

# An Analysis of Violent Crime and Density of Alcohol-Serving Establishments in Arizona

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# **Executive Summary**

Research indicates that 'hot spots' of police reports for violent crime tend to coincide with high density areas of alcohol-serving establishments. The Centers for Disease Control and Prevention (CDC's) National Center for Injury Prevention and Control recommend that metro areas utilize environmental and community planning strategies that target alcohol policies in order to reduce incidence of violent crime. Thus, an important first step in violent crime prevention and response planning is to map police reports of violent crime to alcohol outlets.

This white paper considers the relationships between the density of liquor licenses and police reports of violent crime in four cities in Arizona: Tucson, Tempe, Phoenix, and Flagstaff. Tabulation and comparison of assault, sexual offenses, kidnapping, robbery, and homicide in 2016 was conducted for all cities. Geospatial mapping was conducted for all assault and sexual offenses that were reported to police in the year 2016 in each city. Locations of establishments with liquor licenses for on-premises alcohol consumption (e.g., bars, clubs, restaurants) were also mapped for each city. The maps in this report use a heat feature to highlight high-density areas of alcohol-serving establishments. Violent crime is then mapped over the entire city.

In each city, assault and sexual offenses make up the majority of violent crime. Research shows that alcohol consumption has a strong correlation with both violent perpetration and victimization. The geospatial analysis conducted in this study indicates that in three of the four cities (Tucson, Tempe, and Flagstaff), physical and sexual violence is higher in areas with many liquor licenses. These areas typically are located in city centers and around major university main campuses. It is especially concerning that these crimes are happening around university and college campuses because the emerging adult population in these areas may be unaware of and unequipped to minimize their risks of violent crime. For example, a section of the Tucson map (Figure 1) shows that just west of The University of Arizona, there is a distinct cluster of police reports for physical assaults (green dots) and sexual assaults (pink dots). The background of the map is darkest in places where there are many alcohol-serving establishments, and lighter in places where there are less alcohol-serving establishments. The cluster of police reports of violence is located in an area where there are many alcohol-serving establishments close together.

Figure 1: Section of Map of Tucson Violent Crime and Liquor License Density



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Policy implications for state government, municipal police departments, and institutions of higher education include subsidizing/incentivizing violence prevention training for staff of alcohol-serving establishments, creating consistent crime coding in municipal databases statewide, conducting regular GIS mapping for crime prevention assessment, exploring opportunities to encourage victim reporting of sexual offenses, and re-assessing the impact of dry campus polices in the modern context. Recommendations for practice include increasing community policing strategies in areas with high densities of liquor licenses, endorsement of liquor licenses, seeking out violence prevention training for staff as a strategy for reducing liability incidents, developing college campus alcohol programming that specifically addresses situational characteristics of students' off-campus drinking, and public education regarding the relationship between violent crime and community density of alcohol-serving establishments.

#### Background

A growing body of literature is exploring the relationship between alcohol policies and community violence. A recent review of the effect of alcohol policy approaches on sexual violence perpetration prevention (Lippy & DeGue, 2014) identifies three main levels of alcohol policies that have been hypothesized to affect interpersonal violence rates: pricing policies, sale time policies, and alcohol outlet density policies. Of these policy categories, most strategies have inconsistent or minimal effects on alcohol consumption and interpersonal violence. However, an established body of research suggests that community density of alcohol-serving establishments may be positively associated with interpersonal violence and crime because individuals prone to commit norm-violating behaviors are attracted to environments where there is less social order and neighborhood cohesion (e.g., neighbors who know each other and watch out for each other's homes; people out walking for exercise; neighborhood events in local parks; formal or informal expectations for appearance of yards and buildings) (Kypri, Bell, Hay, & Baxter, 2008; Treno, et. al., 2007).

Recent analyses of observational and cross-sectional data explore the perpetration of aggressive behavior in bar environments. Some types of aggression such as uninvited, sexual or sexually-charged comments (e.g., 'catcalling') are more likely to be perpetrated in the early stages of interaction, whereas more persistent, invasive, and/or physically-assaultive acts often arise later when men misread or mislabel women's cues as welcoming their advances (Graham et. al. 2010, 2013, 2014). Additionally, individuals who are more likely to engage in violence tend to frequent establishments that tolerate aggressive behavior, and in turn these violencetolerant venues have higher rates of interpersonal violence (Schnitzer, Bellis, Anderson, Hughes, Calafat, Juan, Kokkevi, 2010). Violence-tolerant venues tend to be those that offer cheap alcoholic drinks, people "go a little wild", the environment is very busy, patrons perceive it as an easy place to use drugs, where they are likely to leave with new potential sexual partners. In both community and college samples, the most severe episodes of physical aggression that respondents had witnessed occurred inside or outside of a bar, compared to any other environment such as homes, work/school, or streets/parks (Leonard, Quigley, & Collins, 2002). Bars that cater to younger patrons, such as college students, and that have environmental characteristics including games that promote competition (e.g., pool, darts) have been shown to be associated with higher incidents of verbal, minor physical, and severe physical aggression (Buddie & Parks, 2003).

In Arizona, liquor-serving establishments are legally liable and may lose their liquor license for inadequately responding to dangerous patron behavior (A.R.S. §4-210). If staff of the establishment have a reasonable belief that a patron may be a danger to themselves or others, the staff must take reasonable steps to prevent that person from causing harm. For example, if staff have a reasonable belief that a patron is too intoxicated to drive, a reasonable step to prevent the patron from committing a harm might be to offer to call them a cab. This statute is broad, and thus is not limited to drunk driving situations. It also applies to violence that is perpetrated within the establishment, on establishment grounds, or immediately adjacent to the establishment (e.g., on the sidewalk or in a parking lot). Thus, if violent crime such as physical assault or sexual assault occurs on or immediately adjacent to a liquor-serving establishment, that establishment may be legally liable and risks losing its liquor license.

In order to increase public safety and quality of place in Tucson and throughout Arizona, data-driven violence prevention strategies are needed. Most violence prevention evaluations use individual-level outcome variables, such as knowledge and attitude change after individuals undergo educational programs. Contemporary recommendations are that effects of prevention initiatives should be evaluated at the community-level as well (DeGue, Holt, Massetti, Matiasko, Tharp, & Valle, 2012). Prior studies have used Geographic Information System (GIS) mapping to correlate high densities of alcohol outlets to high-risk driving behavior, assaultive behaviors, and general community violence (Brower & Carroll, 2007; Weitzman, Folkman, Folkman, & Wechsler, 2003; Lipton & Gruenewald, 2002). The Arizona Department of Health Services (ADHS) previously developed GIS maps of densities of alcohol-serving establishments and rates of rape in three major Arizona cities; however, these maps are outdated, are limited only to forcible rapes, and the data predated adoption of the current federal definition of the offense (the definitional change took place in 2012). Thus, these maps are of little utility to future violent crime prevention endeavors. The current study builds upon previous work by securing datasets with newer data, using current federal categories of violent crime, and making recommendations for violent crime prevention based on contemporary analysis. The current study explores the relationship between liquor licenses and police reports of violent crime (assault, sexual offenses, kidnapping, robbery, and homicide) in four major urban areas in Arizona: Flagstaff, Phoenix, Tempe, and Tucson. All Arizona city data can be retrieved from: (https://www.census.gov/quickfacts/fact/table/AZ,tucsoncityarizona,tempecityarizona,phoenixcit

yarizona,flagstaffcityarizona,US/PST045217#qf-flag-X).

Flagstaff is a city located in the northern part of Arizona within the Coconino National Forest, just south of the Navajo Nation. Flagstaff has a small urban core and serves as a nexus point between Arizona state route 89A, US Route 180, and US Interstate Highways 17 and 40. A small city with a population estimated by the US Census Bureau to be 71,459 in 2016, the city of Flagstaff makes up approximately 1% of Arizona's population. Flagstaff has a poverty rate of 23.3% and a median household income of \$50,667. Flagstaff is home to Northern Arizona University and Coconino County Community College.

Phoenix is a city located in the central part of Arizona on the southeastern edge of the Tonto National Forest. Phoenix has a large urban core that anchors a major metropolitan area and serves as a nexus point between numerous state routes, national routes, and interstate highways. A large city with a population estimated by the US Census Bureau to be 1,615,017 in 2016, Phoenix makes up approximately 23% of Arizona's population. Phoenix has a poverty rate of 22.3% and a median household income of \$49,328. Phoenix is home to multiple colleges and universities, including Grand Canyon University, GateWay Community College, multiple campuses for the University of Arizona and Arizona State University which, taking into account its six campuses, is one of the largest higher education institutions in the US.

Tempe is a city located immediately southeast of the city of Phoenix. Tempe is an urban area anchored by Phoenix. A geographically small city with a population estimated by the US Census Bureau to be 182,498 in 2016, the city of Tempe makes up approximately 2.5% of Arizona's population. Tempe has a poverty rate of 21.6% and a median household income of \$50,474. Tempe is home to the Tempe Campus of Arizona State University and is headquarters to the University of Phoenix.

Tucson is a city located in the southern part of Arizona, bisecting Saguaro National Park. Tucson has a large urban core with Interstate 10 passing through it and Interstate 19 serving as a major thoroughfare to Mexico. A large city with a population estimated by the US Census Bureau to be 530,706 in 2016, the city of Tucson makes up approximately 7.5% of Arizona's population. Tucson has a poverty rate of 25.1% and a median household income of \$37,973. Tucson is home to Pima Community College and the main campus of the University of Arizona.

## Definitions

The Uniform Crime Reporting (UCR) program is an FBI initiative for cooperative reporting of crime data across nearly 18,000 jurisdictions and agencies in the United States (<u>https://www.bjs.gov/ucrdata/abouttheucr.cfm</u>). Local law enforcement agencies that are responsible for populations that are 10,000 or larger and county law enforcement agencies that are responsible for populations that are 25,000 or larger, report data to the UCR program (<u>https://www.bjs.gov/ucrdata/faq.cfm</u>). The UCR program uses a series of standardized definitions for the crimes it tracks, which can be found at <u>https://www.bjs.gov/ucrdata/faq.cfm</u>. The UCR tracks five major types of violent crime: assault, homicide, kidnapping, robbery, and sexual offenses (Table 1). The sexual offenses category is further broken down into subcategories of rape and other (non-rape) sexual assault.

UCR Crime Categorization	UCR Definitions of Crime Categories
Assault	Aggravated assault Assault with injury Assault that occurred as part of a domestic violence dispute
Homicide	Criminal homicide Murder Non-negligent manslaughter
Kidnapping	Kidnapping
Robbery	Robbery Armed robbery Strong arm robbery
Sexual Offenses	Forcible Rape Rape Revised Rape Sexual assault

Table 1: Uniform Crime Report (UCR) Categories and Definitions

All of the cities queried for this white paper report their annual crime data to the UCR. Crimes are reported by community members to police, and those crimes are then classified in the police crime database using locally defined crime categories. These crime categories are then further

categorized at the federal level into UCR categories. The final UCR database that is publicly available contains crime data in these categories, however, it does not retain coordinate data needed to map crime in a GIS application. In the current study, municipal police databases all contained local geographic information and crime coding. Local crime coding was categorized into UCR categories by the research team (Table 2).

City	UCR Crime Categorization	Crime Locally Coded As
Flagstaff		
	Assault	Aggravated assault, adult on minor Aggravated assault, deadly weapon Aggravated assault, domestic violence Aggravated assault, entering residence Aggravated assault, entering residence Aggravated assault of a law enforcement officer Aggravated assault, serious physical injury Aggravated assault, victim disfigured/impaired/fractured Aggravated assault, victim restrained Assault, fear of injury Assault, intentional recklessness/injury Assault, touch to injury Pointing a laser at an aircraft Pointing a laser at a law enforcement officer
	Homicide	The local law enforcement agency did not code any police reports as homicides in the 2016 Flagstaff dataset.
	Kidnapping	Kidnapping, apprehension of injury Kidnapping, death/injury/sex/aiding a felony Unlawful imprisonment Involuntary servitude
	Robbery	Armed robbery, with a deadly weapon Robbery Robbery, aggravated
	Sexual Offenses	Sex offense, child molestation Sex offense, sexual abuse Sex offense unlawful sexual conduct by correctional staff Sexual assault
Phoenix		
	Assault	Aggravated assault

Table 2: UCR Crime Categorization by City

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	Homicide	Murder and non-negligent manslaughter	
	Kidnapping	The local law enforcement agency did not code any police reports as kidnapping in the 2016 Phoenix dataset.	
	Robbery	The local law enforcement agency did not code any police reports as robbery in the 2016 Phoenix dataset.	
	Sexual Offenses	Rape	
Tempe			
	Assault	Aggravated assault, police officer Aggravated assault, domestic violence Assault, domestic violence Aggravated assault, non-domestic violence Assault, non-domestic violence	
	Homicide	Homicide	
	Kidnapping	Kidnapping	
	Robbery	Robbery, armed Robbery, strong arm	
	Sexual Offenses	Sexual assault	
Tucson			
	Assault	Aggravated assault, drive-by shooting Aggravated assault, domestic violence Aggravated assault, other Aggravated assault, peace officer (non-serious injury) Aggravated assault, peace officer (serious injury) Assault, minor injury Assault, minor injury-domestic violence Assault, no injury-domestic violence Assault, no injury	
	Homicide	Homicide/Murder	
	Kidnapping	The local law enforcement agency did not code any police reports as kidnapping in the 2016 Tucson dataset.	

Robbery	The local law enforcement agency did not code any police reports as robbery in the 2016 Tucson dataset.
Sexual Offenses	Sexual assault, attempted rape Sexual assault, forcible rape Sexual assault, other

# **Data Sources and Mapping Methods**

Municipal police departments in each of the four cities provided violent crime datasets from January 1 through December 31, 2016 for this study. The datasets, all in Microsoft Excel format, contained different types of data depending on the city. Data included in all sources included offense date, crime category, and street location. Some datasets included x/y coordinate data. One dataset, Tucson, included the reported crime as well as the categorization of the crime based on the police report (e.g., "shots fired" may have been reported to 911, but the incident was ultimately coded as "aggravated assault"). For the purposes of this study, the final coding of the incident by police was utilized in data tables and maps.

The geographic information system (GIS) software utilized to generate the maps for the report was ArcMap version 10.5.1. After reviewing the crime datasets, it was determined that extensive data cleansing would be required in order to accurately create a map that displayed the spatial relationship between violence and alcohol-serving establishment locations for the specific areas of interest. The data cleaning included merging excel columns to produce accurate physical addresses, removing incomplete block addresses and substituting with a "00" to obtain close spatial locations (e.g., 41XX N 51<sup>st</sup> Ave to 4100 N 51<sup>st</sup> Ave), removing violent crimes that did not occur in the year of 2016, and the removal of crimes that did not meet the specific parameters of interest for this report (e.g., non-violent incidents such as burglary, arson, drug offenses, traffic accidents, larceny-theft, motor vehicle theft).

Once the data cleaning was completed, the violent crimes of interest for Tucson, Tempe, and Flagstaff were successfully mapped using the "Esri World Geocoder" under the "Geocode Addresses" tool with a 99.2% accuracy rate and shapefile (SHP) layers were created. However, the violent crime of interest for Phoenix required the construction of a custom geocoder, which produced an 87.6% accuracy rate and a shapefile (SHP) layer was created. The violent crime data for Phoenix required the construction of a custom geocoder because the spatial location of where the violent crime took place was incomplete. The geocoder established generalized spatial locations on the same block address. For example, removing the "XX" within the address 41XX N 51<sup>st</sup> Ave and replacing with "00" to form a complete address of 4100 N 51<sup>st</sup> Ave.

Next, spatial information of the liquor licenses for the establishments in Tucson, Tempe, Flagstaff, and Phoenix were obtained from the Arizona Department of Liquor Licenses and Control (DLLC) website query page (<u>https://www.azliquor.gov/query/search\_series\_city.cfm</u>). This database contains information for both "on-premises" and "off-premises" liquor licenses. These licenses indicate whether alcoholic beverages can be open and consumed "on-premises" or whether the alcohol can be sold on-premises, but only opened and consumed "off-premises." For this study, only "on-premises" liquor license addresses were queried and mapped.

The DLLC does not provide latitude and longitude or "x and y" coordinate system data, so geocoding through the Esri World Geocoder via ArcMap v10.5.1 was required in order to accurately obtain the spatial locations of alcohol-serving establishments for the cities of interest. Once this process was completed, shapefile (SHP) layers of establishment locations were created and successfully added to the maps. Utilizing the "Kernel Density" tool within the "Spatial Analyst Toolbox" via ArcMaps v10.5.1 on the establishment location datasets, the density of establishments was created and mapped against violent crime for a specific location. The results illustrate the amount of crime in a specific location in relation to the density of alcohol-serving establishments for that exact location. Lastly, the 2017 U.S. Census Block Groups layer was added to the maps for illustrating the amount of violent crime in a specific block group. The 2017 U.S. Census Block Group layer can be obtained from <a href="https://www.census.gov/geo/maps-data/data/tiger-line.html">https://www.census.gov/geo/maps-data/data/tiger-line.html</a>.

#### Results

This section presents the results for violent crime and liquor license density. First, violent crime raw data and violent crime per capita are presented. Next, violent crime and liquor license density is presented by city using heat maps. These types of maps use color coding, whereby lighter colors show 'less' of the item of interest, and darker colors show 'more' of the item of interest. Darker areas on the map are known as "hot spots" or "high-density" areas of the item of interest.

Because assault and sexual offenses make up the vast majority of violent crime in each city, only these categories of crime are included on the maps. For Phoenix and Tucson, additional crime information that was included in the databases is also presented to provide a more holistic picture of safety issues. All of the datasets included a general block address for every incident. Phoenix also included a description of the location of the incident. Results for assaults and sexual offenses that took place at a bar, lounge, or nightclub, or on a street, roadway, alley, or sidewalk in Phoenix are presented. The Tucson dataset included whether and what type of weapon was used in the commission of a violent crime. Results for weapons used in the commission of an assault or sexual offense in Tucson are presented.

#### Violent Crime in All Cities

Table 3 lists the raw number and per capita violent crime in each city for 2016. All crime from each city's jurisdictional crime coding was categorized into the UCR categories. Crime by city using UCR categories is presented. It is important to note that the datasets from each city did not capture the same spectrum of crime in each category (see Table 2). Using these data of local crime codes into UCR categories, Tucson had the highest rate of violent crime per capita (21.1 violent crimes per 1,000 people), and Phoenix had the lowest rate (3.2 per 1,000). In each city, assault was the highest per capita violent crime (range: 2.1 to 20.5 per 1,000), followed by sexual offenses (range: 0.5-0.9 per 1,000). (Crime categories that are consistent across cities are listed in Table 4 and Table 5, and are described later in this section.)

In three of the four cities, there were some crime categories where the police department data showed that no incidents occurred in 2016 (Table 3). Incidents are reported to police, and are coded in the datasets by the law enforcement agencies. In Flagstaff, there were no incidents reported to police that the law enforcement agency then coded in their dataset as homicide. In

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Phoenix, there were no incidents reported to police that were then coded by the police department as kidnapping or robbery. In Tucson, there were also no incidents reported to police that were coded by the police department as kidnapping or robbery. Tucson is the only dataset that listed a "reported as" for each crime as well as a corresponding description of how the incident was ultimately coded by police. Although no incidents were ultimately coded in the police database as kidnapping or robbery, there were two reports of kidnapping and 36 reports of robbery made to police. These incidents were all coded as assaults or sexual offenses after police responded to the incidents (see Table 3 notes 1-2 for a detailed breakdown of coding).

City & Crime Type	Number of Violent Crimes Reported in 2016	Population & Per Capita Violent Crime (per 1,000 population) <sup>1,2</sup>
Flagstaff		Pop.: 71,459
Total Violent Crime	1,258	17.6
Assault	1,161	16.2
Homicide	0	0
Kidnapping	9	0.1
Robbery	21	0.3
Sexual Offenses	67	0.9
Phoenix		Pop.: 1,615,017
Total Violent Crime	5,123	3.2
Assault	4,103	2.5
Homicide	133	0.1
Kidnapping	0	0
Robbery	0	0
Sexual Offenses	887	0.5
Тетре		Pop.: 182,498
Total Violent Crime	3,008	16.5
Assault	2,609	14.3
Homicide	10	0.1
Kidnapping	4	0.02
Robbery	237	1.3
Sexual Offenses	148	0.8
Tucson		Pop.: 530,706
Total Violent Crime	11,175	21.1
Assault	10,685	20.1
Homicide	31	0.1
Kidnapping <sup>3</sup>	0	0
Robbery <sup>4</sup>	0	0
Sexual Offenses	459	0.9

Table 3: Violent Crime Raw Numbers and Per Capita, by City, 2016

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<sup>1</sup>All populations and per capita estimates are based on US Census Bureau 2016 population estimates <sup>2</sup>Not all per capita crime equals total selected per capita crime due to rounding error

<sup>3</sup>There were 2 reports of Kidnapping made to police in Tucson. Ultimately, 1 report was coded as Assault, Minor Injury/Domestic Violence, and 1 was coded as Disorderly Conduct/Disturbing the Peace.

<sup>4</sup> There were 36 reports of robbery made to police in Tucson. Of the 36 reports, 32 were ultimately coded in the UCR Assault category, 3 were coded as Sexual Offenses, and 1 was coded as a non-violent crime (DUI). The 36 reports of Robbery, included 18 reports of Highway Robbery, 6 reports of Armed Robbery, 6 reports of Armed Robbery/A, and 6 reports of Armed Robbery/R. Of the 18 reports of Highway Robbery, 2 were ultimately coded as Sexual Assault/Forcible Rape, 1 as Disorderly Conduct/Disturbing the Peace, 1 as Assault, No Injury, Domestic Violence, 7 as Assault, Minor Injury, and 7 as Assault, Aggravated/Other. Of the 6 reports of Armed Robbery/A, 1 was coded as Disorderly Conduct, Disturbing the Peace, 2 as Assault, Minor Injury, and 3 as Assault, Aggravated/Other. Of the 6 reports of Armed Robbery/A, 1 was coded as Disorderly Conduct, Disturbing the Peace, 2 as Assault, Minor Injury, and 3 as Assault, Aggravated/Other. Of the 6 reports of Armed Robbery/A, 1 was coded as Disorderly Conduct, Disturbing the Peace, 2 as Assault, Minor Injury, and 3 as Assault, Aggravated/Other. Of the 6 reports of Armed Robbery/A, 1 was coded as Sexual Assault/Forcible Rape, 4 as Assault, Aggravated/Other, and 1 as Assault, Aggravated/Drive-by Shooting.

Tables 4 and 5 compare the categories of crime that overlap for each city to give a more comparable picture of crime across the locations. Homicide, kidnapping, and robbery were not defined and captured in the same way across locations. Likewise, aggravated assault was the only subcategory of assault that could be compared across all four cities (Phoenix did not report non-aggravated assaults in this dataset) (Table 4). In terms of sexual offenses, Phoenix only reported rape; attempted rape; other sexual assaults were not coded into the 2016 dataset. Tucson was the only dataset that broke down sexual offenses into rape and other sexual assaults. Table 5 compares forcible rape in Phoenix and Tucson.

Using comparable data categories, Tucson has the highest rate of aggravated assault (3.5 per 1,000 people) (Table 4). Tempe, Phoenix, and Flagstaff's rates of aggravated assault are all lower than Tucson, but comparable to each other (2.6, 2.5, and 2.2 per 1,000 people, respectively).

City & Aggravated Assault Type	Number of Aggravated Assaults	Population & Per Capita Aggravated Assault (per 1,000 population) <sup>1,2</sup>
Flagstaff		71,459
Total Aggravated Assault	166	2.2
Aggravated assault, adult on minor	4	0.1
Aggravated assault, deadly weapon	89	1.2
Aggravated assault, domestic violence	37	0.5
Aggravated assault, entering residence	5	0.1
Aggravated assault of a law enforcement officer	2	0.02
Aggravated assault, serious physical injury	15	0.2

Table 4: Aggravated Assaults, Raw Numbers and Per Capita, by City, 2016

Aggravated assault, victim	10	0.1
Aggravated assault, victim restrained	4	0.1
Phoenix		1,615,017
Aggravated Assault <sup>3</sup>	4,103	2.5
Tempe		182,498
Total Aggravated Assault	469	2.6
Aggravated assault, police officer	55	0.3
Aggravated assault, domestic violence	144	0.8
Aggravated assault, non-domestic violence	270	1.5
Tucson		530,706
Total Aggravated Assault	1,896	3.5
Aggravated assault, drive-by shooting	84	0.2
Aggravated assault, domestic violence	564	1.1
Aggravated assault, other	1,110	2.1
Aggravated assault, peace officer (non-	134	0.3
serious injury)		
Aggravated assault, peace officer (serious	4	0.007
injury)		

<sup>1</sup>All populations and per capita estimates are based on US Census Bureau 2016 population estimates

<sup>2</sup>Not all per capita crime equals total selected per capita crime due to rounding error

<sup>3</sup>Only aggravated assault crime reported by the city of Phoenix was aggravated assault

Using comparable data categories, Table 5 shows the numbers and rates of rape in Phoenix and Tucson. Sexual Offenses in Tempe and Flagstaff were not broken down in such a way as to separate the incidents into rape and non-rape (e.g., attempted rape, other sexual assaults) offenses. Phoenix only coded rape, and did not include any attempted rape or other sexual offenses in the dataset. Using these data, Tucson had a slightly higher per capita rate of rape (0.8 per 1,000 people) compared to Phoenix (0.5 per 1,000 people).

Table 5: Rapes, Raw Numbers and Per Capita, by City, 2016

City and Sexual Offense Type	Number of Rapes Reported in 2016	Population & Per Capita Rapes (per 1,000 population) <sup>1</sup>
Phoenix		1,615,017
Rape <sup>2</sup>	887	0.5
Tucson		530,706
Sexual Assault, Forcible Rape	423	0.8

<sup>1</sup>All populations and per capita estimates are based on the US Census Bureau 2016 population estimates <sup>2</sup>Only sexual offense code used by the Phoenix law enforcement agency was rape. The dataset had no incidents recorded in other sexual offense categories.

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# Mapping Crime and Liquor Licenses: Flagstaff

The map depicted in Figure 2 represents the city of Flagstaff, including a marker for the Northern Arizona University (NAU) main campus. In 2016, there were 25 on-premises liquor licenses in Flagstaff. The increasing darker shades show an increasing number of alcohol-serving establishments at the core of the city, coinciding with downtown, which is just north of the NAU campus. Violent crimes are distributed throughout the urban area with crimes clustering in the general area with the highest density of establishments as well as in the area northeast of it.



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Figure 2: Density of Liquor Licenses, Assaults, and Sexual Offenses in Flagstaff, AZ, 2016

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# Mapping Crime and Liquor Licenses: Phoenix

In 2016, there were 245 on-premises liquor licenses in Phoenix. Figure 3 shows the city of Phoenix and highlights Arizona State University's downtown campus. The increasing darker shades of the heat map show that the closer the campus, the greater the number of alcoholserving establishments. Violent crimes are distributed throughout the urban area with little clustering of the crimes in any one area. There are no assault or sexual offense incidents located in the area with the highest density of on-premises liquor licenses.



Figure 3: Density of Liquor Licenses, Assaults, and Sexual Offenses in Phoenix, AZ, 2016

Although the map does not show clustering around a high-density area of alcohol-serving establishments, an analysis of incident locations shows that a non-negligible proportion of violent crimes appear to occur in or around bars and restaurants as reflected by the description of the location where each incident took place included in the Phoenix crime dataset. The research team analyzed the location of incidents that took place in a "bar, lounge, or night club" or "restaurant." Additionally, because many incidents of aggression take place on the outskirts of an establishment and liquor licensees are responsible for patron safety extending to the sidewalks and perimeter areas of the establishment, the research team also tabulated assault and sexual offense incidents that took place in a "parking lot" or "street, roadway, alley, or sidewalk." Residential areas (e.g., single-family homes, apartments, hotels), bus stops, parks, and vehicles were excluded.

In 2016, 1.8% of aggravated assaults and 0.5% of rapes in Phoenix took place inside of bars, lounges, night clubs, or restaurants (Table 6). Up to one-third (33.4%) of aggravated assaults and 1 in 12 (8.3%) of rapes took place in or adjacent to these establishments. Approximately 1.5% of all aggravated assaults and rapes took place inside of these establishments, and more than one-quarter (28.9%) took place within the vicinity of the establishments, such as in an adjacent parking lot, street, roadway, alley, or sidewalk.

Violent Crime Type and Location	Number	%
Aggravated Assault	4,103	100
Bar, Lounge, or Night Club	47	1.1
Restaurant	27	0.7
Parking Lot	431	10.5
Street, Roadway, Alley, Sidewalk	865	21.1
Total in Selected Locales	1,370	33.4
Rape	887	100
Bar, Lounge, or Night Club	4	0.5
Restaurant	0	0.0
Parking Lot	21	2.4
Street, Roadway, Alley, Sidewalk	49	5.5
Total in Selected Locales	74	8.3
Aggravated Assault and Rape	4,990	100
Bar, Lounge, or Night Club	51	1.0
Restaurant	27	0.5
Parking Lot	452	9.1
Street, Roadway, Alley, Sidewalk	914	18.3
Total in Selected Locales	1,444	28.9

Table 6: Aggravated Assault and Rape in/around Bars, Lounges, Nightclubs, and Restaurants in Phoenix, AZ, 2016

# Mapping Crime and Liquor Licenses: Tempe

The map in Figure 4 shows the city of Tempe and highlights Arizona State University's main campus. In 2016, there were 57 on-premises liquor licenses in Tempe. We can see by the increasing darker shades that the closer the campus, the greater the number of alcohol-serving establishments. There is some clustering of alcohol-serving establishments just east of the campus and south of the campus. Violent crimes are distributed throughout the urban area with some clustering occurring near alcohol-serving establishment locations as well as to the area immediately southeast of the campus.



Figure 4: Density of Liquor Licenses, Assaults, and Sexual Offenses in Tempe, AZ, 2016

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# Mapping Crime and Liquor Licenses: Tucson

The map depicted in Figure 5 shows the of the city of Tucson and highlights The University of Arizona's main campus. In 2016, there were 182 on-premises liquor licenses in Tucson. The increasing darker shades close to the campus indicate an increasing density of alcohol-serving establishments. Violent crimes are distributed throughout the urban area with some clustering occurring near high-density of bar locations as well as to the area immediately south of the campus.



Figure 5: Density of Liquor Licenses, Assaults, and Sexual Offenses in Tucson, AZ, 2016

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The Tucson dataset includes information about whether and what type of weapon was used in the commission of a reported crime. Weapons used in the commission of assaults and sexual offenses in Tucson were coded as: asphyxiation, rifle, handgun, other firearm, shotgun, firearm: automatic, blunt object (club, etc.), knife/cutting instrument (ax, etc.), personal weapons (hands, etc.), automatic handgun, and motor vehicle (as weapon). In 2016, a weapon was used in nearly half (49.3%) of reported assault incidents, and in more than one-quarter (26.8%) of reported sexual offenses.

### Discussion

This feasibility and preliminary application of GIS methodology combined with liquor outlet density provided rich results when viewed from the perspective of the value of the current approach and how it could be strengthened in future applications.

# Liquor License Density and Violent Crime

On-premises liquor license density appears to be correlated with 'hot spots' of reports of assaults and sexual offenses in three of the four cities (Flagstaff, Tempe, and Tucson). In each of these cities, the highest density of alcohol-serving establishments is immediately adjacent to the main campus of a large state university. The major clusters of violent crime are also adjacent to the university campuses, in both areas of high and low density of alcohol-serving establishments. There may be several explanations for this. First, collegiate students tend to engage in risky behaviors, such as binge drinking, at high rates. They are also a high-risk group for both violent perpetration and victimization, particularly sexual violence. Second, many institutions of higher education have implemented dry campus policies in order to curb student drinking on campus. An unintended consequence of these policies is that student drinking is driven off campus. This may be a factor in why there are both high-density areas of both liquor licenses and violent crime reports adjacent to the three main university campuses: these areas are attractive to business owners as lucrative sites for nightlife establishments, and are convenient drinking spaces for students. Third, the clusters of violent crime adjacent to the main university campuses in Flagstaff, Tucson, and Tempe that do not coincide with high-density areas of liquor licenses may also be related to student drinking. As the universities expand in population size, there is an increased demand for off-campus student housing which is often supplied by private homeowners or developers. These housing units are not required to implement dry policies if they are not owned by the university. Thus, one possible explanation for the additional violent crime clusters may be that the reported incidents are occurring in high-density areas of offcampus student housing adjacent to the main university campuses. Additional study is warranted.

In Phoenix, there was a high-density area of liquor-serving establishments, however, there was not a coinciding cluster of violent crime as was seen in the other three cities. There are several possible factors that may explain this outlier. First, the university campuses adjacent to the high density area (University of Arizona- Phoenix Campus, and Arizona State University-Downtown Campus) are commuter campuses. Students from these campuses do not necessarily live adjacent to the campuses, and thus may not engage in nightlife in these areas. Second, these establishments are in the heart of downtown Phoenix, and may be more expensive/upscale compared to the establishments that students tend to frequent. This could also reduce patronage

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from the high-risk student group. Lastly, although Phoenix has a small high-density area of liquor licenses in the downtown area, the overall number of liquor licenses in the city (245) is nearly 10 times the amount in Flagstaff (25) and four times the amount Tempe (57), and is 35% greater than Tucson (182). It is possible that despite the small high-density area of liquor licenses downtown, the very high number of alcohol-serving establishments overall in the city contributes to the overall diffusion of assaults and sexual offenses throughout the municipality. Despite not clustering around a high-density area of alcohol-serving establishments, more than one-quarter (28.9%) of aggravated assaults and rapes in Phoenix in 2016 took place in or potentially around bars, lounges, night clubs, and restaurants.

#### **Tucson Compared to Other Cities**

Violent crime in Tucson appears diffuse as a "T" shape throughout the city. There is also a distinct cluster of violent incidents that coincide with a high-density area of liquor licenses immediately west of the University of Arizona's main campus (Figure 4). The "T" shape of incidents coincides with several large geographic areas where either population density is extremely low (e.g., the large Santa Catalina Mountains range on the northern end of the city) or crime is not reported to municipal police (the Davis-Monthan Air Force Base, in the south-eastern area of the city). Additionally, alcohol use is prohibited on the Air Force Base, which would drive drinking off-base and thus most alcohol-related incidents may be occurring adjacent to the base. This may partially explain why, just north of the base, there is a low density area of alcohol-serving establishments, yet there is a noticeable band of violent crime incident points.

There are also two distinct areas of low-to-moderate liquor licenses in the northeast and central-east areas of the city (Figure 4). These areas coincide with areas of newer development of commercial businesses to serve residential communities that are growing in the further reaches of the city. The number of liquor licenses in these commercial areas has not yet reached a threshold where a high-density of violent crime clearly coincides with the liquor licenses, however, these areas may be considered for targeted prevention efforts as the city continues to expand.

As shown in Table 3, Tucson had the highest per capita rate of violent crime out (21.1 per 1,000) of all the cities in this study, and had higher per capita rates of the two most frequent types of violent crime (assault and sexual offenses) compared to the three other cities in this study (Table 3; Table 4). The four cities did not report the same types of assault and sexual offenses. When accounting for these differences, the per capita rates of these crimes continued to be higher in Tucson than the other three cities (Table 4), though the rates were much closer than when the differences were not accounted for (Table 3). Tucson's rate of aggravated assault is approximately one per thousand more than the other cities (3.5 per 1,000, compared to 2.6, 2.5, and 2.2 per 1,000 for Tempe, Phoenix, and Flagsaff, respectively). Only Tucson and Phoenix reported comparable sexual offense categories (forcible rape separate from other sexual assaults), so these cities could not be compared to Tempe and Flagstaff after accounting for reporting differences. Compared to Phoenix, Tucson has a slightly higher per capita rate of forcible rape (0.8 per 1,000 people, compared to 0.5 per 1,000 people).

Based on available data, Tucson had lower rates of robbery and kidnapping compared to Flagstaff and Tempe. However, it should be noted that the local law enforcement agencies in Tucson and Phoenix did not code any incidents as robbery or kidnapping, even though some

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incidents may have been reported to police as such. The rate of homicide was the same in all three cities that reported the crime (0.1 homicides per 1,000 people in Phoenix, Tempe, and Tucson; no homicides were coded in Flagstaff for 2016).

#### Lessons Learned

The differences in crime coding and data availability in the four cities limits the comparability of the cities in both quantitative measurements and what can be observed in the resulting crime/liquor license density maps. As shown in Table 2, although all four cities report crime to the UCR, the types of crime coded by each city into the UCR categories vastly differs. For example, Flagstaff includes child molestation and sexual abuse in their sexual offense categories, whereas the other cities only include sexual offenses involving adult victims. Phoenix only reported rape in sexual offenses, to the exclusion of attempted rape and other sexual assaults. Phoenix also only reported aggravated assaults in the UCR assault category; there were no assaults of a non-aggravated nature included in the dataset. Because of these significant variances in which types of assaults and sexual offenses were included in the datasets, there may be artificial differences in the crime rates, and crime listed in Table 3 may potentially be underreported in some cities (e.g., Phoenix) and over-reported in some cities (e.g., Flagstaff) when attempting to make comparisons between the cities. Additionally, there were no robberies or kidnappings coded in Phoenix or Tucson. In major urban cities, it would be unusual to have no kidnapping or robbery events. In Tucson, robberies and kidnappings that were reported to police were ultimately coded as assaults or sexual offenses. There is no information regarding kidnapping or robbery reports made to Phoenix municipal police and whether they may have been ultimately coded as other types of crime. The limited reporting areas of crime for Phoenix (i.e., the inclusion of only aggravated assaults and rapes in the dataset) may have played a role in the non-clustering of crime for the city. Additional study would be needed, with the inclusion of non-aggravated assaults and other types of sexual assault, to determine a better comparison of the Phoenix crime map with the other cities.

The maps presented in this white paper only include assault and sexual offenses, as there were relatively very few incidents of other violent crimes compared to these two categories. However, it is noteworthy that sexual offenses are notoriously underreported to law enforcement. For example, although the 2016 per capita rate of sexual offenses in Tucson was 0.8 per 1,000 people (459 total sexual offenses coded), a survey of University of Arizona undergraduate and graduate students in spring 2015 revealed that 1,113 of respondents (out of 2,852 who took the survey) had experienced a sexual offense (rape or other sexual assault) during the past academic year. This only includes rapes or other sexual assaults perpetrated through physical force or incapacitation of the victim, and does not include those perpetrated using coercion or lack of affirmative consent. Of these 1,113 sexual assaults, 89% were not reported to the municipal police department. This is only one example of underreporting of sexual assaults. If all sexual offenses were reported to police, the raw numbers and per capita rates in each city would be significantly higher, and the resulting mapped data may show additional information that could be useful in prevention efforts.

For example, in Phoenix, 33.4% of aggravated assaults took place in or potentially around an alcohol-serving establishment (Table 6). Only 8.3% of rapes took place in or around

alcohol-serving establishments; the majority of rapes took place in a residence (e.g., single family home, apartment/townhouse/condo, hotel/motel). Thus, even if all sexual offenses were reported and mapped, it is likely that physical assaults would continue to cluster around liquor licenses but sexual offenses would be disbursed into residential areas. However, research shows that alcohol consumption is robustly associated with both sexual offense perpetration and victimization. Although alcohol-serving establishments may not be legally liable for sexual offenses taking place in a private residence off-site from the business, there is an opportunity here to consider *upstream strategies*, which are interventions that can be used early on to disrupt or prevent a chain of events that could lead to a negative outcome. For example, lower insurance rates for homeowners who install gates around swimming pools is an upstream strategy to prevent drowning fatalities. Utilizing strategies to reduce sexual aggression in public drinking spaces is an upstream strategy that could potentially have a prevention effect on reducing sexual assaults that take place later in private residences.

#### Recommendations

This study provides initial evidence that in Arizona, violent crime tends to cluster around highdensity areas of alcohol-serving establishments. This is especially true around the main campuses of the three major state universities. In areas such as Phoenix where there are commuter campuses and an overall high number of alcohol-serving establishments diffused throughout the city, there is a diffusion of violent crime around the city: it does not tend to cluster around commuter campuses. Recommendations for policy and practice follow.

# **Policy Recommendations**

**Develop consistent crime coding across the major municipalities in Arizona.** There were very few consistencies in the categorization of crimes across all four major municipalities assessed in this study. Although all four cities ultimately report to UCR, comparison of crime across the cities using the UCR results is faulty due to the lack of consistency in which types of crimes are coded into each category. An initiative to streamline the crime coding across municipal databases would lead to more accurate comparison of cities.

**Conduct GIS mapping of crime and liquor licenses at regular intervals to assess for new clusters and developing risk areas, as well as crime reduction success over time.** The GIS mapping conducted in this study shows areas in all cities where commercial growth, including increases in liquor licenses, is occurring. These areas could be assessed over time for clustering of crime that would be expected in areas with a high-density of liquor licenses. As violent crime prevention strategies are introduced, re-assessment using GIS mapping can provide visual cues as to whether those strategies are having the intended impact over time.

Subsidize and/or otherwise incentivize physical and sexual violence prevention training for liquor licensees. The Arizona Department of Health Services currently operates a statewide program to provide free sexual violence prevention training to staff of alcohol-serving establishments. However, labor laws require establishment owners to pay for employee time to attend trainings. This cost is prohibitive to many businesses. A subsidy from state or local governments could help defray this cost. Another potential option to incentivize alcohol-serving establishments to get trained could be to reduce liquor license renewal fees for establishments

who meet a certain threshold of staff who are trained in violence prevention. Private insurance companies could offer discounts on liability insurance premiums for trained establishments.

**Explore strategies to encourage and support victim reporting of sexual offenses.** It will continue to be impossible to assess the prevalence, incidence, and spatial attributes of sexual offenses if victims do not report these incidents. Victims do not report to police for a variety of reasons, including fear that they will not be believed, expectations that the justice system will not adequately respond to the report, expectations that the justice process will be retraumatizing, and desiring interventions that are not currently part of the menu of options typically offered by the justice system. Local municipalities could conduct surveys and focus groups with violent crime victims to assess reasons for not reporting, as well as to assess experiences with the justice system of victims who did report. Local justice systems could consider offering additional options for pursuing justice that do not involve the traditional court system, such as restorative justice.

Dry campus policies relocate areas of outlet density. University campuses have enacted dry campus policies to manage and reduce student drinking on campus. However, with the advent of ride sharing apps and the vast increases in off-campus student housing, opportunities and ease for student drinking in spaces outside of campus have increased. In this study, violent crime clustered in high-density areas of alcohol-serving establishments next to every state university main campus. Universities could consider whether dry campus policies are still relevant in the modern context of student life, and whether other policy options might better manage student drinking.

#### **Practice Recommendations**

Utilize community policing strategies targeted at high-density areas of alcoholserving establishments. Community policing focuses on building relationships with community members to better prevent and respond to crimes. Strategies may include utilizing community patrol officers to disseminate information and have discussions with business owners in liquor license-dense areas about violent crime in the area, increasing the passive presence of police in these areas on high-traffic nights, training police officers in violence prevention and then having officers train alcohol-serving establishment staff, and increasing enforcement of alcohol policies in high-density areas during high-traffic nights.

Liquor licensees could explore violence prevention training opportunities for staff who are not required to undergo state Title IV training. Not all liquor servers are required to complete liquor license training (Title IV training) through the State Department of Liquor Licenses and Control, yet liquor servers are legally responsible for taking reasonable steps to ensure patron safety. Liquor servers may be inclined to watch for patrons who are too intoxicated to drive, however, they may not be watching for behaviors or signs that are precursors to interpersonal violence. Interpersonal violence perpetrated by patrons may lead to legal issues for the liquor licensee. In order to potentially reduce incidents and thus subsequent legal liability issues, liquor licensees could explore options for violence prevention training for liquor-serving staff.

Educate the public, including university students, about the relationship between high-density areas of alcohol-serving establishments and incidence of violent crime. Community members, particularly students, may be more likely to patronize establishments that

have been trained in violence prevention. Patrons want to know that the establishment will keep them safe from violence while they are drinking. Establishments may be more likely to undergo violence prevention training and take measures to prevent violence if they hear from patrons that they value establishments that publicly take a stand against violence. Educating the public about the relationship between high-densities of alcohol-serving establishments and violent crime could create a domino effect whereby there is increased patron demand for trained establishments, and thus establishments seek out and engage in violence prevention measures.

Develop alcohol and violence risk reduction initiatives that target students' offcampus drinking behaviors. Universities and alcohol-serving businesses adjacent to campuses could develop alcohol risk reduction partnerships to address risky student behavior such as binge drinking, which has a direct relationship with violent perpetration and victimization. University alcohol risk reduction programming could also be updated to address situations that occur in offcampus housing and other drinking spaces. Focus groups could be held with students who live in or attend parties in off-campus housing complexes in order to gain a better understanding of offcampus student drinking practices and culture. This information could be used to update alcohol programming with specific and relevant situational prevention strategies that students can use to prevent alcohol-related interpersonal violence in these spaces.

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