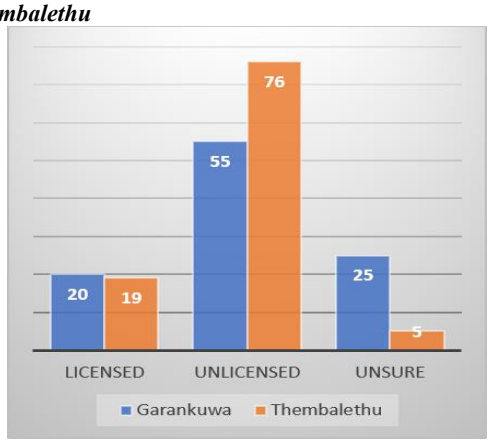
Table 3 above describes alcohol outlet densities (AOD) by zone. The alcohol outlet density data (mean outlets per 1000

population) showing different densities between Ga-Rankuwa and Thembalethu in the zones surveyed, with mean outlets per 1000 population of 1.3 in Ga-Rankuwa, and in Thembalethu the mean outlets per 1000 population was 3.87, when including Zone 15 (see Table 5). However, there are variations in AOD across different zones in both sites.

In Ga-Rankuwa, the alcohol outlet density ranged from 0.13 outlets to 1.90 outlets per 1000 persons, with an overall mean of 1.18 outlets per 1000 persons. There are notable variations in alcohol outlet density across Zones 4, 5, 14, 21, 17, 23, 24, and 25, all of which have higher AOD per 1000 persons than do other zones that were surveyed.

Figure 2

Licensing Status to Sell Alcohol in Ga-Rankuwa and Thembalethu



In Thembalethu, where there is a higher overall alcohol outlet density per 1000 persons (3.87 outlets per 1000 persons) compared to Ga-Rankuwa (1.18 outlets per 1000 persons), there are also variations in alcohol outlet density across zones, ranging from 0.91 outlets per 1000 persons in Zone 3 to 8.51 outlets per 1000 persons in Zone 4. Specifically, Zones 6, 8 and 4 have alcohol outlet densities greater than five outlets per 1000 persons, followed by Zone 1 at 4.86 per 1000 persons.

Qualitative Findings

Themes

The thematic analysis of the qualitative findings revealed four broad areas related to alcohol availability: (a) alcohol accessibility; (b) outlet trading times; (c) alcohol outlet density; and (d) licensing and enforcement. This section highlights some common themes and sub themes observed in both sites: Ga-Rankuwa and Thembalethu. Illustrative quotes are presented by type of qualitative method, participant gender and the community.

Alcohol Availability

Participants in both sites shared that alcohol is ubiquitously available from both licensed and unlicensed outlets. They described the many ways in which alcohol was readily available including being sold at taverns, bottle stores, illegal shebeens, and spaza (small street corner grocery shops or supermarket outlets largely found in informal housing settlements) or back room sales. Overall, accounts from both sites emphasised the breadth of outlets and the ease with which people could shift between licensed and unlicensed sources to obtain alcohol. One FGD participant described how:

> *They access alcohol (not only) from taverns and bottle stores…no even illegal shebeens, those who sell like the Indian shops, they sell dumpies* [340ml bottle of beer], *bottles, underground business. From their original spaza at the back that's where they sell beers, yes* (FGD participant, male, Ga-Rankuwa).

In Thembalethu a participant stated:

> *Smokos or smokololos* [casual gatherings where people gather, enjoy drinks and cigarettes, and socialise with light entertainment] *are not licensed,… this is the place we will go when the taverns are closed, … we can sit, they will play music … more expensive… at the tavern you pay R20 for a beer… at the smoko you pay R25* (KII, female, community member, Thembalethu).

Outlet Trading Times

Across the sites, participants reflected on how outlet trading times made alcohol readily available through extended trading hours: *"As early as 6 o'clock, they will be knocking at the man who is selling beers, they want beers, till as late as 10 o'clock to past 10pm to 11pm at night"*(KII, female, Ga-Rankuwa); while another explained:

> *I am now referring to the licensed outlets, when you go to those places you will see their operational hours is like from 10 o'clock on a Sunday, but then from like 7 o'clock and 8 o'clock they are open and everything is like happening.* (FGD participant, female, Thembalethu)

Another participant described:

> *So I know the owner of shop because I am a regular there, he just opens the door and lets me in as if there is nothing happening. So the availability is no time limit joe, drinks are sold from 12 to 12.* (FGD participant, male, Thembalethu).

A key informant noted how sale through unlicensed outlets and long operating hours made access easier: "*In the shacks* [informal settlements] *there is no taverns, it's all shebeens and also there is no regulation the timing they may run throughout the night"* (KII, male, Thembalethu).

Participants also described a sense of inconsistency and confusion over opening and closing times: *"We are not sure, I think it's 6* (am) *to 6* (pm)". (FGD participant, male, Ga-Rankuwa), while in Thembalethu: *"Sometimes they* [taverns] *don't want to oblige they will stretch it with an hour or two and there is nothing done about it"* (KII, female, Thembalethu).

Participants went on to explain how patrons moved from licensed venues at closing time to unlicensed and informal outlets:

> *And then we have place we will go when the taverns are closed, it's not that good but it's known that even the police, they will pass by as it's a house that they sell any alcohol, they don't have a license where they will have a certain shack or a certain room at the back at the verandah* (KII, female, Thembalethu)

Focus group participants described: *"So like if they* [licensed outlets] *close at 12h00 and that people can go from there if it applies to Shisanyama* [informal food and alcohol outlets]*, the places that don't close are working 24/7".*

Participants consistently noted how trading times increased during weekends: *"When it's the weekend especially here at Ga-Rankuwa, weekend starts Thursday they hold alcohol dumpies and others go"* (FGD participant, male, Ga-Rankuwa); while others remarked: *"When you compare during the week and the weekend a lot of people are drinking so there is a lot of intake of the alcohol. There's not much restriction on times."* (KII, female, Thembalethu).

In several accounts, participants attributed this to weak or absent enforcement of closing times:

> *We notice the police just passing by and they know the time is up already, they know the times to close, ok during the week its 10, weekend its 12 and Sunday its eight but they exceed those times.* (KII, female, Thembalethu),

Another participant explained this as difficulty in police accessing shebeens in informal settlements*:*

> *It's all shebeens and its where most of the time crime is being committed and also there is no regulation the timing they may run throughout the night. Police cannot access the place easy, so they are free to do as they please.* (KII participant, female, Thembalethu)

Alcohol Density

The community described high alcohol outlet density across both sites, with some describing them as too many to name: *"Some* [taverns and shebeens] *I don't know their names they are too many"* (FGD participant, male, Ga-Rankuwa), while others noted that some taverns operated under the same name, but in different areas, making them difficult to distinguish as separate entities. Other participants explained that taverns were clustered: *"We have about six taverns in one place"* (FGD participants, Ga-Rankuwa), while one remarked that*: "If you look at Thembalethu,….basically every second street you find the liquor place whether licensed or not licensed. So that shows the extent of the use of alcohol"* (KII, female, Thembalethu). Participants also described what they perceived to be "hidden" outlets, which suggested undercounting in already high density areas: *"Front is spaza? And at the back it's a liquor outlet"* (FGD participant, male Ga-Rankuwa). Similarly participants explained that sales from back rooms and from homes increase density, that is missed by mapping: "*Yah even some they just open the shebeen inside the house, especially on the informal settlement because some you will find that they don't have license, they don't have those regulations"* (KII, female, Thembalethu)

Accessibility

Participants at both sites consistently described how multiple types of alcohol outlets, licensed and unlicensed, along with proximity to homes and social spaces, increased accessibility. They also highlighted extended operating hours through home-based trading, child-mediated purchasing, and informal supply chains (including deliveries and credit) as contributors to easy access.

A participant stated: *"I mean the illegal ones that are sold by Grannies, they sell Shiboko, Black Label etc. Those house yard shebeens where people go there when they leave the pubs, clubs at the homes"* (FGD participant, female, Ga-Rankuwa). Participants also described how the proximity of outlets to residential homes and social activities increased access: "*It's* [alcohol] *very high especially to the community that I live in because it's an informal settlement. You get alcohol everywhere even small kids can access it"* (FGD participant, female, Ga-Rankuwa), while another participant explained they: "*Yes, they* [outlets] *are near schools and churches"* (Thembalethu, female, FGD participant).

Disturbingly, participants noted how children were used as a means to access alcohol, often with little to no legal ramifications:

> *It's very easy, you send a nine year old to go buy you a beer. The tavern owner won't even say, you are a child and we are not going to sell to you. It's free to all, you hear a child saying I am going to buy Granny a beer or two. And you can see it's a child that there is nothing they can do* (FGD participant, female, Ga-Rankuwa).

Similar accounts emerged in Thembalethu:

> *So they* [vendors] *are operating from the side or from the kitchen door having someone do the selling. Making alcohol easily accessible especially for our youngsters. The other thing that I also see is that the older people…. are at home sending the youngsters to go buy alcohol for them, you know so that also happens a lot* ((FGD participant, female, Thembalethu).

> *The kids are the ones that are in those taverns. Basically because in the taverns there's no demand of IDs* [identity documents]*. So they are free to come in as much as the tavern owners will say yes we don't take young children. But no one is going around carrying an ID into a tavern* (KII, male, Thembalethu).

Other means by which participants perceived that alcohol access contributed to increased availability was through illegal supply chains. One participant described a supply chain system that enables the alcohol industry to supply alcohol to informal traders through an app-based system, whereby the traders can view available stock, place orders, and receive deliveries directly at their premises: *"* [You input] *your name and Company name, there is stock that would appear and you just stock and then they give you the amount, how many, the items that you bought."* The

participant went on to describe how the alcohol is delivered through the supply chain system: "*And they* [distributors] *come… Yes and they deliver."* (KII, female, Ga-Rankuwa). Similar narratives emerged in Thembalethu: *"As I said it's* [alcohol supply] *from the big businesses that is across the bridge the wholesalers. The wholesalers are the ones that are supplying to this community."* He described big trucks entering the community: *" But big trucks go in"*, and went on to describe how *bakkies* (smaller vans) are used for further redistribution: "*And of course one sees these bakkies loading at X City and Y town"* (KII, male, Thembalethu).

The impact of traders buying alcohol on credit from alcohol companies was also noted by participants from both sites as fuelling accessibility. In Ga-Rankuwa, a participant confirmed that alcohol can be bought on credit: *" SAB supplies on credit? …Yah if you are that trustworthy client, yes. And after selling that is when you have to pay*" (KII, female, Ga-rankuwa), while in Thembalethu, referring to regular customers: *"If you go there and ask for credit they give you and write your name on a tag and they know you will pay. They will come to your house if you don't pay"* (KII, female, Thembalethu).

Licensing and Enforcement

Participants across both sites described widespread unlicensed or irregular alcohol trading and highlighted limited enforcement, perceived police complicity, and constrained community voice in licensing and regulation decisions.

> *Yah especially on the informal settlement because some you will find that they don't have license, they don't have those regulations. So every person no matter under age or what they just sell because what they want is money* (KII, female, Ga-Rankuwa).

Similar accounts emerged in Thembalethu:

> *They buying it from, not the licensed outlets, they getting it from where? They are bringing the alcohol to Thembalethu, that's where the stop needs to be, all the unlicensed we trying to close it here, they pop in there, you close it here, they pop in there* (FGD participant, Thembalethu).

Participants consistently described a lack of enforcement of alcohol regulations by the police, liquor authorities and law enforcement agencies, even of licensed outlets. The lack of enforcement in licensed outlets reinforces a lawlessness that enables operation of unlicensed outlets. Even when outlets were licensed, participants described how some outlets did not have visible licences, or how despite this, they flouted licensing conditions and trading times: *"Taverns they have that board which says, trading hours is from this and this, but those just selling without that license, they don't have that trading hours they just say I'm starting from this time to this time"* (KII participant, Ga-Rankuwa), while FGD participants described:

> *There are some licensed shebeens that have signs, no under 18 years but they will verbally say, we don't sell to kids and yet sell to the child whilst talking to them and even warn them they won't sell to them again. And it becomes a continuous thing of which is wrong* (FGD, participant, Ga-Rankuwa).

Some perceived police as being complicit in the illegal alcohol trade: *"…we notice the police just passing by and they know the time is up already, they know the times to close, ok during the week its 10, weekend its 12 and Sunday its eight but they exceed those times."* (KII, male, Thembalethu). Another described: "*The police knows because some of them* (police)*, drink with them. Some of them they are neighbours to these places"* (KII, female, Thembalethu). Other participants allege corruption by police and law enforcement agencies, thereby undermining enforcement: *"Even the police can pass there and say no, they still go there and take tshotsho* [bribe] *there and move on with their lives* (KII, female, Thembalethu)"; while in Ga-Rankuwa: "…*and I think that it's high time that our law enforcement agencies they need to know what needs to be done. The bribes from different communities, alcohol is going to become a mess for the rest of our lives"* (FGD participant, male, Ga-Rankuwa).

Many participants also described a lack of having a voice in the enforcement of alcohol regulations. Some described a process where communities were excluded from decision-making about enforcement and feared retaliation if they raised concerns: *" I don't think they* [community] *do have a voice when it comes to that. The reason I'm saying that they scared of raising their voice"* (KII, female, Thembalethu); while others when asked if they felt the community had a voice in decisions around licensing said: *"No, not at all"* (FGD participant, Ga-Rankuwa).

Discussion

This study demonstrates that alcohol availability in both study sites is characterised by high alcohol outlet density, a preponderance of unlicensed outlets, and alcohol trade in the informal market including "hidden" points of sale such as home-based and back rooms sales. Notably, long operating hours occurred through both licensed and unlicensed alcohol outlets, regularly flouting existing alcohol regulations. Most outlets operated seven days a week, with long daily trading hours, and many opened earlier and closed later than permitted by provincial by-laws. Our participatory mapping approach identified more alcohol outlets than those recorded in official liquor authority registers and from online sources, exposing high alcohol outlet density, and an informal market, especially within residential areas in informal South African settlements. This illustrates the limitations of relying on administrative data alone to characterise alcohol availability and the value of a participatory mixed method approach.

Spatial analysis showed marked variation in alcohol outlet density across zones, with several high density hotspots, especially in Thembalethu, where outlet density per 1000 population was considerably higher than in Ga-Rankuwa. However there was also substantial within-site variation observed in both communities. The predominance of off-

premise and informal outlets suggests that alcohol consumption is largely occurring in private or semi-private settings, where regulation and surveillance are the weakest.

Qualitative findings supported these patterns, with community members and key informants describing alcohol as ubiquitously available. Their insights highlight how high alcohol availability was sustained by mutually reinforcing factors in communities: through availability of both licensed and unlicensed outlets, accessibility, extended and inconsistent trading times, poor licensing, and weak enforcement.

Overall these findings highlight how weak regulation and enforcement, combined with high outlet density and informal trading, shape the drinking landscape in South African communities. This is consistent with other South African studies (Bowers et al., 2020; Matzopoulos & Smithers, 2020; Trangenstein et al., 2018), which found a persistently high number of unlicensed outlets and suggest a prevailing regulatory vacuum, complicated by the legacy of apartheid-era alcohol policy, and compounded by the alcohol industry's resistance to regulation, promotion of self-regulation, and lobbying against evidence-based measures (Parry, 2010).

A central finding was the significant value of engaging and training community members. Their intimate knowledge of local social structures, behaviours, and alcohol-related patterns enriched the research process and provided essential context to guide GIS and qualitative analysis. Such knowledge should be more systematically leveraged to serve both community interests and scientific goals. This aligns with the work of Jelks and colleagues (2018) who highlighted that place-based research is enhanced by the involvement of community members, and Sommer and colleagues who found that using participatory methods can overcome key challenges of traditional qualitative research and produce more nuanced, contextually grounded data (Sommer et al., 2021).

Our findings also underscore the critical role of community participation in informing alcohol policy, particularly regarding licensing in residential areas of South Africa. However, evidence from qualitative enquiry revealed that communities are largely excluded from decision-making concerning alcohol regulation, licensing, and enforcement, highlighting the need to institutionalise community participation within South Africa's liquor governance system,. This is in keeping with recommendations from WHO SAFER's call for multisectoral and community-engaged alcohol control. (WHO, 2018).

Strengths and Limitations

A key strength of this study is the use of a novel community participatory mapping approach, supplemented by local informants, to capture the spatial and temporal dimensions of neighbourhood alcohol availability. This approach addresses a critical research gap in a LMIC setting where alcohol regulation is weak and poorly enforced. Furthermore, mapping both licensed and unlicensed outlets provides a comprehensive overview of the alcohol landscape and its impact on public health, and supports data driven decision-making to identify high density hotspots, guide targeted public health interventions, and strengthen regulatory oversight.

The integration of qualitative and GIS methods provided richer, contextually grounded insights into alcohol availability, while consistent data collection across sites ensured methodological rigour and comparability of results. Despite these strengths, the study did have some limitations. Due to safety concerns, mapping was conducted exclusively during daylight hours, thereby excluding outlets operating only at night, resulting in an undercount of density. Furthermore, with the clandestine nature of back room and home-based alcohol sales, it is likely that some informal outlets remained undetected, resulting in an underestimation of outlet density within the informal market. Another limitation arose from the inconsistent display of licensing information at outlets, which may have led to misclassification. However, fieldworkers' intimate community knowledge helped mitigate this issue. Nonetheless, the value of this study lies in its novel approach, combination of research methods, and the insights it provides into both formal and informal alcohol markets in a high-burden alcohol-consuming country with weak regulatory and enforcement systems.

Lessons Learned and Recommendations

This study offers several lessons for future research on community alcohol environments, Firstly, community collaboration is both feasible and beneficial, provided there is sufficient time and investment to build trust and understand local dynamics. Participatory approaches foster community ownership and can lead to sustainable social change. Secondly, key informants and local fieldworkers are essential for grounding research in social and spatial realities, providing insights that external researchers may miss. However, they must be trained and supported adequately. Third, implementation partners (e.g., NGOs and CBOs) must be carefully selected and fully aligned with the project's goals from the outset. Finally, contextual awareness is critical. Future studies should be guided by community-informed formative research to understand local causes and patterns of alcohol use, regulatory environments, and community dynamics.

Policy Implications

The study findings have direct implications for South Africa's liquor regulatory framework and policy, particularly the implementation of the National Liquor Act (2003) and provincial liquor legislation. The high density of alcohol outlets, most of which are unlicensed and located within residential zones, highlights the urgent need for data driven approaches (e.g. GIS and qualitative research) to inform licensing decisions. The current legislation that permits conditions on outlet location, proximity to churches and schools, and that account for health impacts of alcohol on communities needs to be reviewed and systematically enforced. One way to strengthen alcohol policy, regulation and control is by creating and implementing a more stringent licensing procedure, and carefully monitoring the issuing of

licenses and renewals in an up-to-date national and provincial database, and issuing licensing moratoria in high-density areas. Communities need to be involved in monitoring and establishing anonymous reporting mechanisms given the sensitive nature of reporting alcohol outlet violations. Opening and closing times of alcohol outlets must be strictly enforced through targeted controlled raids on unlicensed outlets and on outlets that operate outside of alcohol regulations. The age limit (18 years) of alcohol sale, purchase and consumption must be strictly enforced collaboratively by alcohol sellers, servers, liquor authority officers, police and community policing forums. In addition, the Liquor Amendment Bill of 2016, which proposes regulating specific trading days and hours for alcohol to be distributed and manufactured, should be passed with expediency. Notably, the findings of this study demonstrate that community-derived data can bolster South Africa's alcohol regulatory system. Participatory mapping revealed significant insights into AOD, trading times practices, and supply chains that are not routinely available in administrative data. Formalising the use of these data and the role of community members in municipal by-law enforcement, licence renewal processes, and liquor authority inspections could improve surveillance enforcement.

Conclusion

This study demonstrates the feasibility and value of a mixed-methods approach to mapping alcohol outlet density (AOD), combining the insights of trained community members and key informants with the technical expertise of GIS specialists and researchers. This collaborative method yielded critical knowledge that benefits both scientific inquiry and community advocacy in settings with high alcohol consumption, poor alcohol regulations, and poor enforcement. However future research should build on the present feasibility study by considering cluster analysis to highlight any clustering/patterns in the spatial distribution by different types of outlets (e.g. licensed vs non-licensed), and explicitly examine the intersection of alcohol outlet density, outlet licensing status, and socio-economic disadvantage. The effects of AOD on a range of alcohol-related harms, and spatial modelling that permits multiple spatial layers, e.g. outlet type, trading times, population density, and routinely collected police data, to assess whether harms are concentrated in the same places as high alcohol availability is a critical next step.

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