12-15-2018

# Associations between Opioid-Related Hospitalizations and Intravenous Drug Users

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# ASSOCIATIONS BETWEEN OPIOID-RELATED HOSPITALIZATIONS AND INTRAVENOUS DRUG USERS

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A thesis submitted in partial fulfillment
of the requirements for the

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The Graduate College

University of Nevada, Las Vegas
December 2018

**Thesis Approval**

The Graduate College
The University of Nevada, Las Vegas

October 29, 2018

This thesis prepared by

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entitled

Associations Between Opioid-Related Hospitalizations and Intravenous Drug Users

is approved in partial fulfillment of the requirements for the degree of

Master of Public Health
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**Abstract**

The opioid epidemic has led to a chain reaction of public health concerns, including an increase in heroin usage, injection drug abuse, incidence of hepatitis C virus (HCV), and HIV transmission. There have been few population-based studies investigating the clinical and socio-demographic data associated with opioid use in Nevada (Feng et al., 2016; Frank, 2000) and few studies investigating the intravenous drug user (IDU) population in Clark County. On February 2017, Clark County's first syringe exchange program (SEP) opened its doors to the IDU population. This study provides an updated analysis of opioid-related injuries within Nevada and provides a first-time analysis of the IDU population within Clark County. According to the 2017 Center of Health Information Analysis (CHIA), there were 9,064 opioid-related injuries in the state of Nevada. The most common comorbidities associated with opioid-related injuries were chronic bodily pains (50.2%), malnutrition (47.3%), nicotine dependence (44.7%), affective disorders (32.4%), and hypertension (28.8%). There was a higher proportion of 18-35 year olds who used SEPs as compared to 18-35 year olds who used hospitals. One Clark County zip code had both high frequencies for opioid-related hospitalizations and injection drug use. In order to implement interventions and programs to battle the opioid epidemic and the consequent public health effects, we must first understand the associations between opioid-related hospitalizations and the IDU population.

## Acknowledgements

I am incredibly grateful to my co-chair, Dr. Sheniz Moonie, for taking me on at the last minute despite already having a full complement of masters and doctoral students. During a difficult time in our department, she helped me put my committee together, guided me through deadlines, and the administration of putting my thesis together.

I am incredibly grateful for my co-chair, Dr. Chad Cross, for his patience, time, and energy spent teaching me SPSS coding techniques and shortcuts using excel. Thank you for taking the vision I had of creating heat maps and bringing this idea into fruition. These GIS maps emphasized the importance of my project and spoke volumes to an audience during presentations.

I am very fortunate to have worked with Dr. Jay Shen and Dr. Jennifer Kawi. Thank you for serving on my committee, for your continuous support, and interest in my project. Your honest feedback always left me encouraged and excited about my thesis research.

I would like to thank Joseph Greenway from the Center for Health Information Analysis (CHIA), as well as, Trac-B-Exchange, for providing the data needed to fulfill my thesis research. I would like to give a special thank you to Chelsie Cheatom and Rick Reich from Trac-B, for sparking my interest in the opioid epidemic.

I am incredibly grateful to my advisor, Dr. Brian Labus, for bringing the opportunity of interning at Trac-B into light and mentoring me throughout my MPH program, thank you! I look forward to these next couple years working with you during my PhD program.

Finally, I am incredibly blessed to have the constant support of my family and friends during my academic career. Thank you for your patience and understanding, especially during long periods

of no phone calls or visits. Thank you for allowing me to enjoy my breaks with you and always finding a way to make me laugh.

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## Introduction

The U.S. Secretary of the Department of Health and Human Services (HHS) declared the current opioid epidemic a public health emergency (Department of Health and Human Services [HHS], 2017a). In 2016, more than 11 million people abused prescription opioids (synthetic pain relievers) (CDC, 2018b) and approximately 116 people die each day from an opioid-related drug overdose (HHS, 2017b). Prescription opioids such as oxycodone, hydrocodone, and methadone reportedly caused four times more deaths in 2016 compared to 1999 (CDC, 2018c); this does not reflect the use of illicit opioids like heroin. These increases in opioid abuse and death are related to several public health concerns derived from the opioid epidemic.

## Background and Significance

### Public Health Concern – Increase of Heroin Usage

The opioid epidemic has led to a chain reaction of public health concerns, costing the U.S. 56 million dollars in annual societal costs (Rossiter et al., 2014). One of the concerns has been the increased number of new heroin users (CDC, 2018a). Among new heroin users, 75% reported the use of prescription opioids before trying heroin (CDC, 2018a). It is common for prescription opioid users to advance to heroin use (Cicero et al., 2014; Lankenau et al., 2012; Mars et al., 2014; Peavy et al., 2012) because of its accessibility, affordability, pain relieving, and euphoric affects (Cicero et al., 2012; Cicero et al., 2014; Lankenau et al., 2012; Library of Congress, 2014; Mars et al., 2014). In 2016, HHS reported 170,000 people used heroin for the first time and 948,000 people were currently using heroin. In addition, there were 15,469 deaths attributed to overdosing on heroin alone (HHS, 2017b).

### Public Health Concern – Increase of Injection Drug Abuse

The number of IDUs have increased consequential to the abuse of opioids and heroin. IDUs report that injection of heroin is easier as opposed to the complex break down and extraction of prescription opioids (Cicero et al., 2014). Injection of drugs, as opposed to ingestion or inhalation, is the most dangerous route of drug administration. It may lead to injection-related endocarditis, increased risk for overdose, emergency department visits, mortality, and infectious disease transmission (Black et al., 2013; Havens et al., 2007). According to Jones, Christensen and Gladden (2017) injection drug abuse increased from 11.7% to 18.1% between 2004 and 2013. As injection drug abuse increases, we can expect the number of IDUs who do not inject safely (i.e. the reusing and sharing of syringes and injection equipment) to increase simultaneously (CDC, 2018d; Strenski, 2000).

**Public Health Concern – Increase of HIV/ HCV Transmission**

There are many injuries associated with injection drug use; however, the transmission of blood-borne viruses, such as HIV and HCV, can have catastrophic results. From 2011 to 2015, new HCV infections had doubled and approximately 6% of new HIV diagnoses were attributed to injection drug use (CDC, 2018d). According to the CDC (1998), injection drug use was the second leading cause of HIV infection (Marx et al., 2001) and continues to be one of the top methods of HIV transmission within the U.S. (CDC, 2018d). This is attributed to the reuse and sharing of injection equipment (Strenski, 2000). Sterile syringes are meant to be used one time and then disposed of; however, obtaining sterile syringes and injection equipment may be difficult for IDUs (Aldrich, 1993).

**Syringe Exchange Programs and Public Health Benefits**

One of the proposed solutions to address these public health concerns are SEPs. SEPs offer sterile injection equipment and social services without judgement and free of charge. During the wake of the HIV pandemic in the 1980's, distributing sterile syringes to IDUs was controversial because a prescription was required (Aldrich, 1993). Anyone caught distributing sterile syringes including public health professionals were arrested because authorities believed they were enabling the use of illicit drugs (Aldrich, 1993). Today, IDUs may attempt to purchase sterile syringes, but may be denied their purchase due to their appearance (Trac-B client, personal communication, September 2017). Many IDUs report living in a low-SES area or are homeless, therefore it is difficult for them to maintain their hygiene and appearances (Trac-B client, personal communication, September 2017). Although a prescription is no longer required to purchase syringes, access to sterile syringes continues to be problematic for IDUs resulting in the reuse and sharing of injection equipment (Strenski, 2000).

One of the consequences of sharing syringes is that HIV can survive in a syringe up to 42 days depending on temperature and other factors (CDC, 2018d). One study found that a single syringe is used an average of 10.7 times by an IDU (Rich, Strong, Towe, & Mckenzie, 1999), making their risk for HIV/HCV infection considerably high. Studies have shown SEPs may decrease rates of HIV drug risk behavior and may prevent HIV/HCV transmission (Aldrich, 1993). In addition, SEPs are cost-effective, costing less than $100,000 as compared to the lifetime cost of treating one HIV-infected individual, which may be as high as $379,668 (Aldrich, 1993; CDC, 2017a).

**Nevada & the Opioid Epidemic**

Not all states within the U.S. are affected by the opioid epidemic equally. Currently, 2.9 million people reside in the state of Nevada and 75% of Nevada residents (2.5 million people) live in Clark County (Southern Nevada) (U.S. Census Bureau, 2018a). According to Nevada's Prescription Drug Monitoring Program (PDMP), approximately 2.5 million opioid prescriptions were administered in 2016 (Nevada Division of Public and Behavioral Health, 2017). This is equivalent to having one opioid prescription for each adult and child who reside in Clark County.

Nevada has one of the highest rates for opioid prescriptions per capita (CDC, 2017b) and Nevada was one of the top five states for HIV diagnoses rates among adults and adolescents in 2016 (CDC, 2018d). HIV outbreaks are recurring; the most recent HIV outbreak included 11 cases involving injection drug abuse (CDC, 2018d). With the current prescription rate in Nevada and the number of heroin and injection drug users on the rise, an HIV or HCV outbreak may be inevitable without intervention.

**Trac-B-Exchange**

As of February 2017, Trac-B-Exchange (Trac-B) became Clark County's first SEP. Trac-B is also the first SEP in the U.S. to distribute syringe kits through vending machines. Trac-B distributes sterile needles, injection equipment (i.e. tourniquets, water, cookers, etc.), safe sex kits, Naloxone kits (overdose reversal drug), and offers various services. These services include HIV/HCV testing, referrals to treatment facilities, safe injection education, how to administer Naloxone appropriately, and promote used syringe disposal. There are currently three vending machine locations in Clark County as well as the storefront location. These vending machines increase access of sterile equipment, supply a greater number of IDUs, and provide a safe place to dispose of used syringes. In addition, before the distribution of any equipment or services are given to an IDU, the completion of specific forms is mandatory. This provides valuable information about a poorly understood population within Southern Nevada.

**Previous Investigations in Nevada**

There have been few population-based studies investigating the clinical and socio-demographic data associated to opioid use (Feng et al., 2016; Frank, 2000)", particularly in Nevada. One recent Nevada study was conducted by Feng et al. (2016) in Clark County. They retrieved CHIA data from 2011 to 2013 and analyzed opioid-related injuries under ICD-9-CM codes. Since October 2015, ICD-10-CM codes have been gradually implemented into healthcare settings and have increased opioid-related diagnoses from 20 to 100 codes (Moore, 2017). Since this change, it was reported that opioid-related hospitalizations had increased 18.3% within the first quarter of ICD-10-CM implementation (Moore, 2017). The modification to ICD-10-CM codes has increased the number of inpatient (IP) visits and increased the overall cost of opioid-related hospitalizations, therefore adding to the cost burden of the opioid epidemic. The data presented on Nevada's Opioid Dashboard (2016), presents emergency department and IP admissions only and does not account for those who use illicit opioids. Since the opening of Clark County's first SEP, we now have the tools necessary to research a poorly understood population within Southern Nevada.

## Research Questions

Given the lack of clinical and socio-demographic population-based studies associated with opioid use in Nevada (Feng et al., 2016; Frank, 2000); this study supplements current knowledge and provides an updated analysis of opioid-related injuries from a clinical perspective. In addition, there have been no recent investigations to our knowledge on the socio-demographic subgroups and injection drug practices of IDUs within Clark County; therefore, this study expands our knowledge on a poorly understood population. The following questions were investigated: What are the frequent comorbidities and costs associated with opioid-related inpatient hospital stays in Nevada? What are the socio-demographic subgroups and drug injection patterns of intravenous drug users within Clark County? Is there a difference in socioeconomic status (SES) between those who are hospitalized for opioid-related injuries compared to IDUs who use Trac-B?

## Hypotheses

My study provides an updated analysis of opioid-related hospitalizations within the state of Nevada, and provides a first-time analysis of the IDU population within Clark County using data from a local SEP. By analyzing 2017 CHIA data, the correlation between the total number of comorbidities associated with opioid-related injuries and cost was determined. The socio-demographic subgroups for both CHIA and Trac-B data; and the drug injection practices of the IDU population within Clark County was analyzed. Lastly, the geographical patterns among those who use hospitals and those who use SEPs was determined.

## Objective 1

To determine the frequent comorbidities and cost-associated with IP opioid-related injuries.

**Objective 2**

To determine the socio-demographic subgroups and drug injection practices of the IDU population within Clark County.

**Objective 3**

To determine if there is a difference in geographical patterns based on income among those who use hospitals and those who use SEPs.

**Hypotheses**

To answer the research question, the following hypotheses will be tested.

**Hypothesis 1**

$H_o$: Increasing costs will not be positively associated with the total number of comorbidities.

$H_a$: Increasing costs will be positively associated with the total number of comorbidities.

Prediction: The number of comorbidities will be positively correlated with higher costs.

**Hypothesis 2**

$H_o$: There will be no difference in socio-demographic subgroups of those who use hospitals and those who use SEPs.

$H_a$: There will be a difference in socio-demographic subgroups of those who use hospitals and those who use SEPs.

Prediction: There will be a difference in socio-demographic subgroups of those who use hospitals and those who use SEPs.

**Hypothesis 3**

$H_o$: There will be no difference in geographical patterns based on income among those who use hospitals and those who use SEPS.

$H_a$: There will be a difference in geographical patterns based on income among those who use hospitals and those who use SEPs.

Prediction: A higher frequency of IDUs will be seen in zip codes of higher need and a higher frequency of opioid-related hospitalizations will be seen in zip codes of lower need.

## Methods

This is a cross-sectional, population-based study that used hospitalization data from CHIA and IDU data from Trac-B. CHIA includes patient billing discharge data from all hospitals and ambulatory surgical centers licensed to operate in Nevada. ICD-10-CM diagnoses codes that include any variation of opioid abuse or dependency (see Appendix A for ICD-10-CM diagnoses codes) were used to measure the frequency of opioid-related hospitalizations from the CHIA database, identified as having an appropriate ICD-10-CM diagnosis in one of the primary, secondary, or tertiary diagnosis variables. Client information from Trac-B's database is self-reported and all registered participants were considered IDUs.

### Study Sample

The study sample included 9,064 opioid-related hospitalizations provided by the 2017 CHIA database and 1,252 clients (IDUs) who registered at Trac-B from February 2017 to February 2018.

### Statistical Analysis

All data were analyzed using IBM SPSS Statistics 24.0 software. The first hypothesis was tested by examining total costs as a function of number of comorbid conditions associated with opioid-related injuries using a Spearman-rank correlation. In addition, total costs as a function of length of stay (LOS) of opioid-related hospitalizations was investigated using Spearman-rank correlation.

The second hypothesis involved the analysis of frequencies for each demographic variable of interest in both CHIA and Trac-B datasets using contingency tables and chi-square statistics. The variables assessed from both CHIA and Trac-B, included age, gender, and race/ethnicity. In addition, analyses included variables available in Trac-B data only, including drugs injected, frequency of injection per day, sharing characteristics, and Naloxone distribution.

Finally, for the third hypothesis, a Geographical Information System (GIS; ArcMap 10.3.1, ESRI) map was generated to indicate the SocioNeeds index of each Clark County zip code. This index is calculated nationwide and ranks each zip code within the U.S. from zero to 100 (Healthy Southern Nevada: SocioNeeds Index, 2018). The SocioNeeds Index (2018) takes into account SES factors, such as, poverty level and education and then assigns an index number to the zip code area. An index of 100 indicates areas of high need and correlates with high rates of preventable hospitalizations and premature death. An index approaching zero, indicates areas of low need and low rates of preventable hospitalizations and premature death. An index of 50 would indicate the national average. This index was used to determine each SocioNeeds rank of each zip code within Clark County, as well as, generate maps to indicate the frequency of opioid-related hospitalizations and injection drug usage within Clark County.

**Ethical Considerations**

This project has been approved by the UNLV Office of Research Integrity for Exempt IRB approval for secondary analysis of de-identified data (Appendix C). Additionally, the Data Use Agreement between CHIA and the School of Community Health Sciences (SCHS) was approved by the State (Nevada Division of Health Care Financing and Policy).

## Results

According to 2017 CHIA data, there was a total of 9,064 opioid-related inpatient cases. Of the 9,064 opioid-related cases, 5,268 were Clark County residents. Within Trac-B's first year of opening, 1,252 IDUs became registered clients.

### Cost Analysis & the Number of Comorbidities

Using 2017 CHIA data, opioid-related hospitalizations were first isolated. Next, comorbidities associated with opioid-related injuries were grouped by comorbidity category and ranked by frequency (Table 1).

**Table 1. Top 10 Comorbidity Categories Associated with Opioid-Related Hospitalizations**

| Rank | ICD-10 Codes | Comorbidity Categories | Frequency |
|---|---|---|---|
| 1 | A00-B99 | Certain infectious and parasitic diseases* | 41356 |
| 2 | C00-D49 | Neoplasms | 15206 |
| 3 | F01-F99 | Mental, Behavioral and Neurodevelopmental disorders* | 11802 |
| 4 | E00-E89 | Endocrine, nutritional and metabolic diseases | 5761 |
| 5 | D50-D89 | Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | 4603 |
| 6 | I00-I99 | Diseases of the circulatory system | 2659 |
| 7 | G00-G99 | Diseases of the nervous system | 2618 |
| 8 | S00-T88 | Injury, poisoning and certain other consequences of external causes | 1288 |
| 9 | M00-M99 | Diseases of the musculoskeletal system and connective tissue | 1129 |
| 10 | K00-K95 | Diseases of the digestive system | 1074 |

*Breakdowns of the comorbidity categories: certain infectious and parasitic diseases; and mental, behavioral and neurodevelopmental disorders are in appendix B.

It was determined the categories of highest frequency of comorbidities associated to opioid-related hospitalizations included: certain infectious and parasitic diseases; neoplasms; mental, behavioral and neurodevelopmental disorders; Endocrine, nutritional and metabolic diseases; and diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism.

Cost analysis was conducted by taking “Total Charge” of the comorbidity categories listed in Table 1 and the “Total Number of Comorbidities.” It should be noted that data are not cost-equalized among participating hospitals in the data. Spearman-rank correlation suggested increasing costs was positively associated with the total number of comorbidities listed in Table 1 (Spearman rho value = 0.046, p <0.0001), but the magnitude of the effect was small. This indicates the correlation between “Total Charge” and the “Total Number of Comorbidities” is most likely not useful.

Because there were several ICD-10 codes within each comorbidity category, the top 10 specific ICD-10 codes associated with opioid-related injuries were identified and ranked by frequency (Table 2).

**Table 2. Top 10 Comorbidity Specific ICD-10 Codes Associated to Opioid-Related Hospitalizations**

| Rank | ICD-10 Codes | Comorbidity Specific Category | Frequency |
|---|---|---|---|
| 1 | G8929/G894/M549 | Chronic Bodily Pains | 4549 |
| 2 | E785/E876/E871/E860 | Malnutrition | 4288 |
| 3 | F17210/F17200/Z87891 | Nicotine Dependence | 4050 |
| 4 | F419/F329 | Affective Disorder | 2939 |
| 5 | I10 | Hypertension | 2607 |
| 6 | K219 | Gastro-Esophageal Reflux Disease | 1204 |
| 7 | N179 | Acute Kidney Failure | 983 |
| 8 | J449 | Chronic Obstructive Pulmonary Disease (COPD) | 901 |
| 9 | R45851 | Suicidal Ideations | 900 |
| 10 | D649 | Anemia | 772 |

The ICD-10 codes of highest frequency for comorbidities associated with opioid-related hospitalizations included: chronic bodily pains, malnutrition, nicotine dependence, affective disorder, and hypertension (Table 2). The specific ICD-10 code comorbidity categories in Table 2 were different from Table 1; therefore, a repeated cost analysis was performed for Table 2. Cost analysis was conducted by taking “Total Charge” and the “Total Number of ICD-10 Codes” listed in Table 2. Spearman-rank correlation suggested increasing costs was positively associated with the total number of ICD-10 Codes listed in Table 2 (Spearman rho value = 0.036, $p < 0.0001$); however, the magnitude of the effect was small. This indicates the correlation between “Total Charge” and the “Total Number of ICD-10 Codes” may not be useful.

**Cost Analysis & the Length of Stay**

To further analyze the “Total Charge”, analysis of the “LOS” from the comorbidity categories listed in Table 1 indicated there was no correlation (Spearman rho = 0.008, $p = 0.46$); however, this value was not statistically significant. This process was repeated using the ICD-10 codes listed in Table 2, which showed a positive correlation between “LOS” and “Total Charge” for specific ICD-10 codes (Spearman rho = 0.378, $p < 0.0001$). The Spearman rank value indicates there is a positive correlation between “Total Charge” and “LOS” when analyzing specific ICD-10 codes (Table 2).

**Socio-demographic Subgroups**

**Age Groups** – Cross tabulations among each age group between CHIA hospitalizations and Trac-B clients indicated there was no significant difference in the proportion of those 17 years or younger (Table 3).

**Table 3. CHIA 2017 IP & Trac-B 2017 IDU Population Demographics***

| Characteristics | CHIA n (%) | Trac-B n (%) | Test Statistic | Significance |
|---|---|---|---|---|
| **Age (years)** | n = 9064 | n = 1252 | | |
| ≤ 17 | 90 (1.0) | 16 (1.3) | | |
| 18-35 | 2937 (32.4) | 586 (46.8) | | CHIA < Trac-B |
| 36-64 | 4488 (49.5) | 446 (35.6) | $x^2 = 122.3$ | CHIA > Trac-B |
| ≥ 65 | 1549 (17.1) | 169 (13.5) | $p < .001$ | CHIA > Trac-B |
| No Response | -- | 35 (2.8) | | |
| **Gender** | | | | |
| Female | 4575 (50.5) | 428 (34.2) | z = 32.7 | % Female: |
| Male | 4489 (49.5) | 796 (63.6) | $p < .001$ | CHIA>Trac-B |
| Female to Male | -- | 1 (0.1) | | % Male: |
| Male to Female | -- | 2 (0.2) | | CHIA < Trac-B |
| No Response | -- | 25 (2.0) | | |
| **Race/Ethnicity** | | | | |
| White/Caucasian | 6670 (73.6) | 928 (74.1) | | |
| Black/African American | 926 (10.2) | 22 (1.8) | $x^2 = 238.05$ | |
| Asian/Pacific Islander | 92 (1.0) | 13 (1.0) | $p < .001$ | |
| Native American/Alaskan | 108 (1.2) | 30 (2.4) | | |
| Other | 496 (5.5) | 186 (14.8) | | |
| No Response | -- | 73 (5.9) | | |
| Unknown | 246 (2.7) | -- | | |
| Hispanic | 526 (5.8) | -- | | |
| **Hispanic/Latino** | | | | |
| Yes | | 192 (15.3) | | |
| No | | 908 (72.5) | | |
| No Response | | 152 (12.2) | | |

*Trac-B data includes data from February 2017 through February 2018.

There was a significant difference between CHIA and Trac-B samples among all other age groups ($x^2 = 122.33$, $p < 0.001$). There was a higher proportion of those in the age group 18-35 years, who used SEPs as compared to the 18-35 year olds who used hospitals (Table 3). There was a higher proportion of those who were 36 years old or older, who used hospitals as compared to those in the same age group who used SEPs (Table 3).

**Gender** – There appears to be an association between those who use hospitals versus SEPs and gender ($z = 32.7$, $p < 0.001$) (Table 3). There were significantly more females who used hospitals as opposed to females who used SEPs. On the contrary, there were significantly more males who used SEPs as opposed to males who used hospitals.

**Race & Ethnicity** – There was a significant difference in the proportion of those who are of Black/African American race/ethnicity, who used hospitals as compared to the Black/African Americans who used SEPs (Table 3). There was a significant difference in the proportion of those who are of Native American/Alaskan race/ethnicity, who used SEPs as compared to Native American/Alaskans who used hospitals (Table 3). In addition, the proportion of those who are of Other race/ethnicity was significantly different from those who used SEPs as compared to Other race/ethnicity who used hospitals (Table 3). There were no significant differences between the White/Caucasian race/ethnicity groups among CHIA and Trac-B data.

**Trac-B Injection Demographics**

There was a high percentage of IDUs who reported injecting heroin, followed by methamphetamines, and speedball (Table 4).

**Table 4. First Year Trac-B-Exchange Drug Preference of IDU Population**

| Drugs Used* | Yes n (%) | No n (%) |
|---|---|---|
| Heroin | 889 (71.0) | 363 (29.0) |
| Methamphetamines | 767 (61.3) | 485 (38.7) |
| Speedball[1] | 342 (27.3) | 910 (72.7) |
| Cocaine | 139 (11.1) | 1113 (88.9) |
| Opioids | 179 (14.3) | 1073 (85.7) |
| Steroids[1] | 45 (3.6) | 1207 (96.4) |
| Hormones[1] | 19 (1.5) | 1233 (98.5) |

*Data does not reflect if the Trac-B client marked multiple drugs on one survey.

1. Speedball is a mixture of heroin and cocaine, steroids and hormones may be injected illegally by the transgender population

The majority of IDUs reported injecting four to 10 times per day, followed by 0-3 times per day, and a low rate of IDUs reported injecting greater than 10 times per day (Table 5).

**Table 5. First Year Trac-B-Exchange Injection Patterns of IDU Population**

| Injection Times per Day | n (%) = 1252 (100) |
|---|---|
| 0 – 3 times | 463 (37.0) |
| 4 to 10 times | 540 (43.1) |
| >10 times | 51 (4.1) |
| Rarely[1] | 57 (4.6) |
| Other Response* | 10 (0.8) |
| No Response | 131 (10.5) |

*Other Response = answers that were difficult to place in an Injection category.

1.Rarely = may inject 5 times per week or month

Of the IDUs who participated in Trac-B's program, many reported to have shared drugs, have shared injection equipment, and have shared needles (Table 6).

**Table 6. First Year Trac-B-Exchange Sharing Characteristics of IDU Population**

| Sharing Characteristics<br>n = 1252 | Yes<br>n (%) | I have in the past<br>n (%) | No<br>n (%) | No Response<br>n (%) |
|---|---|---|---|---|
| Share Drugs | 671 (53.6) | -- | 540 (43.1) | 41 (3.3) |
| Sharing Equipment | 332 (26.4) | -- | 853 (68.1) | 67 (5.4) |
| Sharing Needles | 162 (12.9) | 4 (0.4) | 1038 (82.9) | 48 (3.8) |

Trac-B data indicated 421 Narcan/Naloxone kits were distributed; however, this includes initial kits and refills. The data reflects clients who may have received multiple kits within the past year. Most of the Narcan/Naloxone kits were given to those who were between the ages of 18 to 34 years (Table 7).

**Table 7. Trac-B-Exchange Naloxone Kit Distribution by Age & Gender of IDU Population**

| Characteristic | Mean Age | Median Age | Mode Age | (Min, Max) Age | n (%) |
|---|---|---|---|---|---|
| **Age (years)** | 34.93 | 33.00 | 27.00 | (11, 67) | **n=421 (100)** |
| ≤ 17 | | | | | 1 (0.2) |
| 18-34 | | | | | 229 (54.4) |
| 35-52 | | | | | 135 (32.1) |
| 53-71 | | | | | 40 (9.5) |
| 72-88 | | | | | 0 (0.0) |
| No Response | | | | | 16 (3.8) |
| **Gender** | | | | | |
| Female | | | | | 136 (32.3) |
| Male | | | | | 194 (46.1) |
| Female to Male | | | | | 0 (0.0) |
| Male to Female | | | | | 2 (0.5) |
| Other | | | | | 1 (0.2) |
| No Response | | | | | 88 (20.9) |

Males were more likely to request Narcan/Naloxone kits compared to other gender groups.

## Geographical Patterns Based on Income

The SocioNeeds Index ranks each zip code within the U.S. from 0-100; however, for this study it was modified to five ranks for simplicity (1 = area of low need, 5 = area of high need) (Figure 1).

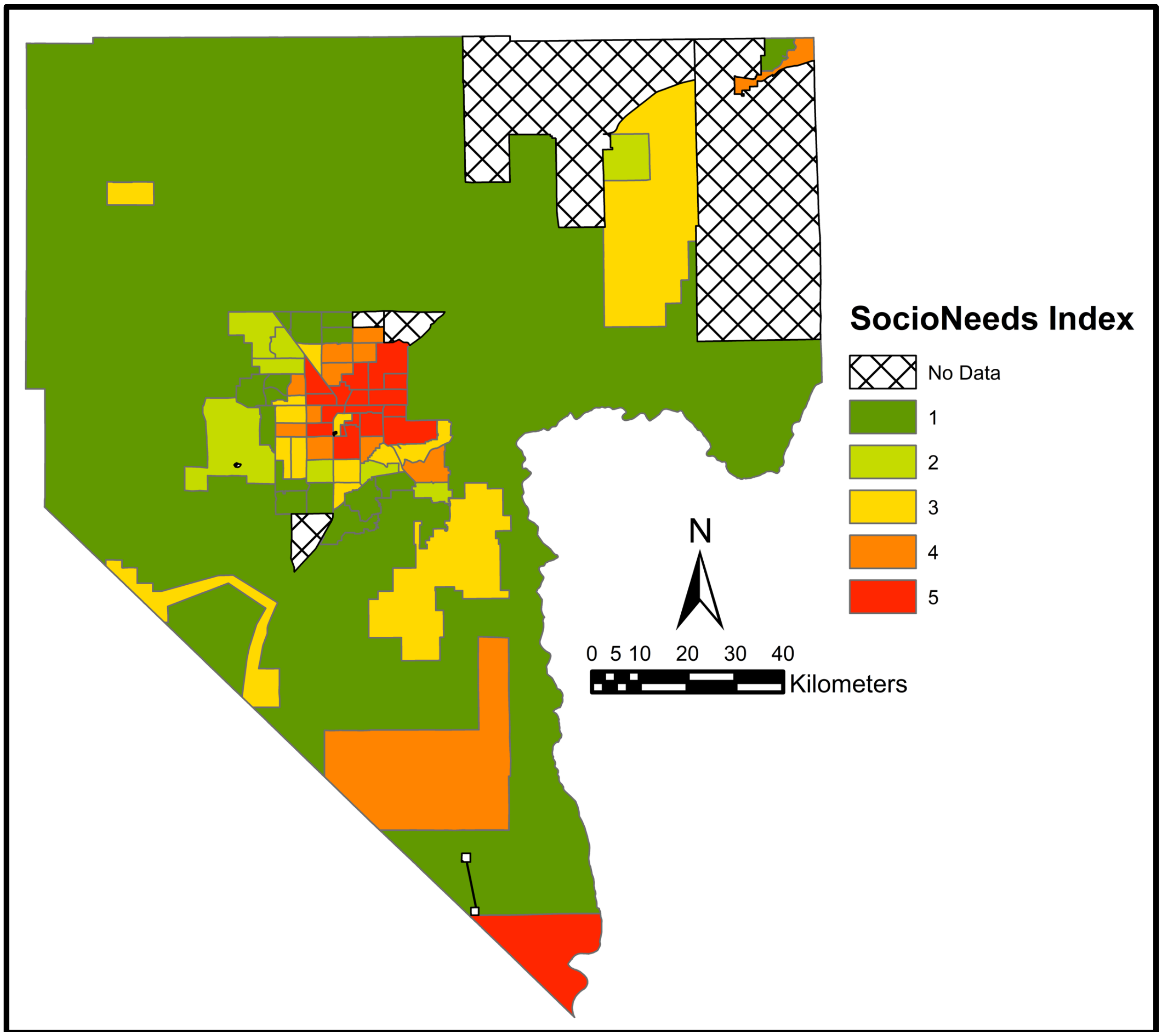

Figure 1. Clark County zip codes by SocioNeeds Index

Many zip codes within the center of Clark County (red regions) are areas of high need, which indicates a high rate of poor health outcomes. As the map branches out from the center of Clark County, more urban areas are designated by the color green, indicating areas of low need or low rates of poor health outcomes (Figure 1).

**Homelessness**

The SocioNeeds Index does not include those who may be transient or of homeless status. CHIA data do not provide this information directly; however, CHIA data do provide a code, Payer 23, which indicates County Indigent Referral. Those who claim Payer 23 are unable to pay for their hospital care and may have alternative ways to pay for their medical expenses or they may be transient. In 2017, 169 (1.86%) opioid-related cases reported Payer 23, which likely captures the transient population in the database.

Trac-B's data directly provides homelessness status because of the required registration forms that are mandatory before equipment are dispersed. Based on self-reported data, 378 (30.2%) of Trac-B's clientele reported homelessness status.

**Cases by Zip Code**

Using Clark County zip code maps, frequencies of CHIA opioid-related cases were color-coded within each zip code (Figure 2).

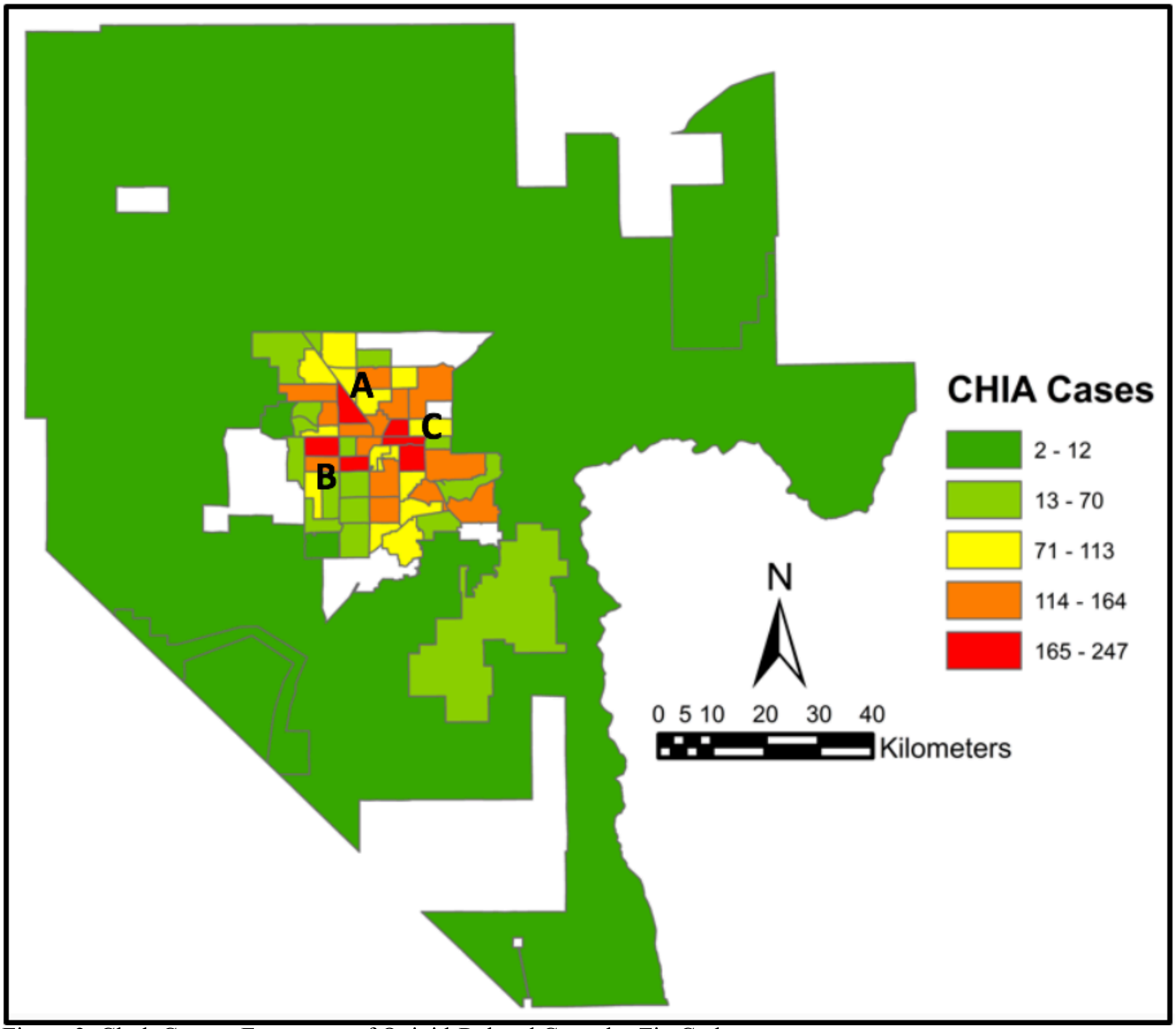

Figure 2. Clark County Frequency of Opioid-Related Cases by Zip Code.

The zip codes that are red, indicate where opioid-related injuries were highest for 2017. The red area near the letter A, is zip code 89108, which is known for section 8 housing and borders an area known for high crime. The red areas near letters B and C, indicate zip codes close to medical facilities (B – Spring Valley Hospital; C – UMC Hospital). The majority of the red areas on Figure 2, associate with a high SocioNeeds index.

Trac-B clientele revealed only two zip codes with a high frequency of injection drug use (Figure 3).

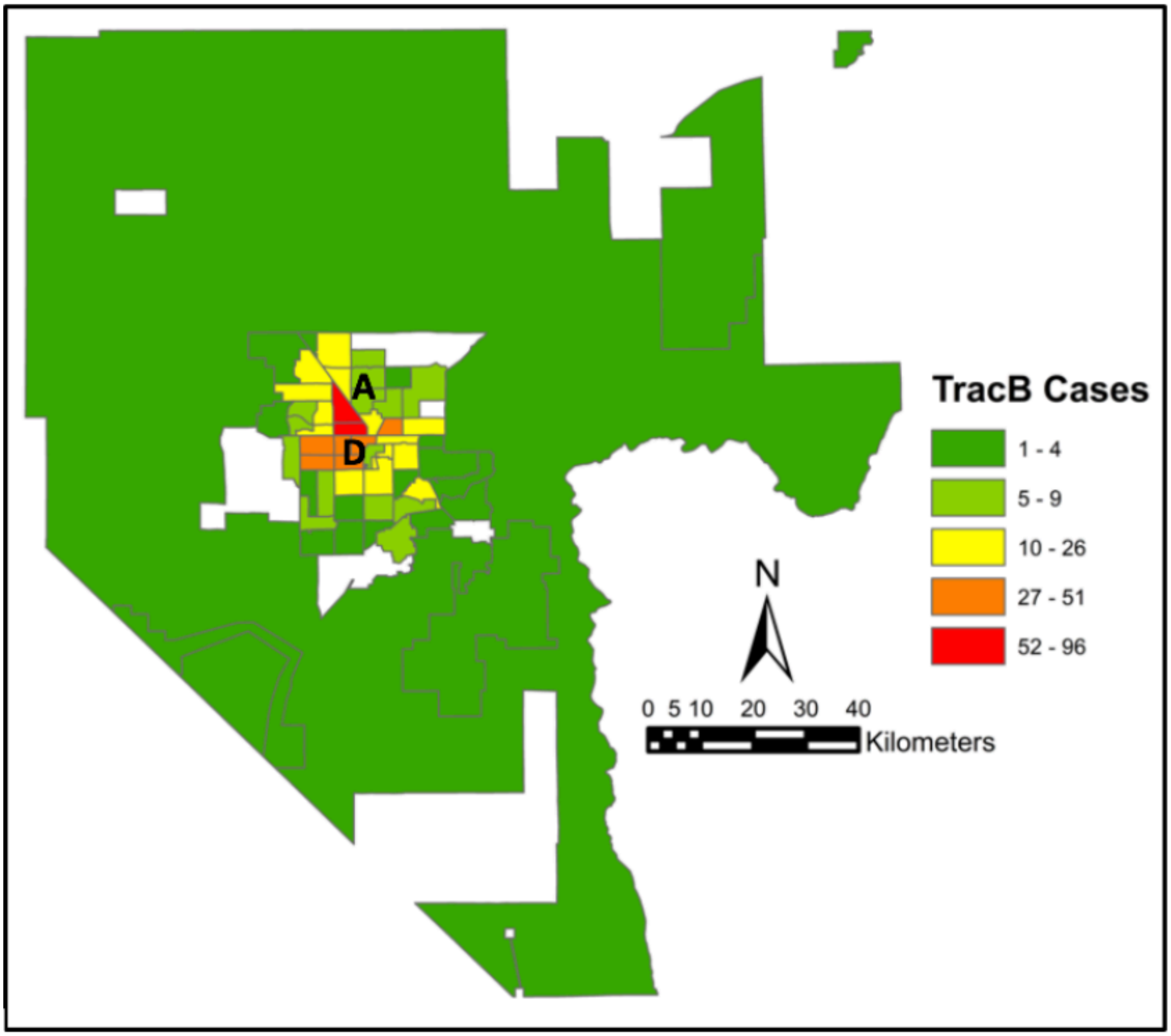

Figure 3. Clark County Frequency of Intravenous Drug Users by Zip Code

The red area near A (Figure 3) is zip code 89108 and is a common zip code for a high frequency of opioid-related hospitalizations seen in Figure 2. The red area near D (Figure 3) is the zip code 89107 and borders the street that Trac-B's storefront is located. Because 30.2% of Trac-B's clientele reported homelessness, we can expect the majority of clients to travel by foot or bike because of their close residence to Trac-B. There were no other shared zip codes in terms of high frequencies for hospitalizations and injection drug use.

There were six total zip codes within Clark County to have a high frequency of opioid-related hospitalizations and two zip codes within Clark County to have a high frequency of injection drug use. The zip code 89108, demonstrated both a high frequency of opioid-related hospitalizations and injection drug use; in addition, it is an area of high need according to the SocioNeeds Index (Figure 1).

## Discussion

In 2017, there were 9,064 opioid-related hospitalizations (ORH) in Nevada State, of these 5,268 occurred within Clark County. This is an increase compared to Feng et al.'s (2016) Clark County study, where they found 5,016 ORHs within a 3-year time frame from 2011-2013. This increase in ORHs could be the result of Nevada's high prescription rate, contributing to the opioid epidemic, or a result of differences in codes used for data extraction under ICD-10 as discussed below.

This study revealed that 58% (n=5,268) of ORH's occurred in Clark County in 2017, which is surprisingly low considering 75% of Nevada residents live in Clark County (U.S. Census Bureau, 2018a). The remainder 42% of ORHs that occurred in 2017 happened in less populated areas of Nevada. Aside from Clark County (population = 2.2 million) (U.S. Census Bureau, 2018b) and Washoe County (population = 460,587) (U.S. Census Bureau, 2018c), all other counties within Nevada do not exceed a population of 54,745 residents, with Esmeralda County having the lowest population of 850 residents (U.S. Census Bureau, 2018d). This may be evidence that many of the ORHs could be occurring in more rural areas of Nevada or medical facilities within these areas are capturing more ORHs.

### *Comorbidities Associated to Opioid-Related Hospitalizations*

When investigating comorbidities associated with ORHs, many of the comorbidities with high frequencies were consistent with Feng et al.'s (2016) study; such as: chronic bodily pains, affective disorders, hypertension, renal failure, and chronic lower respiratory disease. When looking at the number of cases for chronic bodily pains, Feng et al. (2016) found 2,253 cases between 2011 and 2013; however, for 2017 there were 4,549 ORHs associated with chronic bodily pains. According to the Nevada Division of Public and Behavioral Health (2017), opioid-related hospitalizations have increased substantially since 2011 in both emergency department (ED) visits and hospitalizations; however, there may be another explanation that may account for this increase.

Moore and Barrett (2017) found within the first quarter of ICD-10-CM implementation, ORIs increased by 18.3%. Previously, under the ICD-9-CM coding system there were 20 opioid-related codes; however, under the ICD-10-CM coding system ORI's became more specified, increasing from 20 to 100 opioid-related codes. This modification allowed medical facilities to accurately diagnose ORI's compared to previous years using ICD-9-CM codes. Feng et al.'s (2016) study investigated CHIA data from 2011 to 2013; however, ICD-10-CM implementation began October 2015. It is possible that ORIs may not have been accurately diagnosed leading to a misrepresentation of the number of ORIs within the timeframe of their study. This project analyzed CHIA data from 2017 that implemented ICD-10-CM codes providing an updated analysis of ORHs within Nevada and Clark County. Having an accurate analysis of ORHs will allow Nevada public health officials to observe trends of opioid abuse and will aid in appropriate opioid-related interventions.

*Cost Analysis*

When analyzing the number of comorbidities and cost, unexpectedly there were no meaningful correlations observed. It is possible a single comorbidity may have a higher cost compared to a patient who had three comorbidities of lower value; alternatively, after examining LOS associated with cost, a potential story emerged. Using the ICD-10-CM codes listed in Table

2, a positive correlation between LOS and cost was observed; therefore, longer hospital stays accrue higher costs.

In addition, the mean cost evaluated for ORHs for 2017 (n=9,064) was estimated to be $72,632 with the mean LOS of approximately 7 days. Looking at all hospitalizations for 2017 (n=352,262), the mean cost was $74,975 with the mean LOS of 5.27 days. When comparing ORHs to all hospitalizations for 2017, the LOS was higher for ORHs. Considering that LOS is positively associated with higher cost, we can expect those hospitalized for an ORI may be accruing higher hospital costs as a function of longer stays. On the contrary, the mean cost was estimated to be lower for ORHs when compared to all hospitalizations; however, it was not meaningfully different from the mean cost of all hospitalizations. Further, costs are not universally standardized across procedures at different hospitals, which could confound the comparisons.

*Trac-B Analysis*

Analysis of Trac-B's first year of clientele, revealed that 71% of IDUs inject heroin and the average IDU injects 4-10 times per day. In addition, sharing characteristics revealed IDUs are sharing equipment and syringes; however, there was a higher percentage of those that reported sharing drugs. The question of whether an IDU shares drugs may have several interpretations. For instance, are IDUs simply giving a dose to their friend before it is cooked? Or are two IDUs putting both of their syringes into the same cooker and taking in their dose? Because 53.6% reported sharing drugs, it is possible that they are also sharing equipment, resulting in the potential for infectious disease transmission. Because these questions are based on self-reported surveys, the interpretation of this question by IDUs may be unclear; therefore, revealing areas of improvement within Trac-B's surveys. In addition, this analysis provides valuable information for the purposes of research and the services offered in their facility.

For 2017, Trac-B had successfully distributed 206,140 sterile syringes; disposed of 105,136 used syringes; and administered 130 HIV and 101 HCV tests. Of these tests, three (2.3%) positive HIV and 32 (31.7%) positive HCV tests were confirmed. Clients who tested positive were contacted by a representative from the Southern Nevada Health District and referred for treatment. The current AIDS foundation in Clark County, Aid for AIDS of Nevada (AFAN) reported administering 100 HIV tests for the year 2017 and found that two of these tests were positive (AFAN representative, personal communication, October 2018). AFAN is not specific about who they test; however, Trac-B's target population is of a high-risk group known for high rates of HIV/HCV transmission. This emphasizes the importance of Trac-B's services within the community.

Of the 206,000 sterile syringes distributed, 14,000 were dispersed through Trac-B's vending machines. The average cost of a single syringe is approximately $0.08 and each syringe is equivalent to one prevented HIV infected person, which may cost up to $379,668 for a single lifetime of HIV treatment (Aldrich, 1993; CDC, 2017a). Trac-B's innovative method of distributing syringe kits through vending machines is not only cost-effective, but allows more IDUs to access sterile injection equipment. By identifying zip codes with high frequencies for both ORHs and IDUs, Trac-B can strategically place future vending machines in these locations, increasing access to sterile injection equipment; therefore, preventing the transmission of HIV/HCV. In addition, Trac-B offers an array of services to IDUs, proving to be a public health asset to the state of Nevada by filling in the gap between a high-risk population in need and access to health care.

Currently, Trac-B is grant funded and most SEPs in the U.S. are not federally funded (Jarlais, McKnight, & Milliken, 2004). Many are funded through foundation grants and/or private donations (Jarlais, McKnight, & Milliken, 2004). SEPs are experiencing a financial crisis due to the ban on federal funding, in addition HIV prevention funds have been reallocated away from IDU transmission (Guardino, Des Jarlais, Nugent & Purchase, 2014). This federal ban was one of the contributing factors for the 2015 HIV outbreak that occurred in Scott County, Indiana (Rich & Adashi, 2015). There were approximately 153 confirmed HIV cases that were the result of syringe sharing in this low-income community (Rich & Adashi, 2015). Many researchers suggest this preventable incident will happen again, as long as SEPs remain illegal in many states (Rich & Adashi, 2015). In fact, SEPs have been controversial since the wake of their development during the HIV pandemic in the 1980's.

The controversy behind the legalization of SEPs was argued by many public officials believing SEPs would promote and exacerbate the injection of drugs, as well as increase the incidence of HIV cases (Rich & Adashi, 2015). However, decades of research investigations demonstrate that SEPs are safe and effective at reducing disease transmission and promoting referral to treatment facilities (Rich & Adashi, 2015). One study found that SEPs had increased in quantity from 60 SEPs within the U.S. in 1994 to approximately 127 in 2000 (Jarlais, McKnight, & Milliken, 2004), indicating the increased acceptance of SEPs within communities and the role they play in HIV prevention. However, as previously mentioned many states refuse to legalize SEPs, despite decades of research demonstrating SEP effectiveness.

The cost-efficiency of SEPs (less than $100,000 annually) versus the overall opioid epidemic cost burden of 504 billion dollars is incomparable (HHS, 2017b). The first-year analysis of Trac-B's data has proven to be an effective intervention on combating the public health concerns resulting from the current opioid epidemic. Given the information derived from this study, it is evident that SEPs provide one potential solution or a gateway to addressing many public health concerns resulting from the opioid epidemic.

*Socio-Demographic Subgroups*

Analysis of the socio-demographic subgroups demonstrated that a higher proportion of 18-35 year olds used SEPs as compared to 18-35 year olds who were admitted into hospitals for ORIs. In addition, there was a higher proportion of males registered as clients at Trac-B as opposed to the proportion of males who were hospitalized for ORIs. This is consistent with the literature showing that most IDUs are men of younger age groups (Cicero et al., 2014). On the other hand, there was a higher proportion of those 36 years of age or older who were admitted for ORH compared to those in the same age group who used Trac-B's services, a similarity seen in Feng et al.'s (2016) study. By having a younger age group use Trac-B for its services, there may be an associated reduction in future hospitalizations when these 18-35 year olds reach the older age groups of 36 years and above.

In addition, there was a higher proportion of females who were admitted in 2017 for ORIs compared to females who registered as clients at Trac-B providing a consistent trend of what was seen in Feng et al.'s (2016) study. A higher proportion of ORHs were among females, aged 55 years and older. These results demonstrate that gender specific interventions are necessary to battle prescription opioid abuse as well as injection drug abuse.

*SocioNeeds Index*

Density maps identified zip code 89108 as having high rates for both ORHs and IDUs for 2017. In addition, the SocioNeeds index map determined that 89108 is an area of high need or low-SES. This implies zip code 89108 as being an area of high priority for intervention regarding the adverse outcomes of the opioid epidemic. All factors associated to low-SES may be contributing factors to the high rates of ORHs and intravenous drug use. Currently, 89108 has a population of 76,236 residents (Healthy Southern Nevada, 2018), is known to have section-eight housing, and borders a North Las Vegas community known for high crime rates. In 2017, 247

ORHs and 96 IDUs reported this area as their zip code of residence. It is evident that interventions need to be targeted in this area, specifically addressing the contributing factors of prescription opioid abuse and the injection of illicit opioids in low-SES communities.

*CHIA zip code areas*

Five out of the six zip codes that demonstrated a high frequency for ORHs were areas with a high SocioNeeds Index. The sixth zip code (Figure 2 – red area above the letter B) had a SocioNeeds Index that was average to the nation – meaning it's a typical middle class community that demonstrated high rates for ORHs. When combating the effects of the opioid epidemic, interventions may not be a one-size fits all solution. Interventions among different SocioNeeds Index communities may require tailored programs to address the specific needs of the population. In addition, studies identifying what is driving ORHs in this middle-class community as opposed to the higher need areas is suggested.

*Trac-B zip code areas*

There were only two zip codes within Clark County to demonstrate high frequencies for IDUs: 89108 (previously discussed) and 89107. The zip code 89107 (population = 37,908) is located directly below 89108, is an area of high need, and borders the street where Trac-B's storefront is located. Considering 30.2% of Trac-B's clientele reported homelessness, this could explain the close-proximity of IDUs in 89108 and 89107. We would expect many of these clients to be walking, riding their bikes, or using another form of transportation associated to close-proximity to Trac-B. This is an important factor to consider when determining the location of a potential SEP storefront location or when distributing new vending machines.

*National Policy on Prescription Opioids*

Currently, the regulation of prescription opioids is the responsibility of the states, meaning there are no national laws in the regulation of prescription opioids (CDC, 2018e).

However, a CDC funded program called 'Prevention for States' was designed to provide state funding to battle the ongoing prescription drug overdose epidemic (CDC, 2017c). There are currently 29 states receiving CDC funds within the program including Nevada. The strategies of 'Prevention for States' include: maximizing Prescription Drug Monitoring Programs (PDMP), community or insurer/health systems interventions, policy evaluations, and rapid response projects (CDC, 2017c).

'Prevention for States' is fairly new and not all states are funded. Because there is little research on the effectiveness of state regulations regarding the abuse of prescription drugs (CDC, 2018f), this program may provide the necessary data to determine the impact it has on prescription drugs and overdose. In addition, because the regulation of prescription opioids are within the responsibility of the states, some states have implemented state-level policies that regulate pain clinics and PDMPs, successfully reducing their overdose rate.

States such as, Florida, New York, Tennessee, Ohio, and Kentucky (CDC, 2017d) have established PDMPs, mandating that all providers check the PDMP before prescribing opioids. Many of these states have shown reductions in the number of patients seeking multiple providers for the same drugs within two years of PDMP establishment. Florida had implemented several interventions targeting excessive opioid prescribing from pain clinics in addition to mandating PDMPs, resulting in an 80% opioid prescription decrease from 2010 to 2015 (CDC, 2017d). Within the five-year timeframe, Florida simultaneously saw a reduction in prescription opioid overdose rates (CDC, 2017d). In 2012, Florida specifically saw greater than 50% of oxycodone overdose deaths decrease, which was a direct effect of preventing health care providers from dispensing prescription opioids from their offices and having an established PDMP (CDC, 2017d). According to the CDC (2017d), this is the first substantial decrease in drug overdose mortality in the past 10 years (CDC, 2017d).

*Nevada Policy on Prescription Opioids*

As of January 1, 2018, Nevada implemented the Nevada Prescription Drug Abuse Prevention Act (Assembly Bill 474 or AB 474) to curb opioid abuse within the State (Gov.nv.gov, 2017). AB 474 mandates additional requirements before administering controlled substance prescriptions with the purpose of reducing inappropriate prescribing, and hence, preventing addiction (Gov.nv.gov, 2017). Although it does not prevent health care providers from dispensing prescription opioids from their offices like Florida, it may encourage clinicians to find an alternative form of treatment for patients. It will be interesting to see if and how the trends of ORHs have changed during 2018 and within the next five years. If this new policy decreases the opioid prescriptions per capita in Nevada, but ORHs continue to increase, this may suggest the increased abuse of illicit opioids sold on the black market. In addition, continued analysis of Trac-B's data may also contribute valuable information of changing trends of ORHs.

This epidemic has led to a chain reaction of public health concerns: addiction, heroin usage, injection drug abuse, and HIV/HCV transmission. With Nevada having one of the highest rates for opioid prescriptions per capita, it is imperative to understand trends of opioid-related hospitalizations and intravenous drug use. Only then can we implement interventions and programs to battle the opioid epidemic and the consequent public health effects.

**Limitations**

All research must be presented with appropriate caveats, and the limitations of this research are highlighted here. CHIA data were de-identified, and therefore, repeat IP admissions may have occurred. Trac-B clientele are not required to show identification upon registration. All data received from Trac-B are self-reported, which is susceptible to misclassification bias. Respondents may over- or under-report drugs they have used or how many times they inject per day. In addition, the survey data may not reflect true birth dates, gender, race/ethnicity, or zip code.

The cost analyzed in this project was not weighted by medical facility procedural multipliers; therefore, the total charges assessed may not be comparable. In addition, the population within each zip code was not adjusted, but presented in counts. This may influence the number of ORHs and/or IDUs. A large percentage (30.2%) of IDUs reported homelessness, which may skew the zip code data if populations were adjusted. However, less than 1.86% of ORHs claimed Payer 23, which may not influence the zip code data if adjustments were implemented.

Trac-B services did not start until February 2017, and hence data analyzed included one month in 2018; CHIA data analyzed included only 2017 data. Trac-B did not start distributing Naloxone kits until April 2017, and therefore this does not provide a complete year of information for Naloxone distribution. Clients who seek vending machine access cards may have more than one access card. They may have changed their name and/or birth date to receive another access card at a different location, therefore they will be counted as two different clients.

## Conclusion

This project provides the most recent analysis of data on Nevada's opioid-related hospitalizations, as well as, a first-time analysis of Clark County's IDU population. This analysis supplements current research and may serve as a baseline for future research to be done. Only a few states have implemented prescribing interventions that have demonstrated a decline in the number of patients seeking multiple providers for the same drugs. Florida is the only state to have demonstrated substantial reductions in prescription opioid overdose rates. Considering each state may have demographic differences of those who abuse prescription and illicit opioids, it will be interesting to see if AB 474 influences ORHs and IDUs in Nevada. This project provides information to support harm reduction programs like Trac-B and will hopefully open funding opportunities for Trac-B to continue their services within Clark County.

**Appendix A**

ICD-10 CM Codes for Opioid Related Disorders

1. ICD-10-CM Codes
2. F01-F99 Mental, Behavioral and Neurodevelopmental disorders
3. F10-F19 Mental and behavioral disorders due to psychoactive substance use

Opioid related disorders F11

Clinical Information

- Disorders related to resulting from abuse or mis-use of opioids.

Codes

| | |
|---|---|
| F11 | Opioid related disorders |
| F11.1 | Opioid abuse |
| F11.10 | uncomplicated |
| F11.11 | in remission |
| F11.12 | Opioid abuse with intoxication |
| F11.120 | uncomplicated |
| F11.121 | delirium |
| F11.122 | with perceptual disturbance |
| F11.129 | unspecified |
| F11.14 | with opioid-induced mood disorder |
| F11.15 | Opioid abuse with opioid-induced psychotic disorder |
| F11.150 | with delusions |
| F11.151 | with hallucinations |
| F11.159 | unspecified |
| F11.18 | Opioid abuse with other opioid-induced disorder |
| F11.181 | Opioid abuse with opioid-induced sexual dysfunction |

| | |
|---|---|
| F11.182 | Opioid abuse with opioid-induced sleep disorder |
| F11.188 | Opioid abuse with other opioid-induced disorder |
| F11.19 | with unspecified opioid-induced disorder |
| F11.2 | Opioid dependence |
| F11.20 | uncomplicated |
| F11.21 | in remission |
| F11.22 | Opioid dependence with intoxication |
| F11.220 | uncomplicated |
| F11.221 | delirium |
| F11.222 | with perceptual disturbance |
| F11.229 | unspecified |
| F11.23 | with withdrawal |
| F11.24 | with opioid-induced mood disorder |
| F11.25 | Opioid dependence with opioid-induced psychotic disorder |
| F11.250 | with delusions |
| F11.251 | with hallucinations |
| F11.259 | unspecified |
| F11.28 | Opioid dependence with other opioid-induced disorder |
| F11.281 | Opioid dependence with opioid-induced sexual dysfunction |
| F11.282 | Opioid dependence with opioid-induced sleep disorder |
| F11.288 | Opioid dependence with other opioid-induced disorder |
| F11.29 | with unspecified opioid-induced disorder |
| F11.9 | Opioid use, unspecified |
| F11.90 | uncomplicated |
| F11.92 | Opioid use, unspecified with intoxication |
| F11.920 | uncomplicated |
| F11.921 | delirium |
| F11.922 | with perceptual disturbance |

| | |
|---|---|
| F11.929 | unspecified |
| F11.93 | with withdrawal |
| F11.94 | with opioid-induced mood disorder |
| F11.95 | Opioid use, unspecified with opioid-induced psychotic disorder |
| F11.950 | with delusions |
| F11.951 | with hallucinations |
| F11.959 | unspecified |
| F11.98 | Opioid use, unspecified with other specified opioid-induced disorder |
| F11.981 | Opioid use, unspecified with opioid-induced sexual dysfunction |
| F11.982 | Opioid use, unspecified with opioid-induced sleep disorder |
| F11.988 | Opioid use, unspecified with other opioid-induced disorder |
| F11.99 | with unspecified opioid-induced disorder |

## Appendix B

Specified Diagnoses for Selected Comorbidity Categories

**Table 8. Specified Diagnoses of Certain Infectious & Parasitic Diseases**

| Certain infectious and parasitic diseases A00-B99 | Frequency |
|---|---|
| Bacterial Diseases | 10880 |
| Intestinal infectious diseases | 7190 |
| Mycoses | 4814 |
| STI's | 4807 |
| Viral infections characterized by skin and mucous membrane lesions | 3500 |
| Bacterial and viral infectious agents | 3247 |
| Viral hepatitis | 1931 |
| Other Spirochetal Diseases | 1486 |
| Pediculosis, acariasis and other infestations | 971 |
| Other viral diseases | 910 |
| Tuberculosis | 499 |
| Arthropod-Borne Viral Fevers and Viral Hemorrhagic Fevers | 286 |
| Other infectious diseases | 278 |
| HIV | 232 |
| Protozoal diseases | 167 |
| Sequelae of infectious and parasitic diseases | 158 |
| Total | 41356 |

**Table 9. Specified Diagnoses of Mental, Behavioral and Neurodevelopmental disorders**

| Mental, Behavioral and Neurodevelopmental disorders F01-F99 | Frequency |
|---|---|
| Mental and behavioral disorders due to psychoactive substance use | n = 3107 |
| Opioid related disorders | 646 |
| Alcohol related disorders | 522 |
| Other stimulant related disorders | 438 |
| Sedative, hypnotic, or anxiolytic related disorders | 340 |
| Cannabis related disorders | 290 |
| Other psychoactive substance related disorders | 289 |
| Cocaine related disorders | 270 |
| Nicotine dependence | 153 |
| Hallucinogen related disorders | 125 |
| Inhalant related disorders | 34 |
| Total | 3107* |
| Mood [affective] disorders | 658 |
| Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders | 487 |
| Mental disorders due to known physiological conditions | 356 |
| Behavioral syndromes associated with physiological disturbances and physical factors | 224 |
| Disorders of adult personality and behavior | 210 |
| Behavioral and emotional disorders with onset usually occurring in childhood and adolescence | 208 |
| Schizophrenia, schizotypal, delusional, and other non-mood psychotic disorders | 198 |
| Pervasive and specific developmental disorders | 112 |
| Intellectual disabilities | 28 |
| Total | 5588 |

*The total 3107 mental and behavioral disorders due to psychoactive substance use is included in the total 5588 mental, behavioral and neurodevelopmental disorders.

**Appendix C**

Internal Review Board Exclusion

## UNLV Biomedical IRB - Exempt Review
## Exempt Notice

| | |
|---|---|
| **DATE:** | June 12, 2018 |
| **TO:** | Sheniz Moonie |
| **FROM:** | Office of Research Integrity - Human Subjects |
| **PROTOCOL TITLE:** | [1252056-1] Associations Between Opioid-Related Hospitalizations and Intravenous Drug Users |
| **ACTION:** | DETERMINATION OF EXEMPT STATUS |
| **EXEMPT DATE:** | June 12, 2018 |
| **REVIEW CATEGORY:** | Exemption category # 4 |

Thank you for your submission of New Project materials for this protocol. This memorandum is notification that the protocol referenced above has been reviewed as indicated in Federal regulatory statutes 45CFR46.101(b) and deemed exempt.

We will retain a copy of this correspondence with our records.

**PLEASE NOTE:**
Upon final determination of exempt status, the research team is responsible for conducting the research as stated in the exempt application reviewed by the ORI - HS and/or the IRB which shall include using the most recently submitted Informed Consent/Assent Forms (Information Sheet) and recruitment materials.

If your project involves paying research participants, it is recommended to contact Carisa Shaffer, ORI Program Coordinator at (702) 895-2794 to ensure compliance with the Policy for Incentives for Human Research Subjects.

*Any* changes to the application may cause this protocol to require a different level of IRB review. Should any changes need to be made, please submit a **Modification Form**. When the above-referenced protocol has been completed, please submit a **Continuing Review/Progress Completion report** to notify ORI - HS of its closure.

If you have questions, please contact the Office of Research Integrity - Human Subjects at IRB@unlv.edu or call 702-895-2794. Please include your protocol title and IRBNet ID in all correspondence.

Office of Research Integrity - Human Subjects
4505 Maryland Parkway . Box 451047 . Las Vegas, Nevada 89154-1047
(702) 895-2794 . FAX: (702) 895-0805 . IRB@unlv.edu

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Curriculum Vitae

**Jacklynn De Leon**
**deleonjacklynn@gmail.com**

## EDUCATION

**University of Nevada, Las Vegas**, Las Vegas, NV **Admission Spring 2019**
PhD in Public Health with concentration in Epidemiology & Biostatistics

**University of Nevada, Las Vegas**, Las Vegas, NV **August 2016 - Current**
Master's in Public Health with concentration in Epidemiology & Biostatistics
Planned graduation date is December 2018

**University of Nevada, Las Vegas**, Las Vegas, NV **August 2015**
Bachelor of Science, Biological Sciences

**San Diego State University**, San Diego, CA **December 2008**
Bachelor of Science, Kinesiology with concentration in Fitness, Nutrition, and Health

## WORK & RESEARCH EXPERIENCE

**Graduate Research Assistant for Dr. Brian Labus** **August 2018 – Present**

**Graduate Research Assistant for Dr. Sheniz Moonie** **May 2017 – August 2018**

- Collaboration with UNLV School of Medicine & United Health Care
  - Statistical analysis of complex data using SPSS
  - Power Point presentation for Health Partners
  - Developing and writing of health reports
- Teaching Assistant - Grading of PBH 205 "Intro to Public Health" course assignments
- Mentoring Public Health undergraduate student with Capstone project
  - YRBSS Health Report

**Intern at Trac-B Exchange Program** **September 2017 – February 2018**

- Statistical analysis of intravenous drug user data using SPSS
- Supply/Kit preparation: Safe sex kits, safety injection equipment packaging
- Distribution of sterile supplies to intravenous drug users

**Graduate Research Work** **January 2017 – June 2017**

- Represented Dr. Rodriguez at Global Health Initiative team meetings
- Laboratory turnover from chemical hazards lab to biological hazards lab (BSL-2)
- Researched and developed a protocol on carriers and shipping requirements for infectious human samples
- Researched and developed a protocol for supply orders of reagents, safety supplies, and biohazard equipment

**Undergraduate Research**

- **Phylogenetics Laboratory** **May 2012 – April 2013**
  - My research experience focused on laboratory techniques and analyses used in phylogeographic and population genetic studies; investigating phylogeographic patterns of Caribbean reptiles
  - I gained experience in DNA extraction and isolation, DNA amplification (polymerase chain reaction), gel electrophoresis, automated fluorescence-based cycle sequencing and phylogenetic analyses

- **Microbiology Laboratory** **January 2013 – December 2013**
  - My research experience involved investigation of identifying which region of the bacterium *Shigella flexneri virB* genetic locus is needed for Ryh-B dependent regulation of *virB* transcription
  - Methods used included the creation of desired inserts and vectors using PCR amplification, ligation of inserts to vectors, then amplifying plasmids conducting transformation, verifying correct plasmid construct by restriction pattern analysis, confirming amplified insert sequences by DNA sequencing
  - Presentation of research through power point and poster presentations at Wind River Microbiology Conference in Estes Park, CO & UNLV INBRE Scholarship Forum Las Vegas, NV

**Airmen of The United States Air Force –USAF** **January 2004 – January 2006**

- Optometry Technician – Active duty
- Extracurricular Activities: Infection Control representative for Clinic, Secretary for Medical Group dormitory, Vice President of Airmen Against Drunk Driving

## CONFERENCES PROCEEDINGS/PRESENTATIONS

**Presented**

- Poster Session: Wind River Microbiology Conference, Estes Park, CO: June 2013: **Jacklynn De Leon**, Joy A. Immak, William H. Broach, Erin R. Murphy, Helen J. Wing. Characterization of a Novel Mechanism of sRNA-mediated Regulation in *Shigella flexneri* virulence

- Poster Session: UNLV INBRE Scholarship Recipient Ceremony, Las Vegas, NV: August 2013: **Jacklynn De Leon**, Joy A. Immak, William H. Broach, Erin R. Murphy, Helen J. Wing. Characterization of a Novel Mechanism of sRNA-mediated Regulation in *Shigella flexneri* virulence

- Poster Session: UNLV School of Community Health Sciences Honors Society, Las Vegas, NV: April 27, 2018: **Jacklynn De Leon**, Chelsi Cheatom, Chad L. Cross, Sheniz Moonie. Vending Machine Syringe Distribution May Reduce HIV/HCV Incidence in Intravenous Drug Users

- Poster Session: American Radium Society Conference, Orlando, FL: May 6, 2018: Chad L. Cross, Parvesh Kumar, Sheniz Moonie, **Jacklynn De Leon**. Rural-Urban Continuum as a Potential Geographic Correlate of Breast and Prostate Cancer Mortality in Nevada

- Poster Session: VA Southern Nevada InnoVAtion Research Conference, Las Vegas, NV: May 15, 2018: Cross, C. L. Kumar, P., Moonie, S., **De Leon, J.** Rural-urban continuum as a potential geographic correlate of breast and prostate cancer mortality in Nevada

- Oral Presentation: Nevada Public Health Association Annual Conference, Las Vegas, NV: September 27, 2018: **Jacklynn De Leon**, Sheniz Moonie, Chad L. Cross. Associations between Opioid-Related Hospitalizations and Intravenous Drug Users

- Poster Session: American Society for Radiation Oncology, San Antonio, TX: October 21, 2018: Parvesh Kumar, Chad Cross, **Jacklynn De Leon**, Sheniz Moonie. Impact of Mammography Screening Rates on Breast Cancer Mortality in Nevada (NV), California (CA) and US: Implications for Health Care Policy

- Poster Session: American Public Health Association Annual Conference, San Diego, CA: November 13, 2018: **Jacklynn De Leon**, Chelsi Cheatom, Chad L. Cross, Sheniz Moonie. Vending Machine Syringe Distribution May Reduce HIV/HCV Incidence in Intravenous Drug Users

## MANUSCRIPTS

**Submitted/Under Review**

- Admasu E., **De Leon J.**, Moonie S., Cross C. A Summary of Nevada High School Youth Risk Behaviors (YRBSS) 2015. (Submitted October 2018 – *International Journal of Adolescent Medicine and Health*).

- Cross, C. L., Kumar, P., **De Leon, J**., & Anderson, J. L., & Moonie, S. Rural-urban continuum as a potential geographic correlate of breast and prostate cancer mortality: A case study of Nevada, USA. (Submitted October 2018 - *Cancer Epidemiology, Biomarkers & Prevention*).

## VOLUNTEER EXPERIENCES

**Orphanage Mission Trip to Sri Lanka** **June 2011**

- Built furniture for school

**Medical Mission Trip to Ghana, Africa** **September 2010**

- Assisted doctors, nurses and pharmacists

**iMPACT House: Safe House for Sex-Trafficked Victims** **May 2010 – December 2010**

- Tutor for sex-trafficked victims (i.e. GED, occupational license)
- Fundraiser and Awareness events to help and inform people of sex-trafficking

**Medical Mission Trip to Cameroon & Chad, Africa** **April 2005**

- Lead optometry technician performed the following:
  - Eye health exams, prescribed glasses, and treatment of eye health symptoms and diseases

## HONORS & AWARDS

- INBRE Research Scholarship **May 2013**
- Below the Zone - USAF **September 2005**
- Airmen of the Quarter - USAF **April 2005**

## CERTIFICATES & SKILLS

- **UNLV Laboratory Training** **February 2017**
  - Hazard Communication, Blood-borne Pathogens, Slips, Trips and Falls, Chemical Hygiene, Universal Waste, Biosafety, PPE

- **CITI Program Training** **May 2017**
  - Biomedical Responsible Conduct of Research Course
  - Group 1. Biomedical IRB Course

- **Microsoft Word, Xcel, Power Point, SPSS, SAS**