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Samuel John March 30, 2020

# Physician Attitudes and Stigma May Hinder Patient Care with Opioid Prescribing, Pain Management, and Addiction Treatment

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An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
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Abstract

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***Importance***: Physician stigma has been found to exist with substance abuse, however, less research shows how such attitudes have specifically shaped physician opioid prescribing. Given the magnitude of the opioid epidemic, analyzing how physician stigma and attitudes influence prescribing can elucidate how physicians treat pain, and offer suggestions for appropriate pain control.

***Objective***: To determine if:

1) Physicians with stigma towards patients with opioid addiction (opioid use disorder or OUD) are more likely to give substandard patient care towards opioid using patients and patients in chronic pain.
2) Physicians who dislike prescribing opioids in chronic dosages are more likely to give substandard patient care towards opioid using patients and patients in chronic pain.

***Design/Setting, Participants*:** Online survey study, observational; 68 Emory University physicians from all specialties of all ages, with a DEA number to certify legal opioid prescriptions.

***Main Outcome and Measure***: SurveyMonkey online survey devised from physician expertise on opioid prescribing and pain management, to gauge predictors of physician stigma and assess their patients' patient care using commonly accepted standards of care and the 2016 CDC Guideline for Prescribing Opioids for Chronic Pain. Statistical analysis used Principal Component Analysis (PCA), followed by General Linear Modeling.

***Results:*** PCA, linear regression and ANOVA found that physicians who are uncertain with opioids tend to have stigmatizing attitudes towards opioids and addiction, and also tend to dislike opioids. Uncertain physicians gave significantly worse patient care ($p= 0.0054$). Within other specialists, less knowledgeable and experienced physicians gave significantly worse care ($p= 0.0054$). Pain specialists were least uncertain ($p= 0.015$), while ER and other specialists were the most uncertain with opioids on average and were the least knowledgeable ($p= 0.034$). ER and Other specialists also delivered significantly worse care than pain specialists ($p<0.0001$). Specialty was a stronger predictor of patient care than uncertainty or knowledge/experience, according to AIC scores. Females were significantly less uncertain about opioids ($p= 0.017$).

***Conclusion and Relevance***: Results suggest that stigma can manifest as uncertainty, which can significantly worsen pain care. Given specialty-specific worsened care, this suggests that tailoring opioid trainings to non-pain specialists may be necessary.

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## 1. Introduction

The opioid epidemic is one of the most urgent public health issues in the United States. In 2018, almost 70% of the 67,000 deaths from drug overdose were due to opioids, and over 14,000 Americans died from prescription opioid overdose (CDC Understanding the Epidemic, Overdose Death Urbanicity). From the late 1990s through the 2000s, physicians prescribed substantially more opioids to control acute and chronic pain because pain was promoted as a fifth vital sign (Skolnick, 2018). Yet, this liberal prescribing of opioids led to unnecessary opioid exposure and oftentimes addiction, later termed Opioid Use Disorder (OUD) (Compton et al., 2006, Skolnick, 2018). In 2008, Americans consumed roughly 80% of the world's opioid supply despite only constituting 4.6% of the global population, which emphasizes the dramatic rate of American opioid prescription (Reider, 2019). As a result, many patients abused opioids and switched to illicit opioids once their prescription ended, because illicit opioids are often more accessible (Skolnick et al., 2018). After increased government attention in recent times, the public and medical community now have a greater awareness of the addictive properties of long-term prescription opioid use and the deadly effects of using illicit opioids (Hedegaard et al., 2018). Greater attention to the opioid crisis has heightened fears about physician-caused OUD (Dineen et al., 2016, Dowell et al., 2016). As a result, some physicians may be very hesitant to prescribe opioids at all, even for patients with substantial pain (Dineen et al., 2016). The government has expanded access to several tools to combat the epidemic. These include expanding: access to Medication-Assisted Treatment (MAT) for OUD to reduce relapse rates, access to addiction counseling, and access to naloxone which can revive opioid overdose victims (CDC, Treat Opioid Use Disorder, Reverse Overdose to Prevent Death). However, these tools do not address

the beliefs and attitudes behind opioid use and its clinical aspects, particularly with physician stigma.

In addition to the impact of OUD, chronic pain patients also present unique challenges to the American healthcare system and the prescription of opioids. In 2016, CDC estimated that 20% of the US adult population, approximately 50 million people, suffer from chronic pain (Dahlhamer et al., 2018). When considering acute pain, this number includes approximately 125 million people (Skolnick et al., 2018). Moreover, it is important to realize that opioids are unique for a drug of abuse because they simultaneously possess the potential to improve and drastically impair quality of life. Opioids are very useful and widely utilized for certain types of pain management, yet they also have a high potential for abuse (Phillips et al., 2017). Moreover, pain itself is very subjective based on individual experience (Świeboda et al., 2013). This requires physicians to analyze their patients to identify problematic cues which could indicate drug-seeking behavior, yet, physicians must also have a degree of trust in their patients' self-reports of pain (Dineen et al., 2016). Thus, these characteristics of opioids and the subjectivity of pain complicates opioid prescription and appropriate pain management.

Given the scope of the current opioid epidemic, physicians now realize that opioids must be prescribed with caution. Physicians must balance the subjective and diverse pain needs of their patients with standards of care, which often include risk assessment for opioid abuse (Dowell et al., 2016). Pain management with opioids requires advanced understanding of patients' unique circumstances, social history, and pain tolerance (Dowell et al., 2016). However, thorough pain assessment is challenging given that many physicians struggle to find enough time to appropriately assess their patients (Dugdale et al., 1999). Moreover, opioids remain among the most effective pain control methods for many types of pain, such as acute pain, pain due to

cancer, and pain management in palliative care (Phillips et al., 2017). So, the medical establishment cannot readily forgo opioid use for all patients given the benefits to certain patient populations. Thus, given the scope of opioid use and the large patient groups who use them, it is important to understand how physicians prescribe opioids in order to guide best practice standards and enhance patient care.

At the center of understanding physician prescribing behavior and practice, attitudes and beliefs play an important role in altering medical decision-making. For the last few centuries, addiction has been framed as a form of weakness and poor moral character (moral model) versus a chronic brain disease (Brain Disease Model of Addiction, BDMA) (Heather, 2017). Nora Volkow, director of the National Institutes on Drug Abuse, has advocated for BDMA over a moral model and research provides more biological support for the former (Volkow et. al., 2016, Leshner, 1999). However, the debate has recently been between BDMA and a biopsychosocial model, which emphasizes that addiction is more holistic with social and psychological factors and not purely due to neural changes (Becoña, 2018). Proponents of the biopsychosocial model claim this model more appropriately reflects the dynamic nature of addiction and its nuances in different social and psychological contexts (Becoña, 2018). Furthermore, those supporters criticize BDMA for oversimplifying addiction and the model's implication that individuals with addiction often cannot change their own behavior (Becoña, 2018). Despite some progress towards placing less moral blame on those with OUD and immense research on addiction neuroscience, this has not reduced the stigma of addiction (Heather, 2017). Stigmatization is often defined as the process in which a label is applied to a group of people with shared characteristics, and then labeled people are associated with certain prejudicial stereotypes (van Boekel et al., 2014, Corrigan et al., 2017). Regrettably, attitudes and prejudice are widely known

to influence clinical outcomes, particularly along racial and socio-economic lines (FitzGerald et al., 2017, Daugherty et al., 2017). Implicit bias has gained attention and is widely known to influence physician clinical decision-making, yet, some physicians still fail to consciously recognize the influence of implicit bias (FitzGerald et al., 2017, Daugherty et al., 2017). Moreover, these psychological processes have consistent neural bases, which can provide more concrete methods of analyzing behavior (Amodio et al., 2014). Neural structures often involved in prejudice and stereotypes include the amygdala, which processes social category cues, and the orbitofrontal cortex and the prefrontal cortex, which create affect-driven judgments of social outgroup members (Amodio, 2014). Despite studies of physician implicit bias and neuroscience studies demonstrating neural correlates of stigma, there remains little knowledge of how physician stigma can specifically influence patient care with opioid prescribing.

Given the known role of stigma and its influence on broader clinical decision making, it is important to evaluate how physician stigma influences opioid prescribing within the context of the opioid epidemic. Aforementioned government measures, such as expanding access to MAT, have been ineffective at reducing stigma, which has frequently precluded effective OUD treatment and pain management (Kreek et al., 2019, Nichols et al., 2020). To this point, little research has studied how this stigma directly impacts opioid prescribing, pain management, and OUD in America. Yet, stigma is a major factor which continues to hinder OUD treatment outcomes and broader treatment of chronic pain (van Boekel, et al., 2013, Nichols et al., 2020). Regrettably, stigma towards certain groups, including towards racial minorities or towards those with hard to treat illness like chronic pain, can cloud physician medical judgment (FitzGerald et al., 2017, Nichols et al., 2020). For example, a survey of medical students and residents found many negative attitudes (Lindberg et al., 2006). Many believe that addiction treatment is

"repetitive" because the treatment detracts from time needed to treat patients with other medical illnesses (Lindberg et al., 2006). This result suggested that medical students and residents were unconvinced that their interventions could genuinely help those with addiction, so, they believed more focus should be on treating other illnesses. Moreover, the study supports that patient satisfaction in addiction treatment is consistently decreasing over time (Lindberg et al., 2006). In addition, some physicians disagree with patient pain expectations, which can strain the doctor-patient relationship (Nichols et al., 2020). Nichols et al. conducted a meta-ethnography of patients using opioids for chronic non-malignant pain, and found that clinicians were frequently "not on the same page" as their patients about opioid usage (Nichols et al., 2020). Sometimes, physicians find that the risk of OUD outweighs the benefits of pain relief, which can prompt them to prescribe less opioids (Nichols et al., 2020, Dineen et al., 2016). However, these beliefs can contrast with patients' desire to treat severe pain (Dineen et al., 2016). Some patients prioritize analgesic benefits over potential addiction risks given their often-debilitating symptoms with severe pain (Krebs et al., 2014, Nichols et al., 2020). These conflicting interests can be hard to reconcile and further complicate the effective prescribing of opioids. Moreover, the physician fear of patient addiction can hinder patient pain outcomes, prompting denial of opioids for patients with genuine pain (Nichols et al., 2020). Overall, people who suffer from OUD and people who take opioids to relieve chronic pain face significant stigmatization and strongly perceived negative attitudes (Kreek et al., 2019, Nichols et al., 2020). Apart from causing psychological distress such as ostracization, stigma also has more tangible negative consequences. SAMHSA's 2017 National Survey on Drug Use and Health suggests stigma is a major reason why those with substance abuse frequently avoid treatment (Ashford et al., 2018, Center for Behavioral Health Statistics and Quality, 2017). Unfortunately, many individuals

continue to deny the importance of evidence-based treatments (Ashford et al., 2018, Center for Behavioral Health Statistics and Quality, 2017). Among OUD patients who do not receive treatment for opioid addiction, 28% avoid treatment because of stigma (Ashford et al., 2018, Center for Behavioral Health Statistics and Quality, 2017). Thus, given research on physician bias in other areas and that stigma is known to influence clinical care, it is essential to analyze how physician stigma presents with opioid prescribing given the potential for biased and sub-standard care.

## 2. Methods and Hypotheses

### *2.1 Survey Design*

The main goal of this study is to understand the scope of physician stigma with opioid prescribing in pain management and addiction settings. We believe that physician stigma remains widespread with the prescription of opioids and hampers patient care in pain management. Overall, we hypothesize that physicians with stigmatizing attitudes are more likely to give substandard patient care towards opioid using patients and patients in chronic pain, and physicians with dislike towards opioids are also more likely to give substandard patient care with those patient populations. Stigma in chronic pain care has been found to influence patient care in one meta analysis (Nichols et al., 2020), while previous studies on stigma in other drug-specific patient populations have demonstrated the evidence of stigma in substance use disorder care (van Boekel et al., 2013, Lindberg et al., 2006). In constructing these aims, we acknowledge that a universally approved "standard of care" for opioid prescribing and chronic pain is unclear. Standards of care in pain management are essential because a significant number of opioid mis-prescribing was due to practices below the standards of care, while mis-prescribing errors associated with practices below the standards of care resulted in substantial opioid mortality (Rich et al., 2011, Dineen et al., 2016). Moreover, American medical schools do not have a

standard of pain management curricula, and an estimated 96% of American medical schools do not address pain medicine at all (Shipton et al., 2018). However, within the US, many pain specialists and primary care physicians refer to the 2016 CDC Guideline for Prescribing Opioids for Chronic Pain as the closest approximation to a standard of care for opioid prescribing (Dowell et al., 2016, Raheemullah et al., 2020). Thus, the 2016 CDC Guideline was used when assessing physician opioid prescribing behavior. In assessing physician attitudes and prescribing behavior, we used an anonymous, confidential online survey through the SurveyMonkey platform. No HIPAA protected data was collected. SurveyMonkey was chosen due to its accessibility of use and its reliable security and privacy policy. The survey questions were constructed in close consultation with Dr. Sudheer Potru, DO, Assistant Professor, Emory University School of Medicine, Department of Anesthesiology. Dr. Potru has extensive experience working in the field of pain management, and also treating patients with OUD. Dr. Potru's experience helped to appropriately ask questions which reflect daily experiences of physicians. Broadly, the survey questions evaluate how physicians assess evidence-based medicine given personal beliefs about addiction and pain management with regards to opioids, and how knowledge and education about the biological processes of addiction influence this behavior. Physician respondents were required to have a DEA number certifying they can prescribe opioids and had to be fluent in English.

The project was conducted in the Atlanta metropolitan area, which we believed was well-suited as a target population for two reasons. Firstly, Georgia's opioid prescription rate is notably higher than the national average, about 71 opioid prescriptions per 100 persons compared to the national rate of approximately 59 prescriptions per 100 persons (NIDA, Georgia Opioid Summary). Secondly, Georgia opioid overdoses have almost consistently increased every year

since 1999, with a brief decline in 2013 followed by rising overdose rates. (NIDA, Georgia Opioid Summary). This project consulted medical professionals and researchers at one academic medical system, Emory Healthcare, the largest healthcare employer in Metropolitan Atlanta. In doing so, we aim to understand the role of stigma in this crisis and to seek practical experience about how stigma impacts care for patients using opioids. To collect responses, surveys were emailed through multiple Emory email lists to physicians. Recruitment focused solely on Emory Healthcare physicians as a sample to represent physicians in the Atlanta metropolitan area, with n=68 following data processing.

All survey questions were separated into categories: physician stigma predictors, dislike prescribing opioid predictors, patient care questions, knowledge questions, demographic questions, and potential response bias. Each survey question was given a short code when questions were used for statistical analysis, see Table A1 in the appendix for full list of survey questions and abbreviated codes. Survey question wording was carefully chosen to avoid cueing the physicians towards a clear morally correct or otherwise politically correct answer that ought to be chosen. For example, we ask: to what extent are addicts at fault for their addiction? We provide the answer choices: very much at fault, somewhat at fault, and not at fault at all. Thus, we believe that placing more fault on patients with OUD is a reasonable assessment of stigmatizing attitudes towards those with addiction. This is based on literature which supports that those with OUD have impaired judgment and often experience permanent brain changes which enhance drug seeking behavior, thus, they are not always to blame for their addiction (Volkow et al., 2016, Volkow et al, 2015, Leshner, 1997). Stigma predictor questions include how physicians trust patients to accurately report pain because we believe it identifies if physicians believe that addiction is influenced by morals. Notably, questions assess stigma

without explicitly mentioning it to avoid biased responses. The survey will also assess knowledge of the biological process of addiction and how this process impacts treatment and pain management. Overall, we understand that many attitudes often exist on a spectrum, thus, many questions used a gradient or modified Likert scale (strongly agree, agree, disagree, and strongly disagree). For our survey, we purposely omitted a neutral answer choice because we wanted to require physicians to choose one view over another, in order to make data analysis more readily interpretable and less ambiguous.

### *2.2 Principal Component Analysis and Other Statistical Methods*

First, we performed a statistical power analysis with G*Power 3.1.9.4 (Faul et al., 2007). To perform Principal Component Analysis, some statisticians advise at least 50 subjects (Faul et al., 2007). We performed a sensitivity analysis to determine an effect size, given a set sample size of 50 or 70, based on a two-tailed, linear bivariate regression with one group. The size of slope was determined with settings of $\alpha$=0.05, power=0.80, standard deviation of x and y at 1.0, and a sample size of 50 (our final sample for the survey contained n= 68). This size would allow for the detection of a slope of the linear regression of -0.375 or steeper. Analysis revealed that increasing the sample size to n=70 would allow for detection of -0.32 or steeper, but having n=70 is not critical.

After closing surveys for responses, we processed the data to ensure that responses were complete enough for analysis and testing. During this processing, we deleted two physician participants from the survey because they met exclusion criteria, not having a DEA number to certify opioid prescriptions. In addition, two more physician participants were deleted prior to hypothesis testing because of missing responses to essential patient care questions. Also, one outlier response to one question was rescored, effectively merging “strongly agree” with “agree,” to avoid giving the respondent undue weight. After accounting for the impact of the outlier and

eliminating four physician responses, we performed Chi-Square tests to obtain descriptive statistics. To further process data, survey responses were reversed when appropriate so that all predictor questions were "bad" (worse stigma, less knowledge about opioids and addiction, exaggerated reluctance/dislike about opioids) and all patient care were "good" (better patient care). Thus, responses which indicated more stigma, less knowledge, and more exaggerated reluctance/dislike with opioids and addiction received higher scores when grading responses.

Survey answers were mostly binary or ordinal (scores on ordered scale from 1-4), with a few nominal variables (e.g. race). We utilized Principal Component Analysis (PCA) and the General Linear Model, an umbrella term which includes simple linear regression. Accordingly, SAS was used to conduct Principal Component Analysis, which reduced the number of survey questions down to their underlying, major factors. In addition, we conducted a monotonic transformation using polychoric correlation as part of the PCA, in order to make the ordinal data (Likert scores with an inherent order) behave as continuous data (Appendix Figures A2.1-A2.3). The polychoric correlation coefficient is a measure of association for ordinal variables. This measure assumes an underlying, continuous normal distribution. In addition, orthogonal rotation ensured that there is no correlation between resulting component axes. A General Linear Model (AKA linear regression) was fit to the new axes against patient care. Also, demographics (age, gender, race and physician specialty) were tested against both patient care and the new PC axes. We also analyzed demographics to determine if the sample was representative of Fulton County, which is primarily Atlanta.

In order to analyze this survey data, we used SAS 9.4 (Cary NC). See Appendix Fig. A3 for sample SAS code of important procedures performed. PCA was chosen because it is a method of dimension reduction, when multiple variables are present and we would like to

simplify the analysis to their broader underlying factor or factors to analyze. For instance, our surveys are trying to assess physician stigma as a variable, which is a difficult attitude to qualitatively or quantitatively evaluate with a single question. It is ineffective to ask the physician directly, for example, "Do you have stigma towards addicted individuals?" because those with genuine stigma may not realize they stigmatize patients who take opioids or they may not want to disclose prejudicial beliefs. Thus, question variety is needed to appropriately capture different elements of stigma, as seen in the daily life of a physician. PCA can readily reduce the multiple questions needed to assess stigma into one variable.

Regarding the patient care variable, only one variable was desired for patient care. Since PCA created an patient care principal component with more than 1 axis (i.e. more than one dimension of data to compare to PC1 and PC2). Since only one variable is allowed in order to conduct linear regression, we decided to use a simple summation of the scores on patient care questions (OutSum) to determine how physicians performed with patient care. Also, the benefits did not outweigh the complexity of using PCA to weight patient care questions separately since 4 of 5 patient care questions were weighted similarly towards assessing patient care (see Fig 1.). In addition, three outliers appeared to skew the patient care PC.

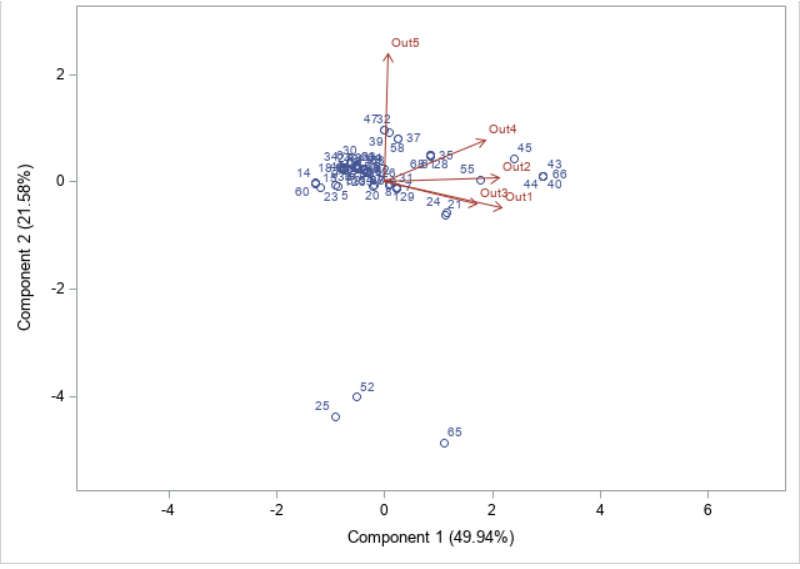



**Fig. 1 Attempted Patient Care Principal Component**: Each circle represents a physician response. Arrows long on the x-axis relate to PC1, long on y-axis relate to PC2, arrows represent the correlation of responses to two underlying variables (principal components 1 and 2). Note that patient care questions (Out 1 – 4) all align primarily with PC1 (Component 1) and Out5 only aligns with PC2 (Component 2).

Following the creation of principal components, predictors were compared to patient care using simple linear regression. Linear regression allowed us to analyze how predictors of physician attitudes and behavior influence patient care, thus, providing the method to ultimately test our hypotheses. Notable simple linear regression comparisons include patient care vs. uncertainty with opioids (principal component 1, Fig. 7), and patient care vs. knowledge/experience with opioids and addiction (principal component 2, Fig. 8). See results and discussion for explanation of how we defined these principal components. Lastly, PCs and demographic responses were used to conduct subset analysis, to discern if demographics played significant roles in predicting better patient care and to see if demographic factors were a potential confounding variable which could influence patient care.

Specifically, with PCA, the method considered each of the 8 stigma predictor questions, along with most other predictor questions, and treated each question as a separate variable. PCA did not include demographic questions nor patient care questions. Demographics stand as their own variable to be analyzed separately while patient care questions are used later in simple linear regression to test our hypotheses. Also, PCA did not receive any coding commands to inform which questions were meant to be the stigma predictors. Thus, the data analysis was blind to question categories and was not based solely on correlations between certain types of questions. PCA assigned a weight to each question from 0 to 1 (known as the eigenvector) indicating how strongly answer choices to a certain question correlated with selected answer choices to other questions. Accordingly, from a large number of related questions, PCA created numerous principal components, which give highly correlated questions more weight. From those principal components, we attempted to discern an underlying stigma variable. The weighted sum of variables is used to create a Principal Component or PC, whereby the variables (survey

questions) with the highest correlation received the highest weight towards explaining one larger, underlying variable. The intended underlying variables were stigma, opioid and addiction knowledge/experience, and patient care. As an example, Question 26 (listed as Know3 in data analysis) “My occasional lack of knowledge about the biology of addiction sometimes hinders my patients' patient care”, received a relatively higher weight of 0.48 in the first principal component. Since this question received a higher weight for PC1, this could suggest that knowledge may play an important role in PC1’s underlying variable. For the purpose of our analysis, we consider weights above 0.20 to be noteworthy; however, there is no formalized cutoff for significance unlike p-values. After all of the PCs were created using SAS, we individually analyzed which questions were associated with that principal component. PCA created numerous PCs, however, only the two strongest principal components yielded interpretable results in the context of our hypotheses, results related to our aforementioned three underlying variables. Importantly, we identified PCs that could be readily supported by literature or reasonably interpreted based on past research. Following the identification of statistically valid and conceptually useful principal components, these PCs were then used to create the axes for several scatterplots in order to conduct simple linear regression and analyze data correlations. PC1 and PC2 were both compared against patient care.

## 3. Results

### *3.1 Unprocessed Survey Results and Transformation*

Analysis of raw, unprocessed data allowed us to observe a few key trends (see Table 1 below for sample demographics and comparison to Fulton County).

**Table 1: Summary of Descriptive Statistics**

| | Sample Demographics | | | | Fulton County Averages* | | p-values |
|---|---|---|---|---|---|---|---|
| | **VALUE** | **SPECIFIC** | **FREQ (%)** | **FREQ (%)** | **VALUE** | **FREQ (%)** | |
| **AGE (YRS)** | < 35 | | | 9 (13%) | < 35 | 514 (11%) | p=0.20 no significant difference |
| | 35-44 | | | 29 (43%) | 35-49 | 1899 (41%) | |
| | 45-54 | 45-49 † ➡<br>50-55 † ➡ | 6 (9%)<br>5 (7%) | 11 (16%) | | | |
| | 55-64 | | | 18 (26%) | 50-64 | 1547 (33%) | |
| | ≥ 65 | | | 6 (9%) | ≥ 65 | 675 (15%) | |
| **SEX** | Male | | | 39 (57%) | Male | 2124 (62%) | p=0.41 no significant difference |
| | Female | | | 29 (43%) | Female | 1293 (38%) | |
| | | | | | Unknown ‡ | 1218 (NA) | |
| **RACE** | White | | | 41 (60%) | White | 2,165 (47%) | p<0.0001 significantly fewer Af. Amer & more Asian Am. |
| | Af. Amer. | | | 2 (3%) | Af. Amer. | 654 (14%) | |
| | Asian Am. | | | 16 (24%) | Asian Am. | 451 (10%) | |
| | Other | Hispanic<br>Other<br>No answer | 4 (6%)<br>1 (1%)<br>4 (6%) | 9 (13%) | Other | 1,365 (29%) | |
| **SPEC-IALTY** | Pain | Anesthesiology<br>Addicn. Psyc./Med.<br>General Psychiatry | 2 (3%)<br>4 (6%)<br>1(1%) | 8 (12%) | Pain | 476 (10%) | p<0.0001 significantly more ER & fewer Other |
| | ER | | | 26 (38%) | ER | 157 (3%) | |
| | Other | Cardiology<br>Critical care<br>Endocrinology<br>Family Medicine<br>Hematology<br>Hemat./Onco.<br>Infectious Dis.<br>Internal Med.<br>Nephrology<br>Neurology<br>OB/GYN<br>Oncology<br>Ophthalmology<br>Otolaryngology | 1 (1%)<br>2 (3%)<br>2 (3%)<br>2 (3%)<br>1 (1%)<br>2 (3%)<br>4 (6%)<br>5 (7%)<br>1 (1%)<br>7 (10%)<br>2 (3%)<br>2 (3%)<br>1 (1%)<br>2 (3%) | 34 (50%) | Other | 4002 (86%) | |
| **LOCA-TION** | Atlanta | | | 58 (85%) | | | |
| | Other | Decatur<br>Gainesville<br>Sharpsburg | 4 (6%)<br>1 (1%)<br>1 (1%) | 6 (9%) | | | |
| | No answer | | | 4 (6%) | | | |

* From 2017-2018 physician renewal survey, Georgia Board of Health Care Workforce (Physician Workforce Data)
† Divided into 6 and 5 respectively as an estimate, for comparison to Fulton County groups.
‡ Assuming proportional (non-biased) distribution of gender among unknowns.

First, we observed key demographic findings within our sample. Male respondents were significant older (p= 0.0064) and with more years of practice (p=0.0004) than females, and

significantly more males were white (p= 0.023) than females. Also, ER physicians were significantly younger than other specialists and Asian physicians are significantly younger than physicians of other races (p= 0.043 and p= 0.0002, respectively). In addition to being younger, Asian physicians also had significantly fewer years of practice than other races (p=0.0003). Moreover, the vast majority heard about the survey through email, and many indicated that they are faculty at Emory. Second, when comparing our sample to Fulton County averages for physicians, we observed that respondents' age was not significantly different than Fulton County (p>0.05) (Physician Workforce Data). The survey contained proportionally more ER physicians and Asians, with fewer African Americans than in Fulton County (Physician Workforce Data).

### *3.2 PCA Results: PC1 and PC2 Interpretations*

The most distinct principal components which could be interpreted are PC1, which corresponds most to uncertainty with opioids, and PC2, which corresponds most to knowledge of opioids. See appendix, Appendix Table A1, for full questions, abbreviations, and categories, and Tables 2.1 and 2.2 below for the PCA results. Note, negative weights indicate that those variables are inversely correlated with the principal component variable (uncertainty with opioids or knowledge/experience with opioids).

| TABLE 2.1: PC1 (UNCERTAINTY WITH OPIOIDS): HIGHEST WEIGHTED VARIABLES | |
|---|---|
| Eigenvalue | 3.13 |
| **VARIABLE eigenvector or weight** | **FULL NAME** |
| Know3 0.48 | My occasional lack of knowledge about the biology of addiction sometimes hinders my patients' outcomes. |
| Dis2 0.39 | I sometimes feel that stigma makes me err on the side of caution with opioids and prescribe less, even if the patient presents with considerable pain.* |
| Stigma8 0.31 | A person with good character and upbringing is unlikely to develop opioid use disorder.* |
| Stigma7 0.30 | Addicted patients are extremely difficult to treat, thus, prioritizing the treatment of other diseases has more benefits to more patients.* |
| Know1 0.30 | Which of the following best describes how well-informed you are about the latest scientific literature on the pathophysiology of addiction? (I have expert level knowledge, I am well informed, I understand the basics of addiction, I could use a review of the pathophysiology of addiction) |
| Stigma1 0.25 | To what extent are people who are addicted at fault for their addiction? |
| Know4 -0.25 | Have you received any training in addiction medicine? |
| Stigma5 0.24 | Do you believe that opioid using patients are generally: (honest reporters of their own pain or dishonest reporters of their own pain) |
| Stigma6 0.23 | Do you believe that non-opioid using patients are generally: (honest reporters of their own pain or dishonest reporters of their own pain) |
| Dis1 -0.23 | Prescription opioids should be prescribed for: (Only after all other analgesic options have been attempted, acute pain only, acute & chronic pain from cancer or palliative care, acute & chronic pain) |
| Yrs4gp -0.18 | How many years have you been a practicing physician (out of highest level of training)? |
| Know2 0.17 | What is the name for the program which tracks prescribed opioids in Georgia? (Please do not look this up online) |
| Stigma2 -0.02 | Do you think physician stigma towards opioid addiction impacts quality of care for patients? |
| OpFreq -0.01 | Within the past year, I have prescribed opioids: |
| Stigma4 0.00 | Do you believe that opioid-addicted patients are: (less compliant than non-opioid addicted patients, about as compliant as non-opioid addicted patients, more compliant than non-opioid addicted patients) |
| Stigma3 0.00 | Do you believe that opioid-addicted patients are: (less trustworthy than non-opioid addicted patients, about as trustworthy as non-opioid addicted patients, or more trustworthy than non-opioid addicted patients) |

*Questions preceded by “To what extent do you agree with this statement”

The weights assigned to PC1 drove our interpretation that this principal component represents uncertainty with opioids. We theorized that uncertainty with opioids could be caused by lack of knowledge, an exaggerated reluctance or hesitance with opioids, or even stigmatizing attitudes towards opioids and those who use them. In support of our interpretation, Know3 (I lack knowledge, worse care) and Dis2 (stigma makes me prescribe less) were the most heavily weighted variables, emphasizing the importance of knowledge, dislike, and stigma for this principal component. Furthermore, PC1 incorporated several stigma predictor questions, especially Stigma8 and Stigma7, which further supports that stigma influences our idea of uncertainty with opioids. This stigma or other perceived negative attitudes may create uncertainty with how to safely prescribe opioids (see Discussion).

Regarding PC2, see Table 2.2 below for full PC2 results. Thus, since knowledge and experience (years of practice and frequency prescribing opioids) featured prominently, this principal component corresponds most strongly to overall knowledge/experience of opioids and addiction. Knowledge/experience with opioids is associated with correct recognition of the crucial opioid monitoring program, with years of experience in medicine, and with self-reported familiarity with addiction literature.

| TABLE 2.2: KNOWLEDGE/EXPERIENCE WITH OPIOIDS AND ADDICTION | |
|---|---|
| Eigenvalue | 2.34 |
| **VARIABLE<br>eigenvector or weight** | **FULL NAME** |
| OpFreq<br>0.49 | Within the past year, I have prescribed opioids: (Often, sometimes, rarely, never but I still have a DEA number to certify opioid prescriptions, never and I do not have a DEA number) |
| Know2<br>0.46 | What is the name for the program which tracks prescribed opioids in Georgia? (Please do not look this up online) |
| Know1<br>0.37 | Which of the following best describes how well-informed you are about the latest scientific literature on the pathophysiology of addiction? (I have expert level knowledge, I am well informed, I understand the basics of addiction, I could use a review of the pathophysiology of addiction) |
| Yrs4gp<br>0.32 | How many years have you been a practicing physician (out of highest level of training)? |
| Stigma5<br>0.28 | Do you believe that opioid using patients are generally: (honest reporters of their own pain or dishonest reporters of their own pain) |
| Stigma6<br>0.26 | Do you believe that non-opioid using patients are generally: (honest reporters of their own pain or dishonest reporters of their own pain) |
| Stigma7<br>-0.21 | Addicted patients are extremely difficult to treat, thus, prioritizing the treatment of other diseases has more benefits to more patients. * |
| Stigma2<br>0.19 | Do you think physician stigma towards opioid addiction impacts quality of care for patients? |
| Stigma8<br>-0.16 | A person with good character and upbringing is unlikely to develop opioid use disorder.* |
| Dis2<br>-0.15 | I sometimes feel that stigma makes me err on the side of caution with opioids and prescribe less, even if the patient presents with considerable pain.* |
| Stigma1<br>-0.15 | To what extent are people who are addicted at fault for their addiction? |
| Dis1<br>0.08 | Prescription opioids should be prescribed for: ( Only after all other analgesic options have been attempted, acute pain only, acute & chronic pain from cancer or palliative care, acute & chronic pain) |
| Know4<br>0.06 | Have you received any training in addiction medicine? |
| Stigma3<br>0.02 | Do you believe that opioid-addicted patients are: (less trustworthy than non-opioid addicted patients, about as trustworthy as non-opioid addicted patients, or more trustworthy than non-opioid addicted patients) |
| Stigma4<br>0.01 | Do you believe that opioid-addicted patients are: (less compliant than non-opioid addicted patients, about as compliant as non-opioid addicted patients, more compliant than non-opioid addicted patients) |
| Know3<br>-0.01 | My occasional lack of knowledge about the biology of addiction sometimes hinders my patients' outcomes. |

In addition, we attempted to discern a specific principal component for physician stigma to eventually compare with patient care. However, PCA did not produce an easily discernable stigma PC, as shown in Table 2.1 and 2.2 above. Figure 2 below shows a visual representation of PCA, where PC1 comprises the x-axis and PC2 comprises the y-axis. The vectors in the center represent the eigenvectors, which are calculated by how much weight each question received (relative importance) towards calculating the respective principal component.

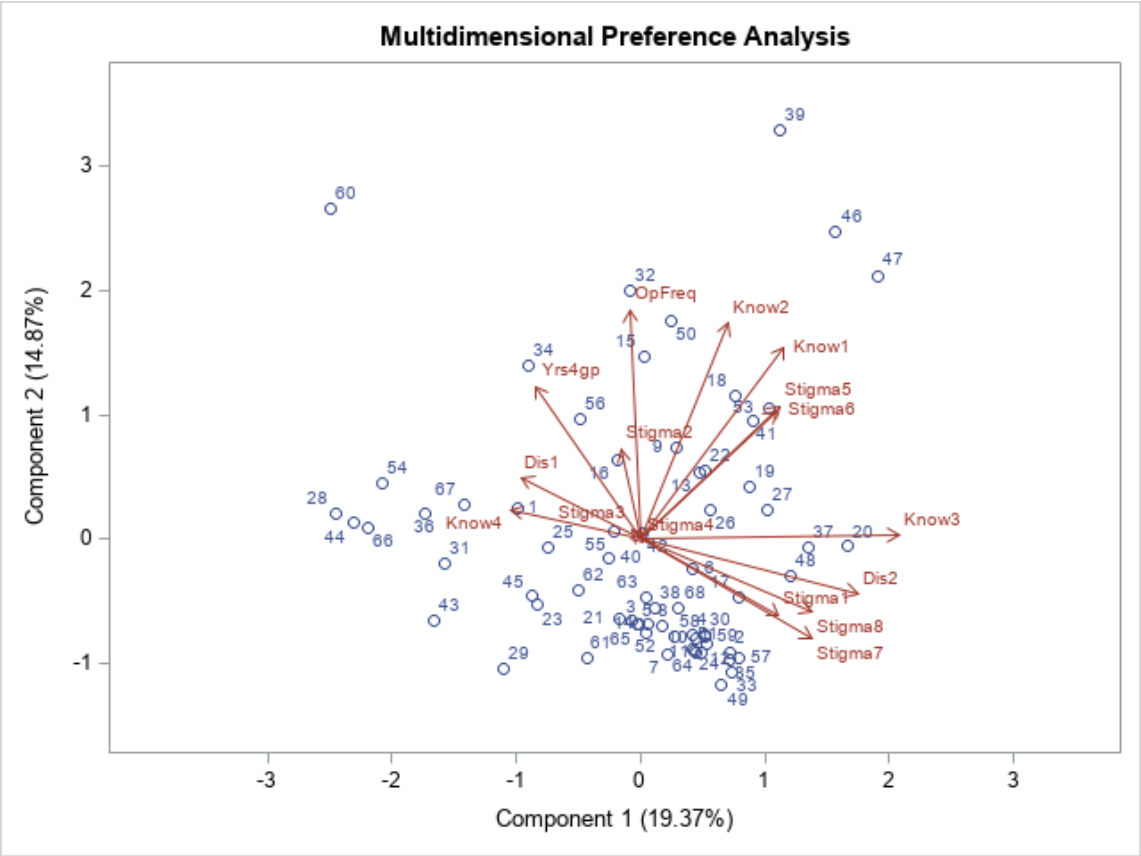



**Fig. 2: Visual representation of Table 2.1 and 2.2**, shows important variables explaining PCA-created, underlying variables. Each variable (question) is shown as a vector (eigenvector). Longer vectors represent more heavily weighted and more important variables to explaining a shared, underlying variable. Vectors projecting long on the x axis are more important to explaining uncertainty with opioids (PC1) and vectors long on y axis are more important to explaining knowledge/experience with opioids and addiction (PC2). Know3 (I lack knowledge, worse care) and Dis2 (Stigma makes me prescribe less) are most important for PC1, which drives our interpretation that PC1 represents uncertainty because it incorporates limited knowledge and limited certainty about opioid prescribing. OpFreq (freq. prescribed) and Know2 (Name of monitor prog) are most heavily weighted for PC2. Both questions assess knowledge and experience, which drives our knowledge/experience interpretation for PC2.

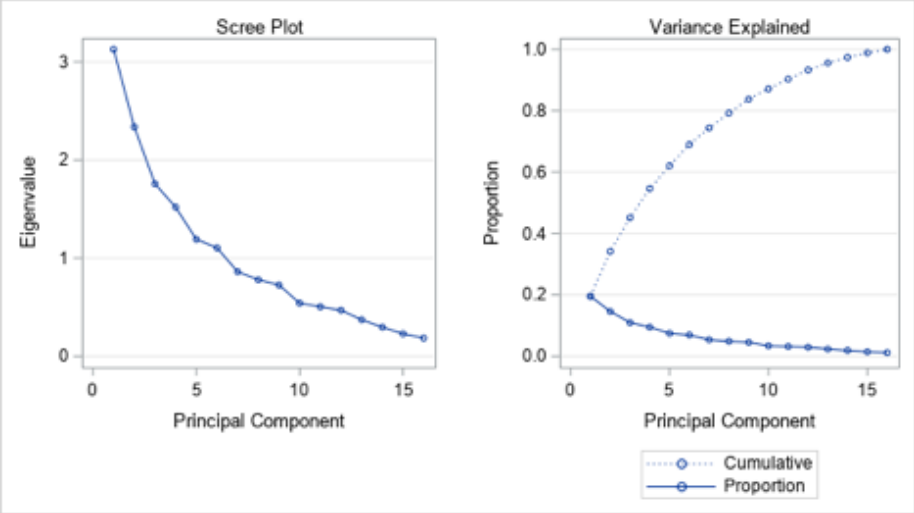



**Fig. 3: Scree Plot and Variance**
On left, Scree plot represents how much variability in the data is captured by our principal components. Highest point represents uncertainty with opioids (PC1, approx. 19%) and second highest represents knowledge/experience with opioids and addiction (PC2, approx. 15%). On right, variance explained shows that total variability accounted for by PC1 and PC2 is about 34%. The greater variability captured by PCs means more comprehensive questions and components.

### *3.3 Demographic Influences on Uncertainty with Opioids (PC1) and Knowledge/Experience (PC2)*

Upon examining the major demographics of age, race, sex, specialty, we found that physician sex, specialty, and age had significant influence on the principal components. Sex was significantly associated with uncertainty with opioids, in particular, significantly more females were less uncertain with opioids (p= 0.017, see Fig. 4). Additionally, there were some significantly different responses on specific stigma questions between sexes. Significantly fewer females believed that opioid using patients are dishonest reporters of their own pain (p= 0.002, Stigma 5, Table 3). Also, significantly fewer females agreed with the statement that addicted patients are extremely difficult to treat, and we should prioritize other patients (p= 0.017, Stigma 7, Table 4). Regarding specialty, ER specialists and other specialists were significantly more uncertain with opioids, while pain specialists were significantly more certain (p=0.01, see Fig.

5). Fig. 6 demonstrates that older physicians had significantly more experience and knowledge with opioids and addiction (p=0.02).

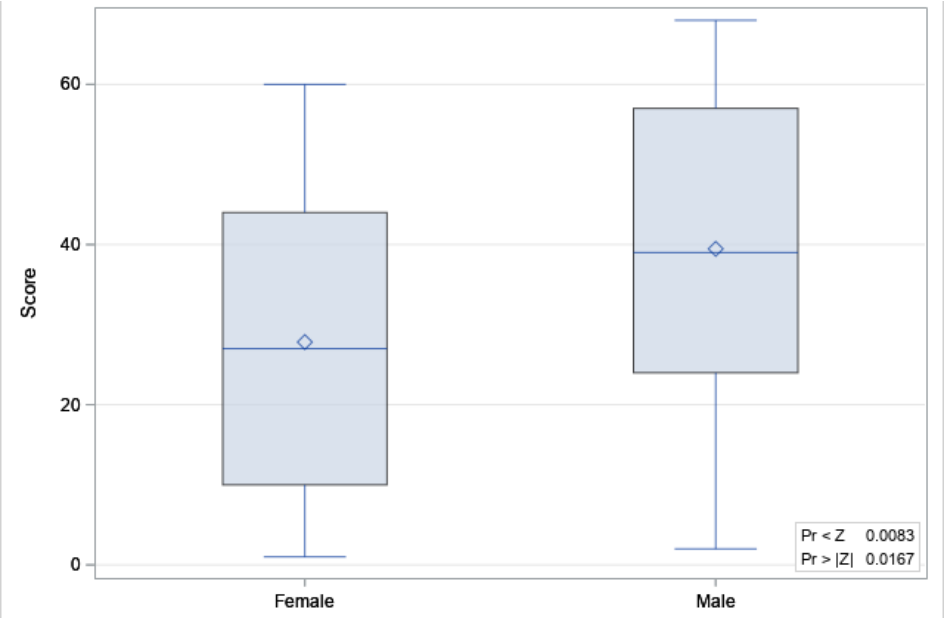



**Fig. 4: Sex Compared to Uncertainty with Opioids (Score for PC1)** Females have significantly less uncertainty with opioids than males (p= 0.017). Suggests females hold different attitudes or perceptions about opioids than males.

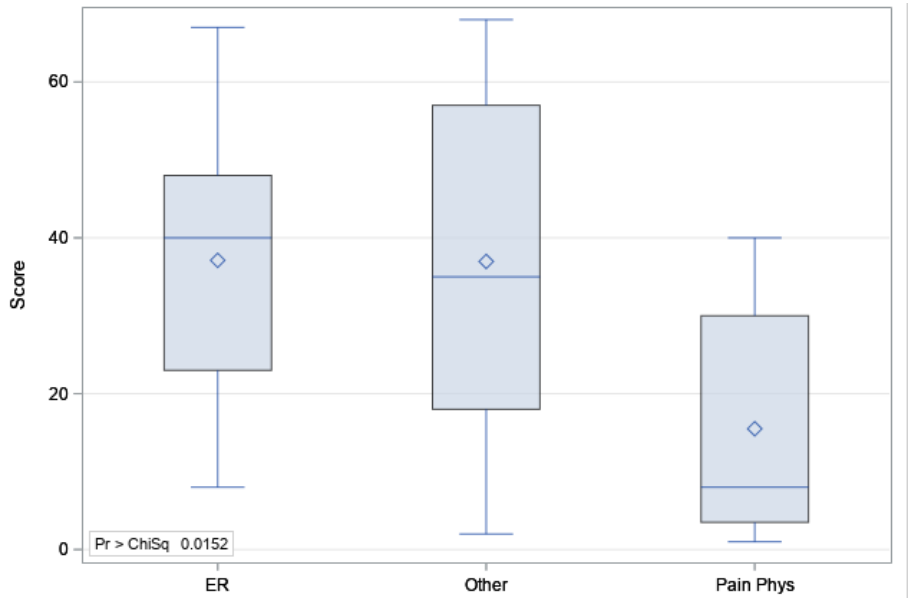



**Fig. 5: Specialty Compared to Uncertainty with Opioids (Score for PC1**) p= 0.015 indicates significantly more uncertainty with opioids amongst ER and other specialties. Pain physicians added experience and training is likely contributor to greater certainty

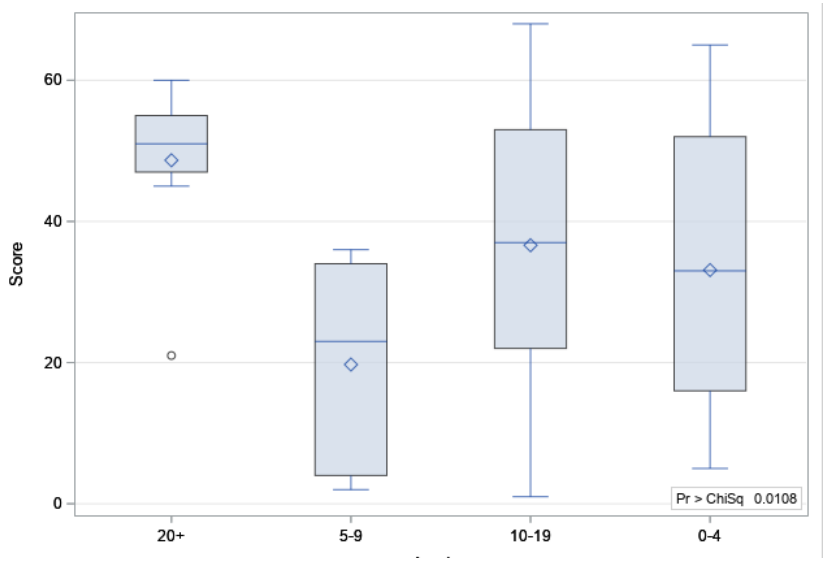



**Fig. 6: Knowledge/experience with opioids and addiction (Score for PC2), compared between years of practice in four groups** Physicians who have practiced longer are significantly more knowledgeable/experienced with opioids and addiction.

**Table 3: Significantly fewer females distrust opioid-using patients' reports of pain (p=0.002).**

| STIGMA 5: DO YOU BELIEVE THAT OPIOID USING PATIENTS ARE GENERALLY: | | | | |
|---|---|---|---|---|
| | | **HONEST PAIN REPORTERS** | **DISHONEST PAIN REPORTERS** | **TOTAL** |
| **GENDER** | Male | 26 (67%) | 13 (33%) | 39 |
| | Female | 28 (97%) | 1 (3%) | 29 |
| **TOTAL** | | 54 (79%) | 14 (21%) | 68 |
| | | Fisher Exact Test | p= **0.0024** | |

**Table 4: Significantly fewer females agree to prioritize non-OUD patients (p= 0.017)**

| STIGMA 7: (TO WHAT EXTENT DO YOU AGREE WITH THIS STATEMENT?) ADDICTED PATIENTS ARE EXTREMELY DIFFICULT TO TREAT, THUS, PRIORITIZING THE TREATMENT OF OTHER DISEASES HAS MORE BENEFITS TO MORE PATIENTS | | | | | | |
|---|---|---|---|---|---|---|
| | | **STRONGLY DISAGREE** | **DISAGREE** | **AGREE** | **STRONGLY AGREE** | **TOTAL** |
| **GENDER** | Male | 6 (15%) | 21 (54%) | 12 (31%) | 0 (0%) | 39 |
| | Female | 5 (17%) | 23 (79%) | 1 (3%) | 0 (0%) | 29 |
| **TOTAL** | | 11 (16%) | 44 (65%) | 13 (19%) | 0 (0%) | 68 |
| | | | | Mantel-Haenszel Chi-Square Test | p= **0.017** | |

### *3.4 Patient Care vs Uncertainty with Opioids (PC1) and Knowledge/Experience (PC2)*

Both uncertainty with opioids and knowledge/experience with opioids and addiction were significant predictors of patient care. Figure 7 shows that uncertainty with opioids was a significant predictor of patient care ($p= 0.005$), as uncertainty increases then care worsens. Figure 8 shows that knowledge/experience is also a significant predictor of patient care ($p= 0.02$), as knowledge increases than care improves. Moreover, we observed that data for PC2 were positively skewed. A Spearman Rank Correlation was conducted to ensure that the data were not "too skewed,", or, that a violation of the assumption of normality in the linear regression was not disproportionately influencing results. Spearman Rank Correlation is the non-parametric equivalent to Pearson Correlation, and uses the median and rank order of the data to calculate correlation. So, when using Spearman Rank Correlation, any outliers do not have as strong an impact on the overall model. Results show that the correlation was still significant ($p=0.037$, $r= -0.25$). Therefore, the data were not too skewed, and results of the linear regression are reliable.

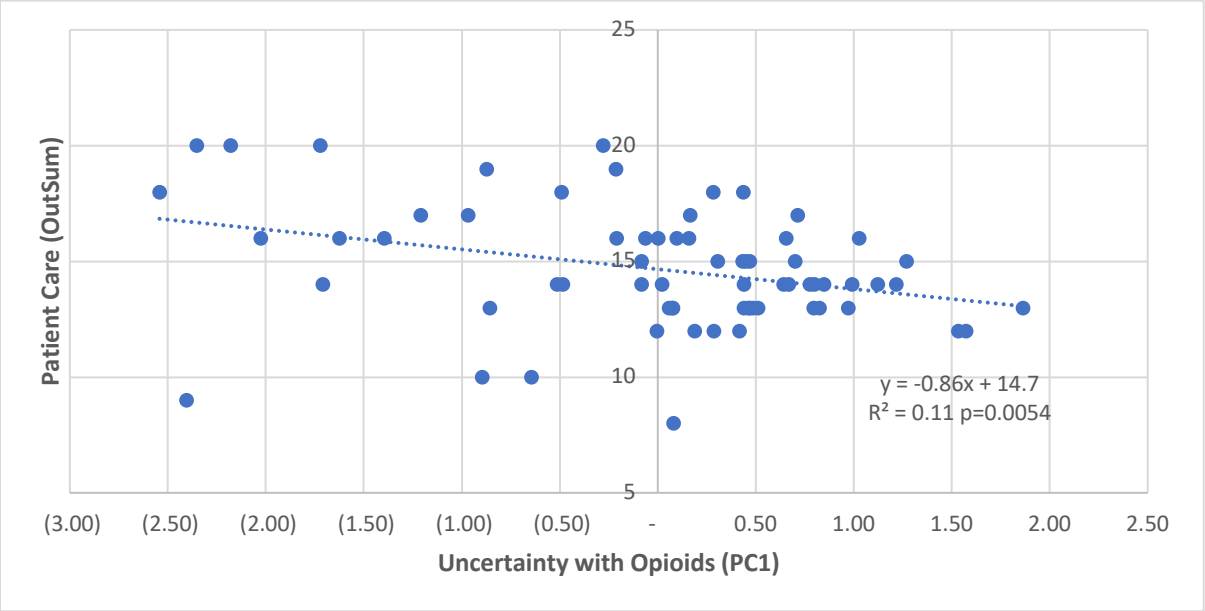



**Fig. 7: Patient Care vs Uncertainty with Opioids (PC1)**
Slope of trendline is significantly different than zero (p=0.0054); thus, PC1 is significant predictor of patient care when assessed in simple linear regression. Higher score on PC1 (more positive on x-axis) means greater uncertainty. Thus, negative slope of trendline indicates inverse correlation between uncertainty and patient care: as uncertainty with opioids increases, then patient care worsens.

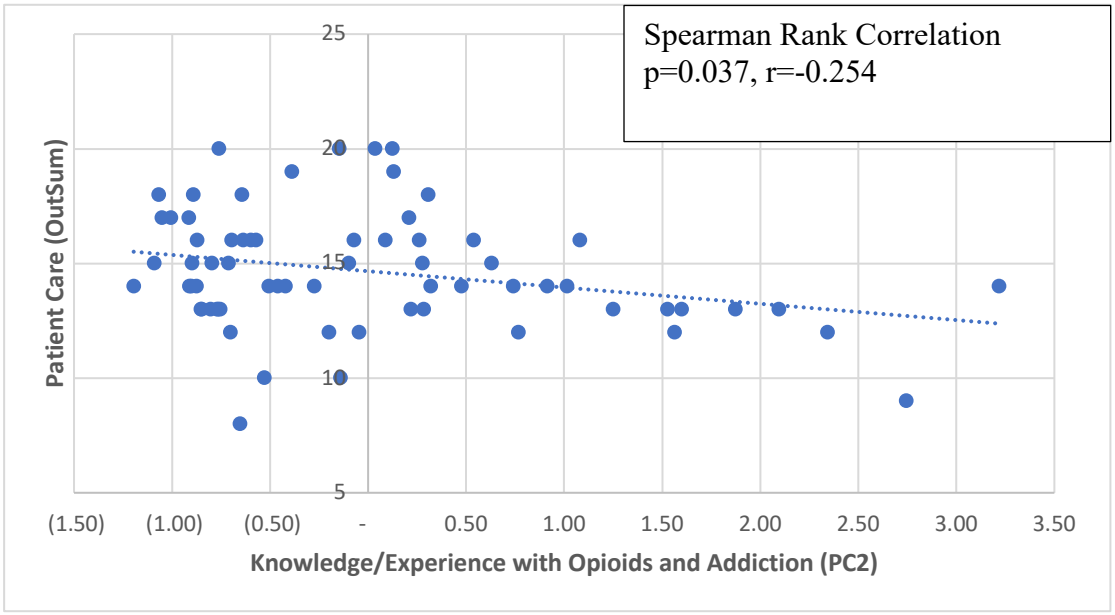



**Fig. 8: Patient Care vs Knowledge/Experience with Opioids and Addiction (PC2)**
Unequal variance required Spearman Rank Correlation. Spearman Rank Correlation yielded p= 0.037; thus, PC2 is a significant predictor of patient care. Note, unlike PC1 where a higher score corresponds to a greater value, a higher score on PC2 signifies less knowledge/experience.

**Table 5, Linear Models of Patient Care vs Predictor Variables**

| Model | Predictors | Beta | p-value | AIC | Adj $R^2$ |
|---|---|---|---|---|---|
| 1 | PC1<br>PC2 | -0.86<br>-0.71 | 0.0054<br>0.016 | 189.0 | 0.16 |
| 2 | ER Specialty*<br>Other Specialty* | -4.42<br>-3.29 | <0.0001 | 181.6 | 0.25 |

* Compared to Pain Physician Specialty as the reference group

Displayed above with Table 5, row 2, specialty was the only demographic which was a significant predictor of better patient care. Pain specialists unsurprisingly provide the best pain care, and ER physicians and other specialists provide the worst pain care ($p<0.0001$, Table 5). Top row p-values demonstrate that uncertainty with opioids and knowledge/experience with opioids and addiction are significant predictor variables of patient care, with PC1 more significant than PC2 by an order of magnitude. Furthermore, multiple regression considering all predictors and demographics revealed that specialty was more significant at predicting better patient care than uncertainty with opioids and opioids and addiction knowledge/experience. Model 2's lower Akaike Information Criterion (AIC) score relative to Model 1 indicates that there is a stronger correlation between specialty and patient care, than between uncertainty with opioids (PC1) and patient care, and between knowledge/experience with opioids and addiction (PC2) and patient care. Moreover, when specialty is incorporated into multiple regression, then uncertainty and knowledge/experience are no longer significant predictors of patient care. This prompted a subset analysis to determine how uncertainty and knowledge/experience can influence patient care within specialty.

### *3.5 Subset Analysis within Specialties: Patient Care vs Uncertainty and Knowledge/Experience*

Table 6 below shows subset analysis results. Subset analysis used linear regression to compare patient care vs knowledge/experience with opioids and addiction (PC2) within ER and

other specialists (Model 3), and patient care vs uncertainty with opioids (PC1) within pain specialists (Model 4).

**Table 6 Subset Analysis: Patient Care vs Principal Components within Specialties**

| MODEL | WITHIN THE SPECIALTY | PC1 | PC2 | BETA | 95% LCL | 95% UCL | p-value | Adj. $R^2$ |
|---|---|---|---|---|---|---|---|---|
| 3 | Other only | | Yes | -0.86 | -1.45 | -0.27 | **0.005** | 0.19 |
| 4 | Pain only | Yes | | -1.19 | -2.31 | -0.07 | **0.031** | 0.50 |

Model 3 indicates that knowledge/experience with opioids and addiction (PC2) was significant among other specialists (p= 0.005). Thus, since other specialists reported lower knowledge/experience and worse patient care on average, then those specialists had significantly less knowledge and significantly worse patient care, compared to pain physicians. Model 4 indicates that uncertainty with opioids (PC1) was significant among pain physicians, thus, pain physicians were significantly less uncertain with opioids (i.e. more certain or confident). Note, PC1's high R squared (50%) specifies that PC1 accounts for 50% of the variability in the data among pain physicians, suggesting that PC1 is a good metric of uncertainty among pain physicians despite the low sample size (n= 8). Moreover, Figure 9 below suggests that pain physicians (who are more certain about opioids on average) had better patient care than ER and other specialists (who were less certain on average). The pain specialists' trendline suggests that as uncertainty increased among pain specialists, then patient care worsened. But, patient care among uncertain pain physicians remained higher on average than patient care of similarly uncertain ER and other specialists. Lastly, Figure 10 highlights that the relationship between knowledge/experience and patient care is more significant when solely analyzed with other

specialists. Linear regression was only possible within other specialties because the assumptions of linear regression were violated in other groups with unequal variance.

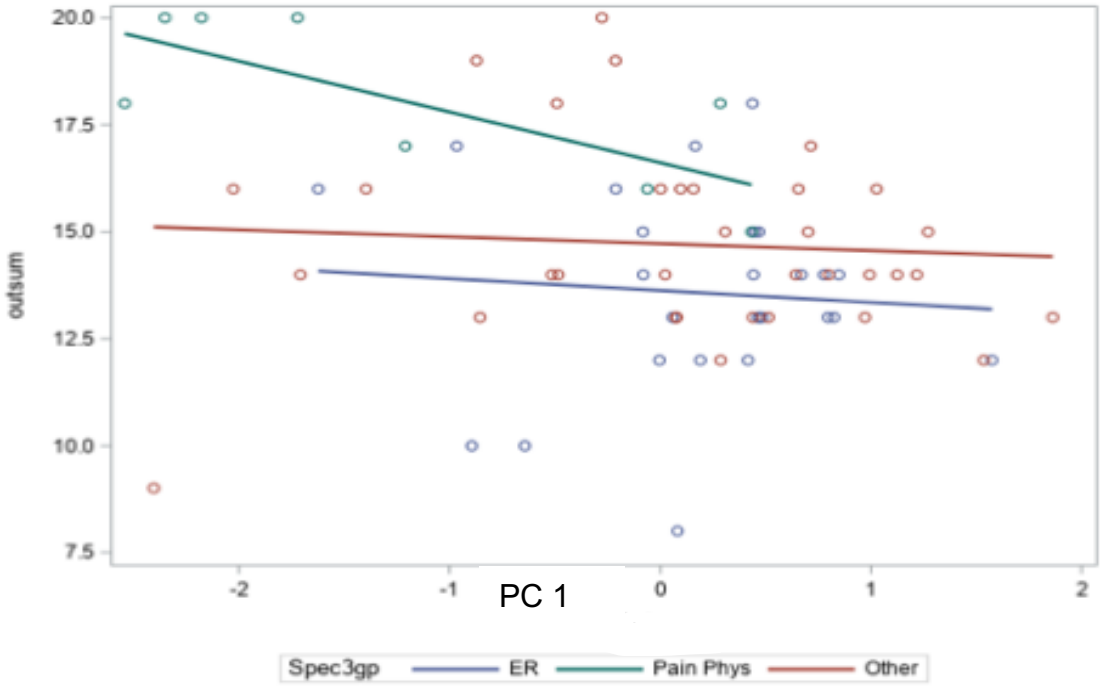



**Fig. 9 Patient Care (OutSum) vs Uncertainty with Opioids (PC1) Compared by Specialty:** As uncertainty increases along x axis, patient care tends to decrease. There is clear certainty and better patient care with some high performing pain specialists (top left green circles). As uncertainty increased among pain physicians, then patient care worsened (middle green circles). However, uncertain pain physicians' patient care is still better on average compared to similarly uncertain ER and Other specialists.

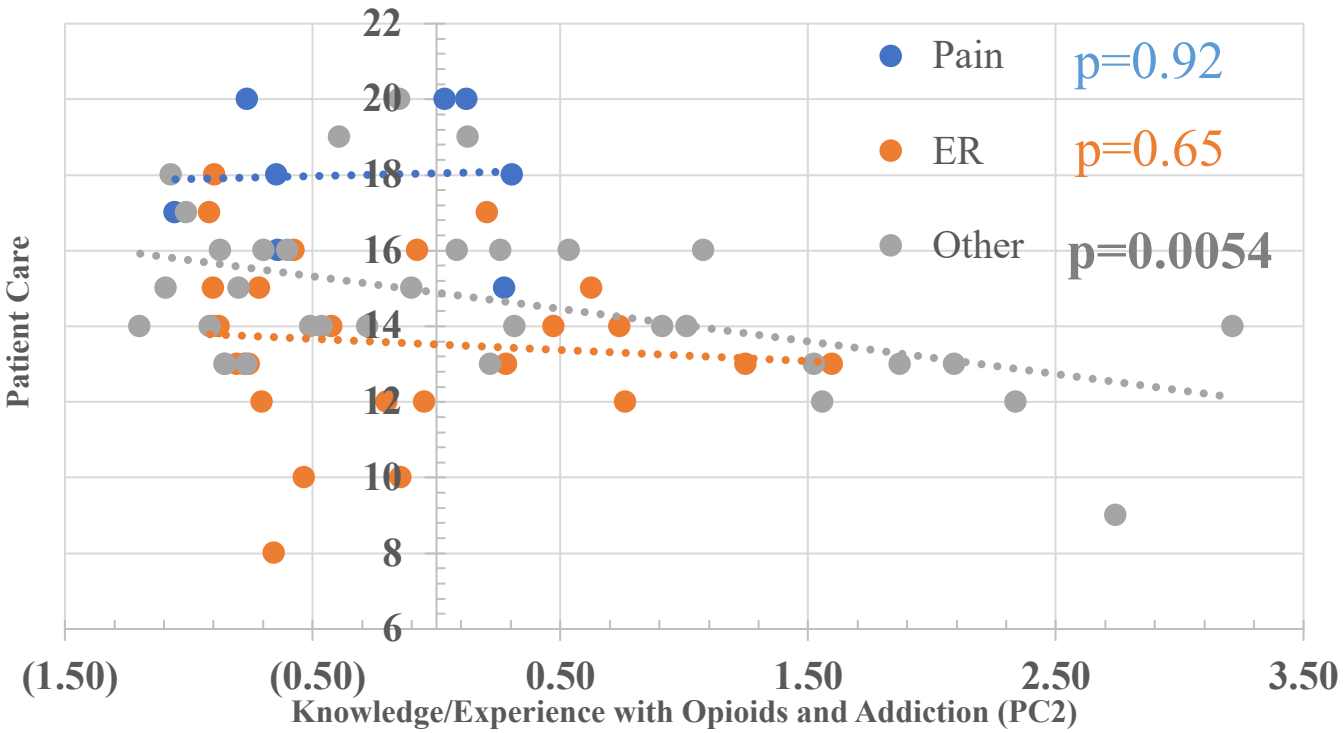



**Fig. 10 By Specialty, Patient Care vs Knowledge/Experience with Opioids and Addiction (PC2):** Unlike PC1 where a higher score corresponds to a greater value, a higher score on PC2 signifies less knowledge/experience. Note, within other specialists, stronger relationship between better patient care and more knowledge/experience than when compared with all specialties (Fig. 8) p=0.005 vs p= 0.037. Negative trendline and significant p value indicate that within other, as knowledge/experience increases, then patient care significantly improves.

## 4. Discussion

### *4.1 Importance*

#### *4.1.1 Hypothesis Testing: Stigma's Influence on Patient care*

We tested two hypotheses overall: 1) physicians with stigmatizing attitudes are more likely to give substandard patient care towards opioid using patients and patients in chronic pain, and 2) that physicians with dislike towards opioids are also more likely to give substandard patient care with opioid using patients and patients in chronic pain. Regarding the former, PCA results support this hypothesis. Our principal component of uncertainty with opioids (PC1) prominently features stigmatizing attitudes (see table 2.1), suggesting that physicians who have this uncertainty also tend to have stigmatizing attitudes. In addition, simple linear regression revealed that physicians who are more uncertain are significantly more likely to give substandard patient care (Fig. 7). Given those results, physicians who are uncertain are more likely to hold stigmatizing views towards opioids and addiction, and are also more likely to give substandard patient care. Regarding the second hypothesis, uncertainty with opioids (PC1) also heavily featured dislike of opioids: Dis2 (stigma makes me prescribe less opioids) was the second highest correlated variable towards uncertainty with opioids. This finding also emphasizes the role of stigma in creating this uncertainty with opioids.

#### *4.1.2 Reviewing our Interpretations: Evidence in Literature and Significance of PCs*

We interpreted that PC1 could represent that physicians' stigmatizing attitudes can influence their behavior and can create uncertainty with how to safely prescribe opioids. Previous literature on physician attitudes with opioids supports some of this underlying rationale (Nichols et al., 2020, Dineen et al., 2016). Nichols et al. found that many chronic pain patients are reluctant to use opioids but feel obligated to continue taking them because they perceive opioids as the only effective treatment (Nichols et al., 2020). This relates to Dis2, which assesses how physician

stigma towards opioids (i.e. opioid dislike) influences their decision to prescribe them. Physicians may feel obligated to go against their clinical instinct or beliefs to prescribe opioids, like their patients who may possibly continue opioids against their wishes. Opioids could be perceived to be the only way to deal with pain or treat pain most effectively. Despite risks of opioid abuse, some physicians may feel they have to prescribe opioids to treat pain because that is the only effective treatment for their patients. Given the role of stigma and the cost-benefit analysis required with opioids, it is reasonable to suggest that physicians may be conflicted or uncertain about how to prescribe opioids. This internal physician conflict has been observed as a substantial complication of effective pain management and safe opioid prescribing (Dineen et al., 2016).

With PC1, we believe that uncertainty could be associated with opioid dislike or reluctance as shown with Dis2 (stigma makes me prescribe less) featuring prominently in this principal component. With Dis2, we analyze how stigma impacts clinical practice. The question evaluates if physicians refuse to prescribe opioids to patients presenting with considerable pain, specifically due to stigma. We might suspect that physicians may be uncertain about when to prescribe opioids because they are unsure if patients are drug-seekers or faking their pain. Thus, this uncertainty could manifest in altered prescribing. Physicians may be unsure about risking opioid abuse to treat pain with opioids because they may hold stigmatizing beliefs about opioids themselves (given publicity about opioid abuse) or about patients who use opioids (given stereotypes that continue to pervade society about addiction). Moreover, Nichols et al. mentions that patients often feel as though providers are “not on the same page” about opioids and their chronic pain (Nichols et al., 2020). This suggests that there may exist a breakdown in communication between the physician and their patient, perhaps due to a broader physician

uncertainty about how to treat pain and when to prescribe opioids. Especially regarding chronic pain, some physicians are uncertain how to approach the complexity and nuance of pain (Nichols et al., 2020). Intense medical scrutiny of prescribing larger doses of opioids, coupled with nuanced pain presentations unique to every patient and the limited time for physicians to assess pain, all creates a challenging environment for physicians (Dineen et al., 2016). PC2 (knowledge/experience with opioids and addiction) follows with the reasonable assumption that physicians with more experience and knowledge perform better.

#### *4.1.3 Specialty, Uncertainty, and Worse Patient Care: Training as a Solution?*

Non-pain specialists (ER and other) were significantly more uncertain with opioids on average. While this result was unsurprising, it emphasizes the need for non-pain specialists to be trained in effective pain management. In addition, and important to note, specialty was a more significant predictor of stigma than uncertainty with opioids and knowledge/experience with opioids and addiction. One possible interpretation is that physician specialty and training plays a major role in how physicians treat pain effectively. This could suggest that certain specialties are better trained to handle complex pain situations and opioid prescribing, and may suggest that some physicians are more vulnerable to delivering worse pain care. For example, primary care physicians (PCPs) are often the first interaction a patient has in a healthcare setting when they present with pain (Mills et al., 2016). PCPs must recognize and treat pain, despite limited pain training. If these physicians are more prone to stigma, then this is especially troubling because the PCPs' initial impression of patients often guides further referrals to pain specialists. Thus, stigma in primary care could be especially burdensome on overall patient care given the large quantity of patients seen by PCPs and their overall influence on patient care (Mills et al., 2016, Krebs et al., 2014). Our study only included 5 PCPs, and further research should specifically

analyze how uncertainty impacts PCPs and patient care. Moreover, given that millions of Americans suffer from chronic pain, proper training is essential and is strongly suggested by our results (Dahlhamer et al., 2018, Mills et al., 2016). In our results, as uncertainty increased among pain specialists, then patient care worsened and became closer to patient care obtained by ER and other specialists (Fig. 7). This could suggest that even pain specialists are vulnerable to uncertainty with opioids, and should perhaps be exposed to periodic, supplementary training on opioids as newer research emerges. While this finding is limited by the small number of pain specialist participants (n=8), R squared analysis (50% of variability captured) suggests that it should be supported in larger cohorts.

#### *4.1.4 Sex Comparison to Uncertainty with Opioids (PC1)*

One major unexpected finding was that sex was significantly associated with uncertainty. To the best of our knowledge, this is the only known study to indicate that sex can influence attitudes related to opioid prescribing, specifically with stigmatizing attitudes related to uncertainty with opioids. Since females are less uncertain about opioids and because the construction of our uncertainty variable features stigma variables, then this finding suggests that females are less likely to possess stigmatizing attitudes. One possible interpretation is that females are more confident in their decision to prescribe opioids. Since females trust their patients' pain reports more than males, perhaps females are more certain about prescribing opioids to patients in opioid-necessitating pain because they are less likely to suspect drug seeking behavior. Chi-squared analysis supports that females do indeed trust their patients more, with significantly less females reporting that they distrust opioid using patients reports of their own pain ($p=0.0024$). However, more research is needed to support these interpretations further, and it is not clear why females may trust their patients more than males.

### *4.1.5 Miscellaneous: Patient Care Significance and Honesty vs Compliance*

We had attempted to create a patient care variable from PCA by weighing 5 patient care questions, however, answers to 4 of the 5 questions were closely correlated and weighted very similarly. Thus, a simple summation of patient care score was effective because most of the questions were the same type of patient care question. Yet, of note, Out 5 (I always suggest non-opioid alternative treatments and therapies) was answered significantly differently than the other patient care questions. This suggests that Out 5 should be explored in further studies to analyze how it relates to stigma separately. Moreover, physicians who responded that opioid using patients are more dishonest than other patients did not necessarily agree that opioid using patients are less compliant than other patients. Perceived dishonesty is not directly related to compliance, which could suggest that while physicians may stigmatize opioid users, they also acknowledge that they can still be "good" patients in terms of their compliance with physician directions.

## *4.2 Limitations and Future Directions*

While our results supported our hypotheses, we acknowledge some limitations with our data collection, the ambiguity of stigma, lack of patient input, and generalizability. First, survey data is inherently limited in the type of questions that it can ask and how many questions it can ask. We could not easily capture the attitudes of stigma with a survey because stigma encompasses several variables and we cannot ask too many questions to encourage survey completion. Thus, further studies should evaluate the influence of stigma on patient care using in-person interviews or other qualitative methods, which could allow more question flexibility. Second, we acknowledge that stigma is a very complex set of ideas and our survey cannot accurately reflect its entire set of behaviors. Also, stigma is not a strictly defined term, so there is ambiguity on the study of stigma since we could not directly ask physicians about their stigma without biasing

responses. This difficulty is emphasized when PCA did not create a "stigma" PC. However, as a pilot study directly studying stigma with opioids and effects on care, we believe our results are still validated by suggestions in the literature and appropriate use of statistical methods. Additionally, our recruitment was unable to incorporate patient attitudes, which could serve as a valuable guide in complement with physician responses. Further study should analyze patient attitudes towards opioids and how the physician-patient interaction influences pain management and OUD risk. Also, another limitation is that demographic differences altered the descriptive statistics and limited our sample generalizability to Fulton County. Lastly, despite our power analysis supporting our sample size (necessitating $n > 50$), our sample size is smaller than ideal for a PCA analysis, which typically has over 100 responses. The smaller sample size may have influenced creation of unstable principal components. Our sample was focused on Emory physicians, and future studies should evaluate physician attitudes from a wider range of areas. Our survey also did not consider the impact of opioids in rural communities, whose physicians may possess different attitudes than urban physicians. Overall, while we suspect that our underlying hypotheses should still be supported, further studies should be conducted in larger and more diverse physician samples to support our findings.

## 5. Conclusions

As a pilot study, we believe our findings are promising towards understanding how physicians prescribe opioids and alleviating the healthcare burden of opioid over-prescription, especially when considering that millions of patients complain of pain (Mills et al., 2016). While opioid mortality is important to study and reduce, we approach this societal issue of opioids in a more nuanced way which reflects the complexities of American opioid prescribing. Stigma is complex, so we used PCA which can readily use multiple questions to combine towards an appropriate stigma variable. While we did not create a precise stigma variable, we did create a

clearer concept of physician uncertainty with opioids (PC1), which strongly incorporated stigma. Moreover, we found that this uncertainty significantly worsens patient care. While there have been many studies on stigma's prevalence in various medical settings, few studies have analyzed how stigmatizing attitudes are directly linked to patient care with opioids (van Boekel et al., 2013, Nichols et al., 2020). We intend our results to guide more effective pain management, to support more universalized standards of pain care, and to assist in safe prescribing of opioids. In response to the opioid crisis, the medical community should be wary of blanket bans on opioids or assuming that all patients who use opioids will become addicted. Opioids are dangerous; however, they offer remarkable benefits to many patients in extensive pain (Nichols et al., 2020). We intend for our research to encourage greater efforts to studying the relationship between opioid use and OUD, in order to guide more practical OUD risk assessment. Recently, the medical community and larger society have recognized that stigma is a serious idea that prevents people from getting appropriate mental healthcare, however, there has been limited attention on exactly how stigma manifests in medical care. Our results suggest that stigma can manifest as uncertainty, and further study should pursue the constellation of attitudes and behaviors which can influence opioid prescribing. Moreover, our results suggest that stigma is more nuanced with opioids, and training efforts should go beyond discouraging opioid prescribing as a rule of thumb. The inability to directly identify a stigma variable emphasizes that stigma is hard to clearly recognize and fix with an absolute policy across all specialties. This suggests the need for nuanced training, tailored to physician specialty. Given our results which found that ER and Other specialists are more prone to stigma, our results encourage opioid trainings more tailored to the lives of certain specialists and the realities they face. For example, ER physicians may be more rushed and may not be able to make thorough pain evaluations and OUD risk assessments,

given the fast-paced nature of emergency medicine. Thus, results suggest that current opioid training efforts must focus on certain specialties which are more vulnerable to stigma and to providing worse care with opioids.

Moreover, it is important to understand that patient satisfaction and good standards of practice can often align. Currently, standards of care with opioids are often unclear or unstandardized. There are clear benefits to endorsing more universal standards of care, for both physicians and patients. Some patients consider urine tests to be evidence that physicians genuinely care for them, rather than physician suspicion, by checking for evidence of addiction without judgment as a policy consistent across all patients (Krebs et al., 2014). This further emphasizes the importance of good practice standards which may also encourage better patient attitudes. Standards of care are especially important in pain management when opioid prescribing can vary extremely. Thus, more research focused on standards of care in opioid care is crucial to improve patient care. Continued research should focus on how physician attitudes can influence adoption of standards of care, how standards of care vary with pain management and opioids, and how patient attitudes towards opioids and opioid prescribers can influence their patient care. Given the scope of the opioid crisis, it is essential that physicians understand how their attitudes and their patients' attitudes impact individual quality of life and overall public health and safety.

## 6. Appendix: Tables and Figures

**Table A1: Survey Questions Categories and Abbreviations**

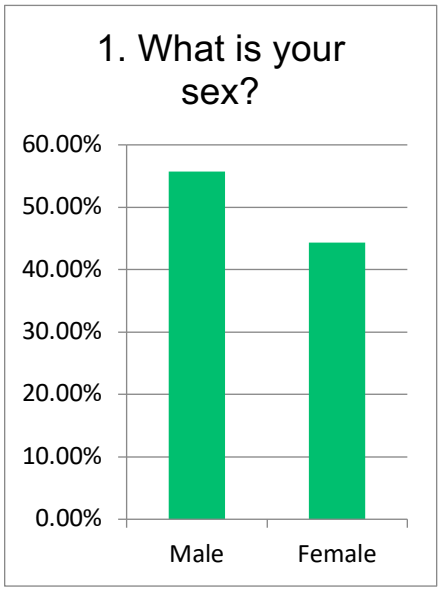
| | | | | WEIGHT | |
|---|---|---|---|---|---|
| **CATEGORY** | **QUESTION ABBREV.** | **FULL QUESTIONS** | **SHORT QUESTION** | **PC1** | **PC2** |
| **STIGMA PREDICTOR QUESTIONS** | Stigma1 | 14. To what extent are people who are addicted at fault for their addiction? | At fault for addiction | 0.25 | -0.15 |
| | Stigma2 | 15. Do you think physician stigma towards opioid addiction impacts quality of care for patients? | Stigma affects pt QoC | -0.02 | 0.19 |
| | Stigma3 | 17. Do you believe that opioid-addicted patients are: (less trustworthy than non-opioid addicted patients, about as trustworthy as non-opioid addicted patients, or more trustworthy than non-opioid addicted patients) | OUD pt less trustworthy | 0.00 | 0.02 |
| | Stigma4 | 18. Do you believe that opioid-addicted patients are: (less compliant than non-opioid addicted patients, about as compliant as non-opioid addicted patients, more compliant than non-opioid addicted patients) | OUD pt less compliant | 0.00 | 0.01 |
| | Stigma5 | 19. Do you believe that opioid using patients are generally: (honest reporters of their own pain or dishonest reporters of their own pain) | Opioid pt dishonest pain | 0.24 | 0.28 |
| | Stigma6 | 20. Do you believe that non-opioid using patients are generally: (honest reporters of their own pain or dishonest reporters of their own pain) | Reg pt dishonest pain | 0.23 | 0.26 |
| | Stigma7 | 23. Addicted patients are extremely difficult to | OUD difficult, treat others | 0.30 | -0.21 |

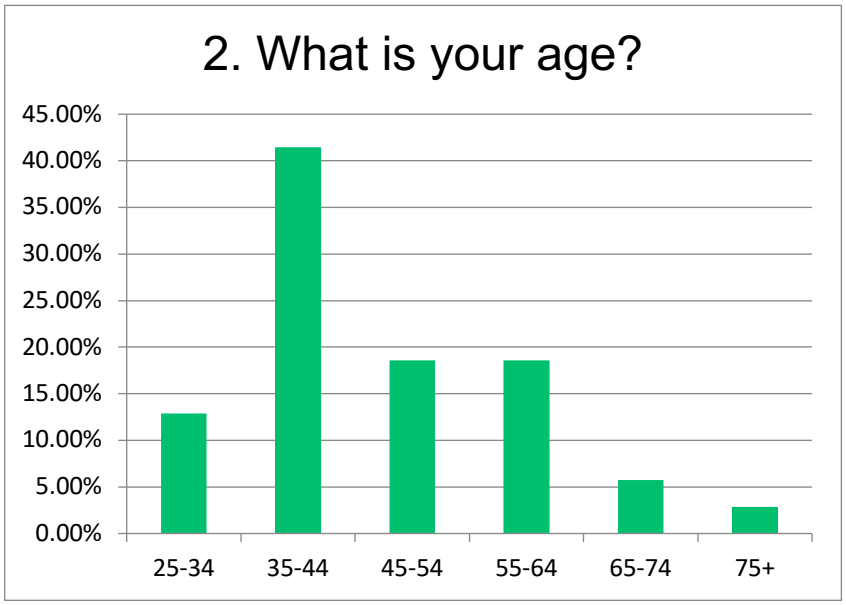
| | | | | | |
|---|---|---|---|---|---|
| | | treat, thus, prioritizing the treatment of other diseases has more benefits to more patients.* | | | |
| | Stigma8 | 24. A person with good character and upbringing is unlikely to develop opioid use disorder.* | Good character not OUD | 0.31 | -0.16 |
| **DISLIKE PRESCRIBING OPIOID PREDICTORS** | Dis1 | 16. Prescription opioids should be prescribed for: ( Only after all other analgesic options have been attempted, acute pain only, acute & chronic pain from cancer or palliative care, acute & chronic pain) | Prescribe for situation | -0.23 | 0.08 |
| | Dis2 | 25. I sometimes feel that stigma makes me err on the side of caution with opioids and prescribe less, even if the patient presents with considerable pain.* | Stigma makes me prescribe less | 0.39 | -0.15 |
| **KNOWLEDGE QUESTIONS** | Know1 | 21. Which of the following best describes how well-informed you are about the latest scientific literature on the pathophysiology of addiction? (I have expert level knowledge, I am well informed, I understand the basics of addiction, I could use a review of the pathophysiology of addiction) | How Informed Addiction | 0.30 | 0.37 |
| | Know2 | 22. What is the name for the program which tracks prescribed opioids in Georgia? (Please do not look this up online) | Name of monitor prog | 0.17 | 0.46 |
| | Know3 | 26. My occasional lack of knowledge about the biology of addiction sometimes hinders my patients' patient care.* | I lack knowledge, worse care | 0.48 | -0.01 |

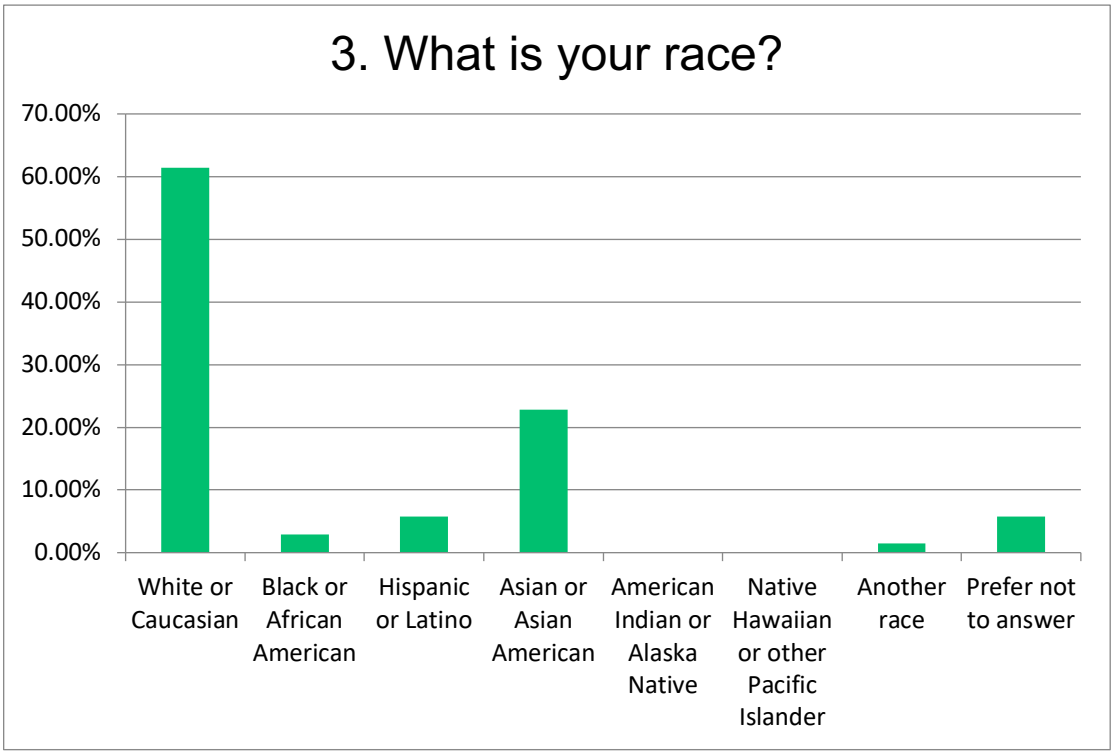
| | | | | | |
|---|---|---|---|---|---|
| | Know4 | 7. Have you received any training in addiction medicine? | Addiction training | -0.25 | 0.06 |
| **DEMOGRAPHIC QUESTIONS** | GenderF2 | 1. What is your sex? | Sex | N/A | N/A |
| | Age6gp | 2. What is your age? | Age group | N/A | N/A |
| | Race8gp | 3. What is your race? | Race | N/A | N/A |
| | Location | 4. Please list the town or city where you practice. | City | N/A | N/A |
| | Yrs4gp | 5. How many years have you been a practicing physician (out of highest level of training)? | Years practice, 4 groups | -0.18 | 0.32 |
| | Spec3gp | 6. What is your medical specialty? | Specialty | N/A | N/A |
| | OpFreq | 8. Within the past year, I have prescribed opioids: | Freq. prescribed | -0.01 | 0.49 |
| **POTENTIAL RESPONSE BIAS** | Bias | 27. How did you hear about the survey? | How heard of survey | N/A | N/A |
| | | | | **Outcome PC1**** | **Outcome PC2**** |
| **PATIENT CARE QUESTIONS **** | Out1 | 9. I feel that I am able to provide individualized care for the majority of my chronic pain patients.* | Individualized care | 0.55 | -0.19 |
| | Out2 | 10. I have good rapport with most of my chronic pain patients.* | Good rapport | 0.54 | 0.03 |
| | Out3 | 11. I routinely monitor my opioid patients with drug screens and checks of the prescription monitoring database.* | Monitor PDMP | 0.43 | -0.16 |
| | Out4 | 12. I routinely ensure that my patients have improved pain and function when I prescribe opioids.* | Improved pain/function | 0.47 | 0.30 |
| | Out5 | 13. I always suggest non-opioid alternative treatments and therapies.* | Non-opioid alternatives | 0.02 | 0.92 |

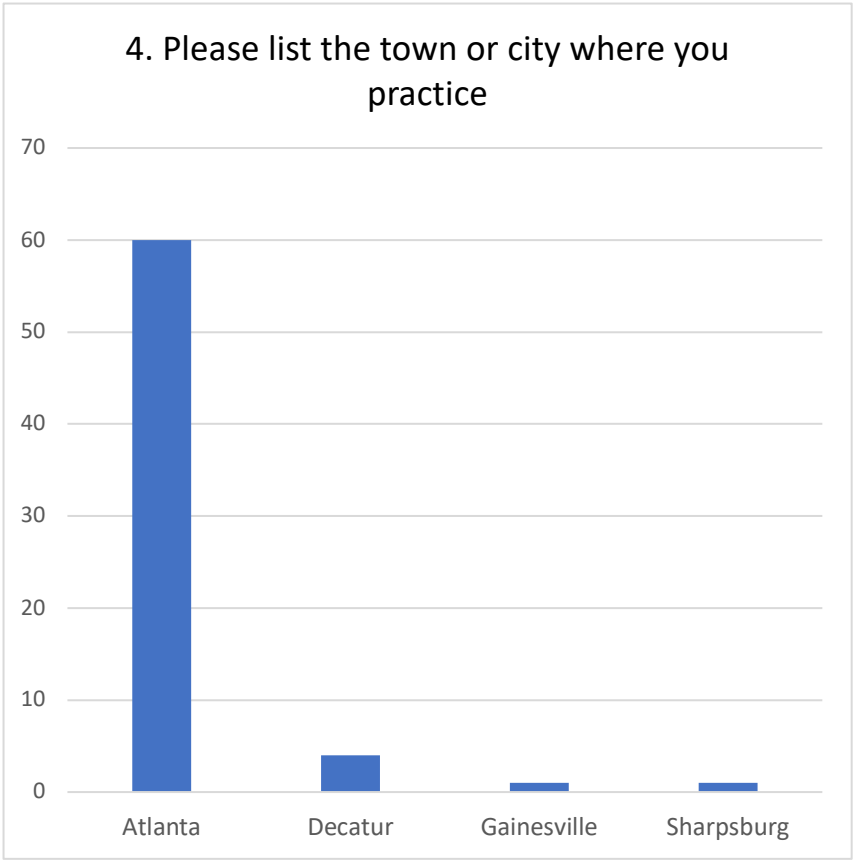
*Questions preceded by "To what extent do you agree with this statement?"
**PCA was ultimately not used for patient care; unweighted patient care scores were summed to achieve the same result (see Methods)

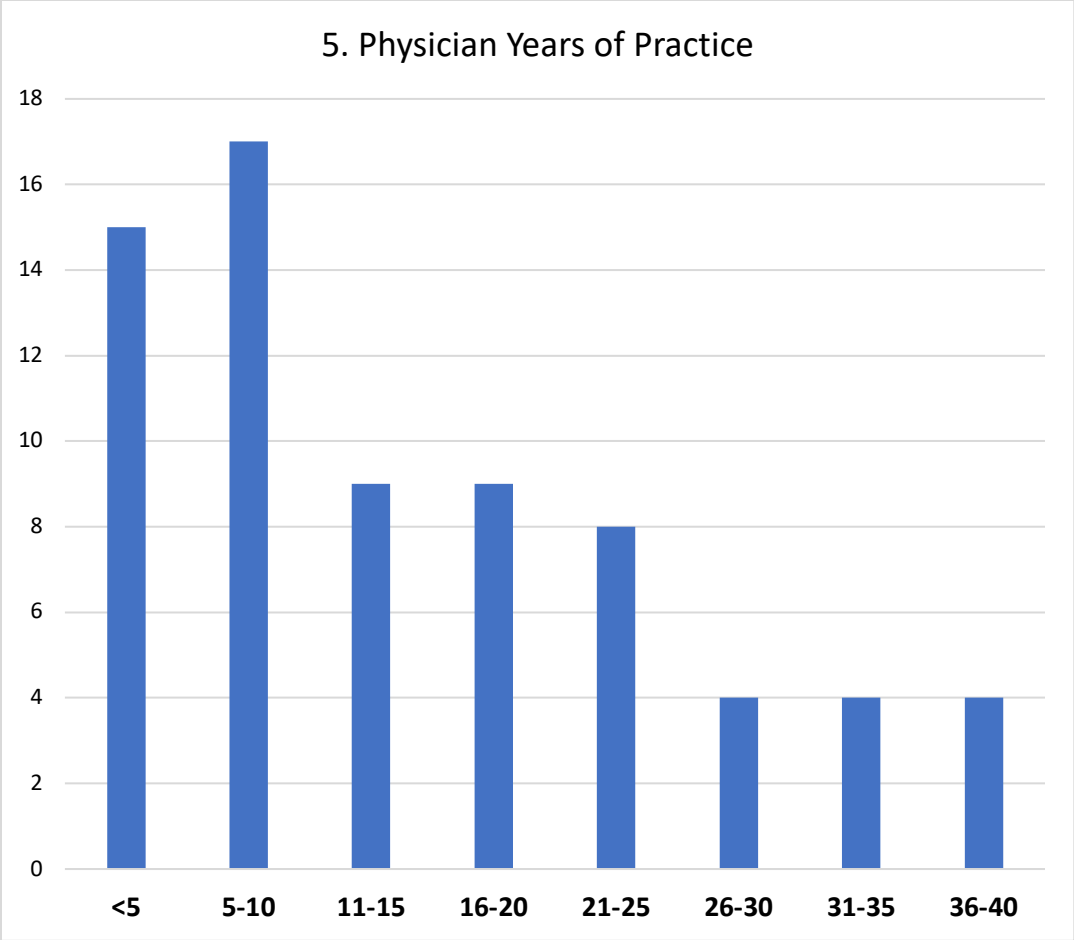
**Figure A1: Raw Response Frequencies (n= 70), Prior to Eliminating 2 Incomplete Responses**

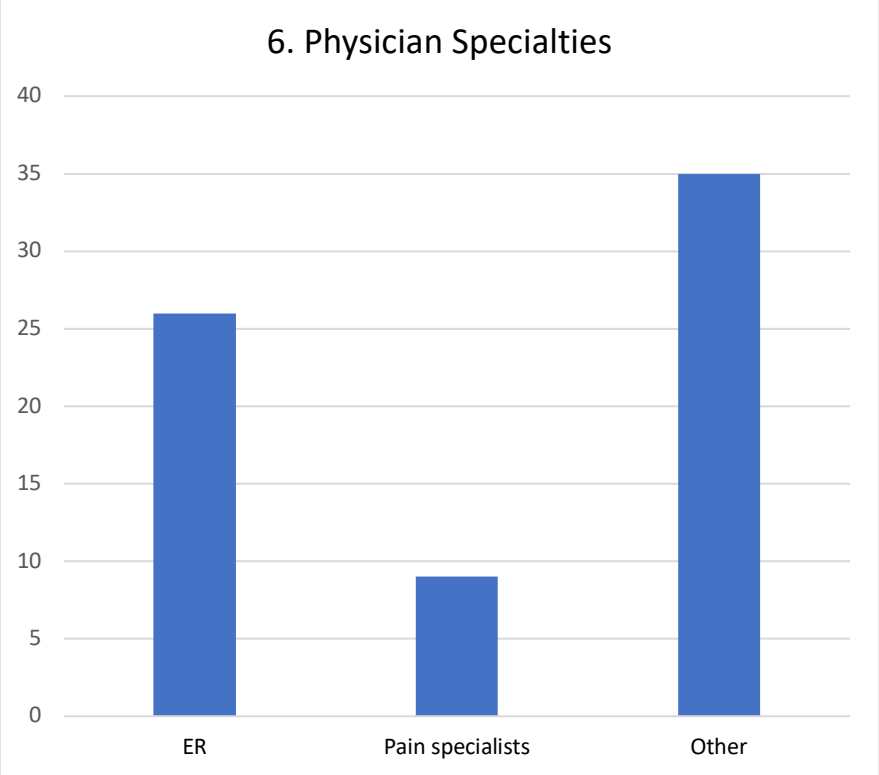


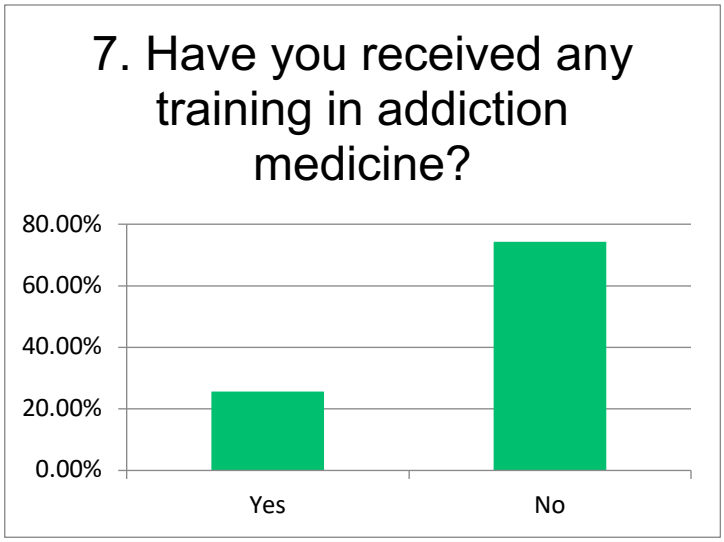



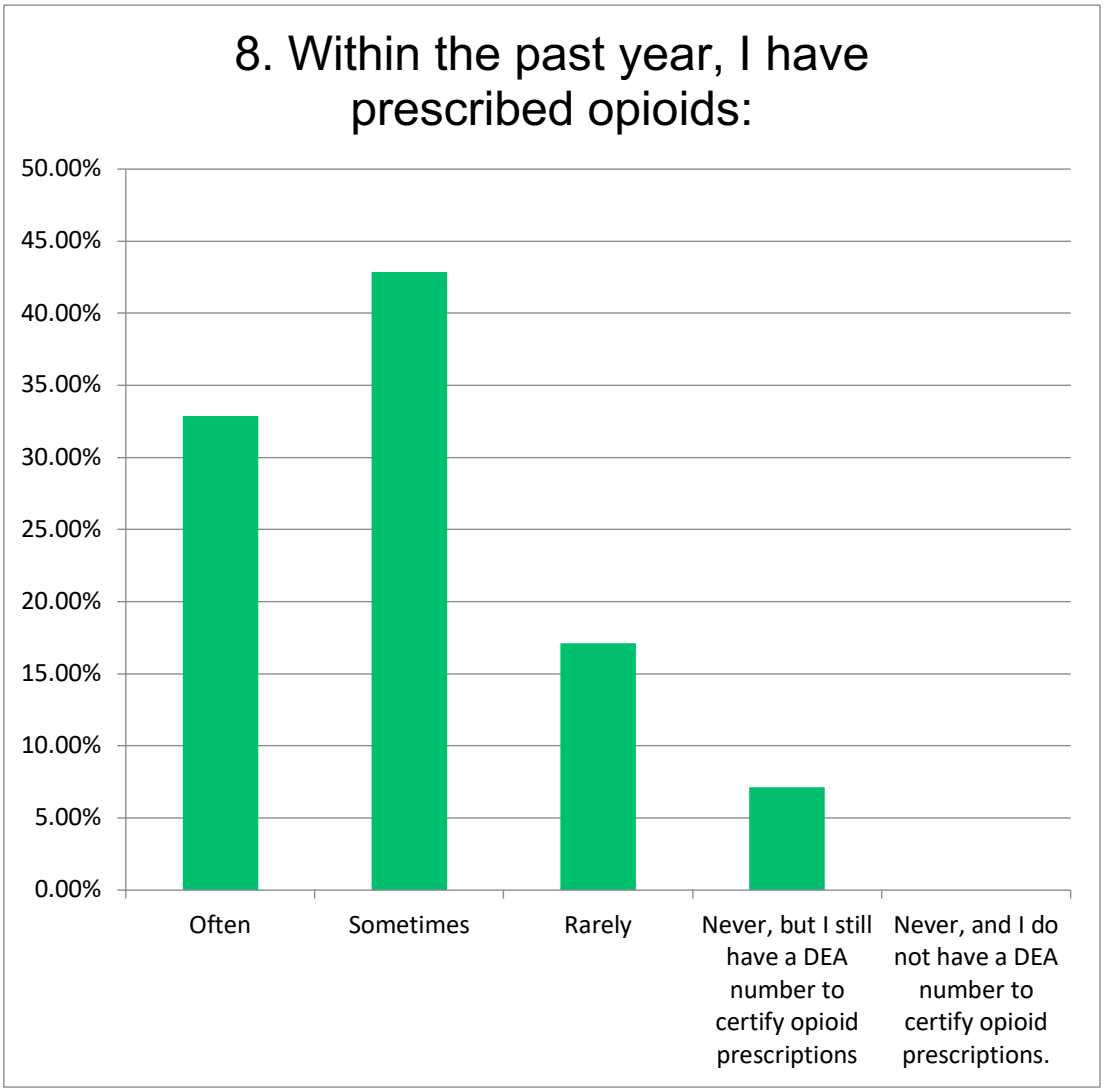



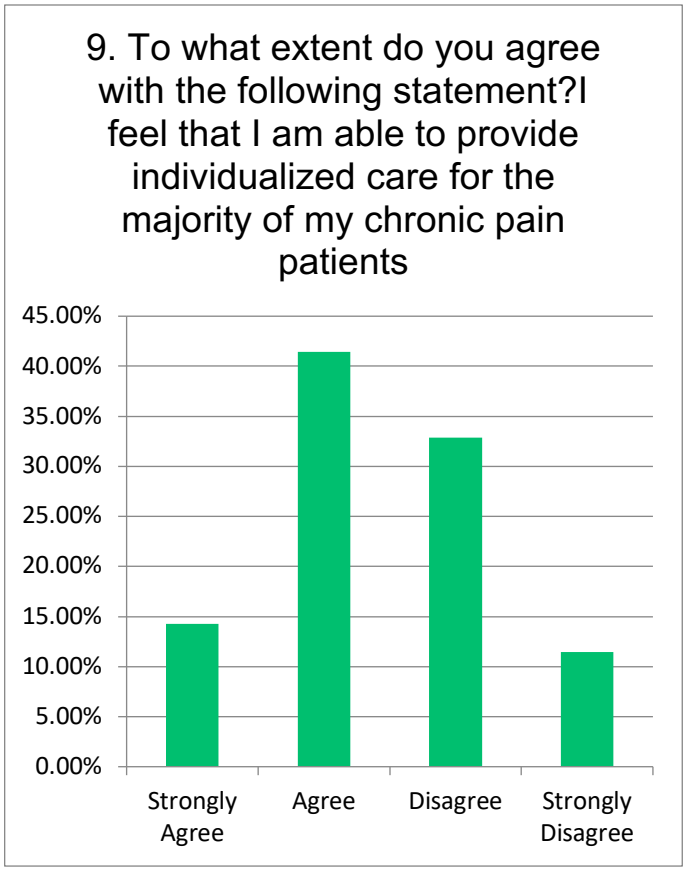

4. Please list the town or city where you practice
70
60
50
40
30
20
10
0
Atlanta
Decatur
Gainesville
Sharpsburg

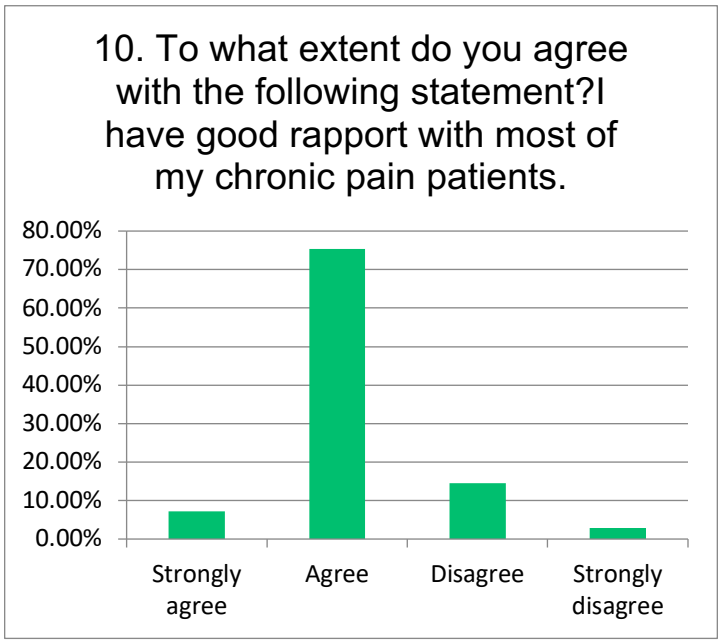

5. Physician Years of Practice
18
16
14
12
10
8
6
4
2
0
<5
5-10
11-15
16-20
21-25
26-30
31-35
36-40


6. Physician Specialties
40
35
30
25
20
15
10
5
0
ER
Pain specialists
Other

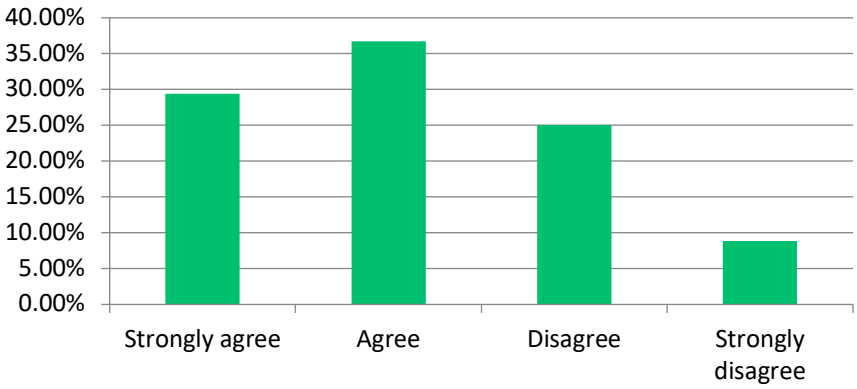

7. Have you received any training in addiction medicine?
80.00%
60.00%
40.00%
20.00%
0.00%
Yes
No


8. Within the past year, I have prescribed opioids:
50.00%
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Often
Sometimes
Rarely
Never, but I still have a DEA number to certify opioid prescriptions
Never, and I do not have a DEA number to certify opioid prescriptions.

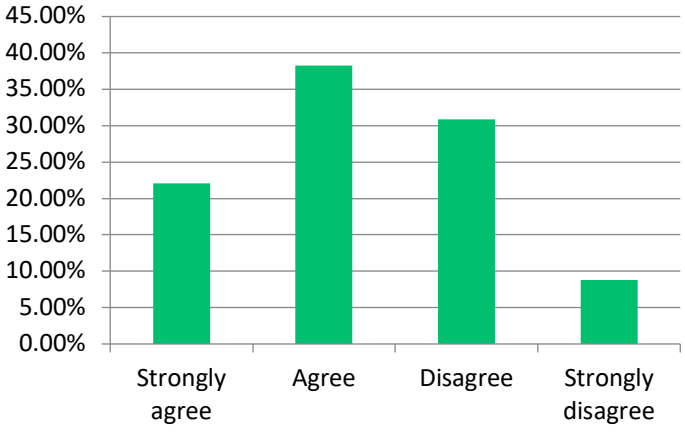

9. To what extent do you agree with the following statement?I feel that I am able to provide individualized care for the majority of my chronic pain patients
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Strongly Agree
Agree
Disagree
Strongly Disagree

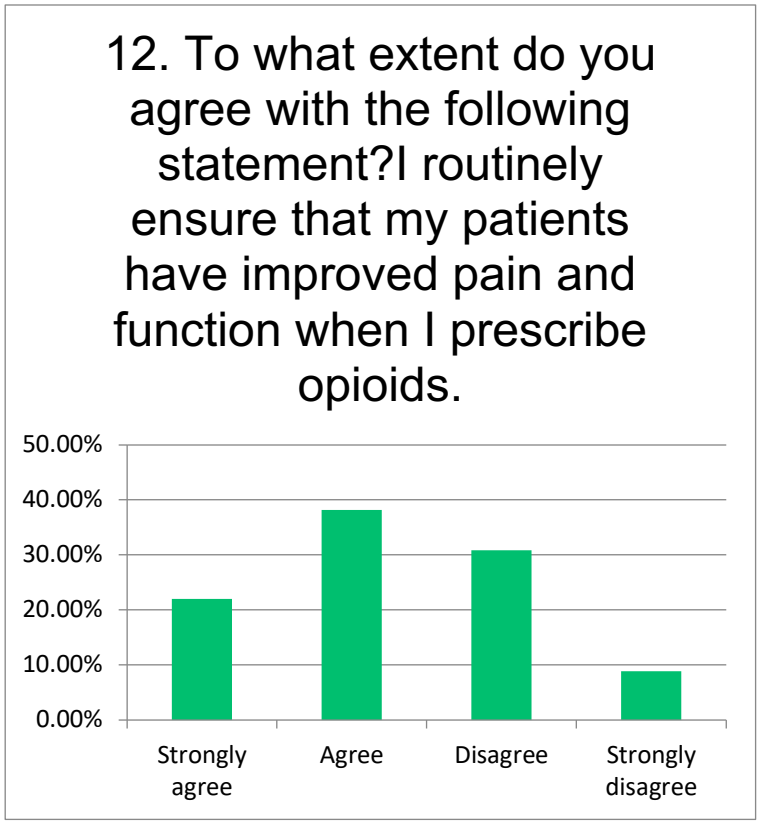

10. To what extent do you agree with the following statement?I have good rapport with most of my chronic pain patients.
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly agree
Agree
Disagree
Strongly disagree

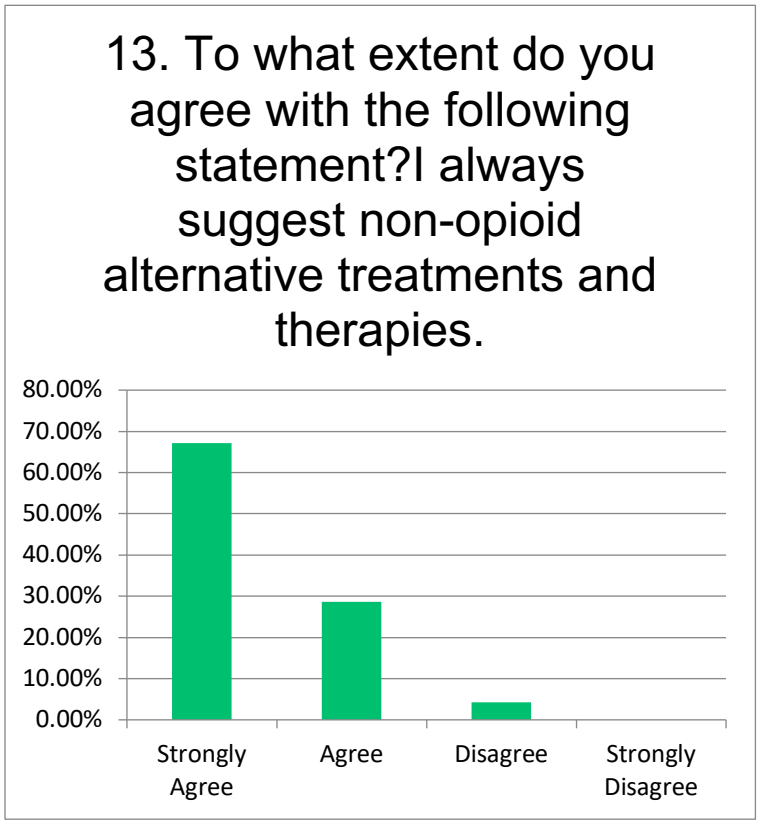
## 11. To what extent do you agree with the following statement?I routinely monitor my opioid patients with drug screens and checks of the prescription monitoring database.

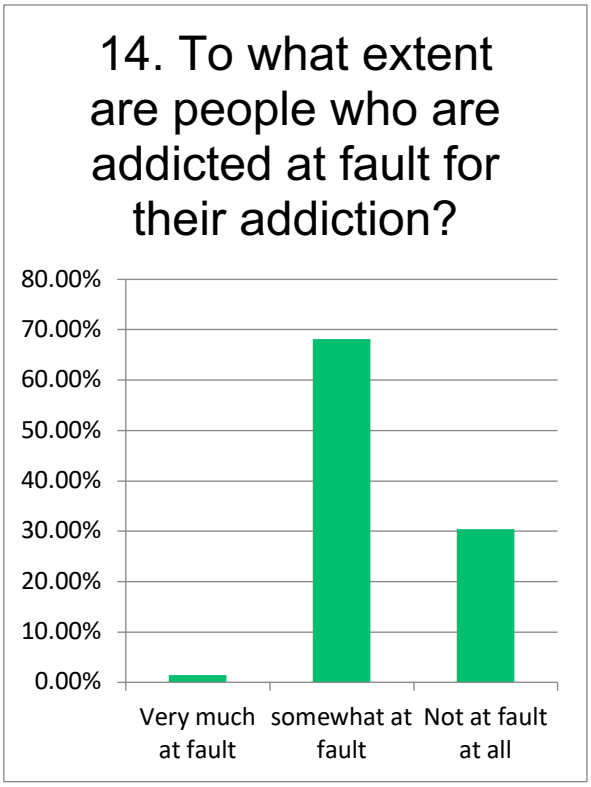


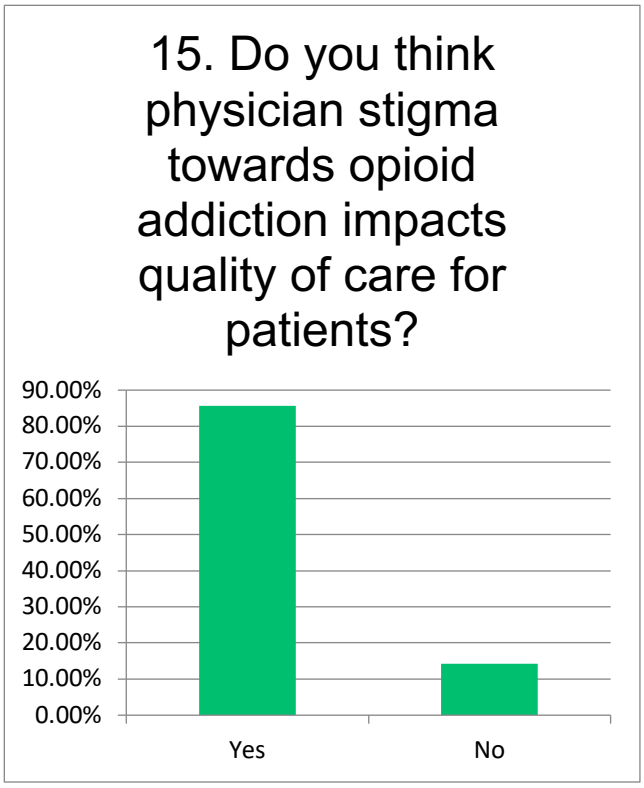

## 12. To what extent do you agree with the following statement?I routinely ensure that my patients have improved pain and function when I prescribe opioids.

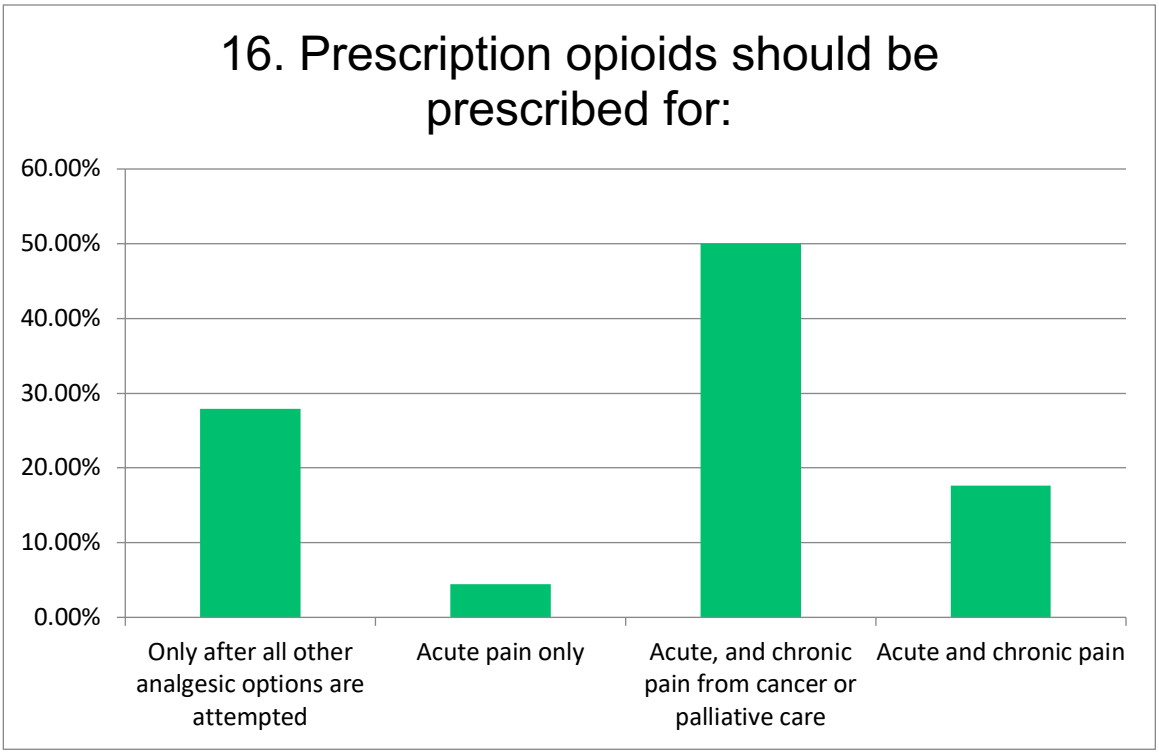


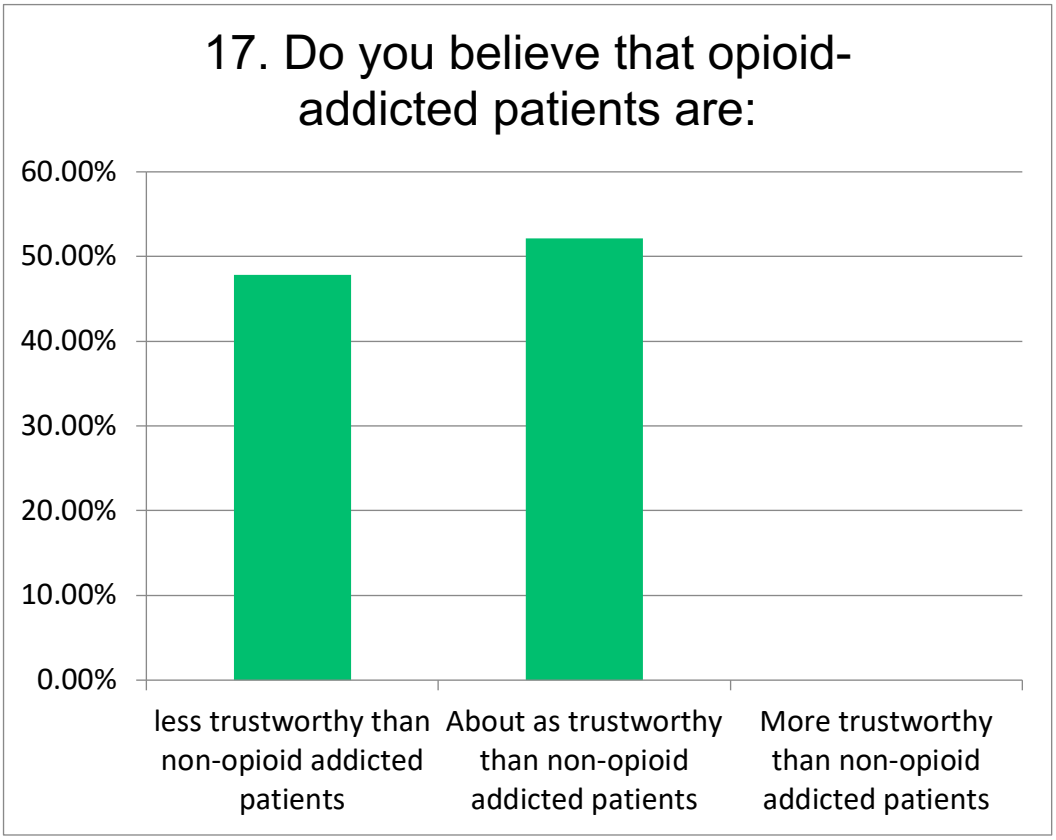

12. To what extent do you agree with the following statement?I routinely ensure that my patients have improved pain and function when I prescribe opioids.
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly agree
Agree
Disagree
Strongly disagree

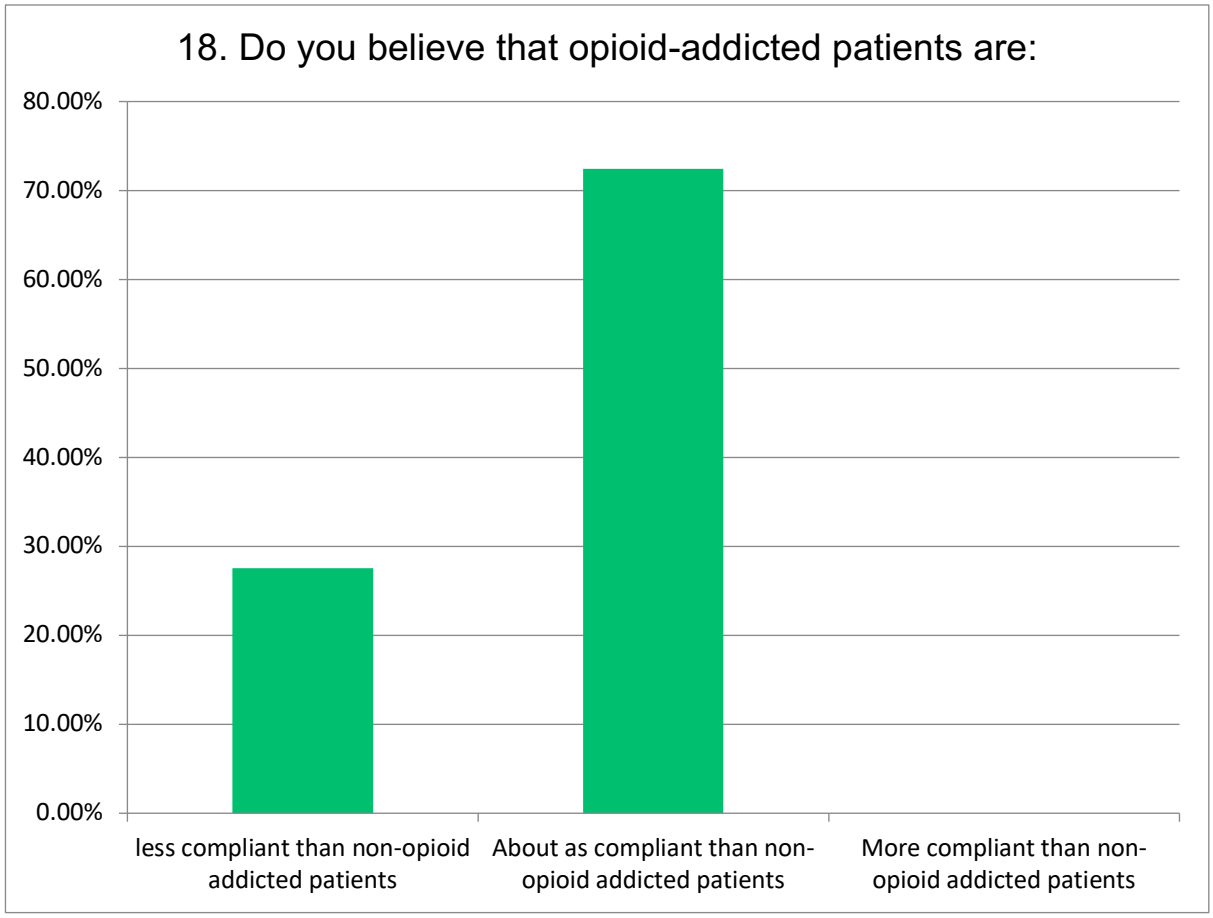

13. To what extent do you agree with the following statement?I always suggest non-opioid alternative treatments and therapies.
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly Agree
Agree
Disagree
Strongly Disagree

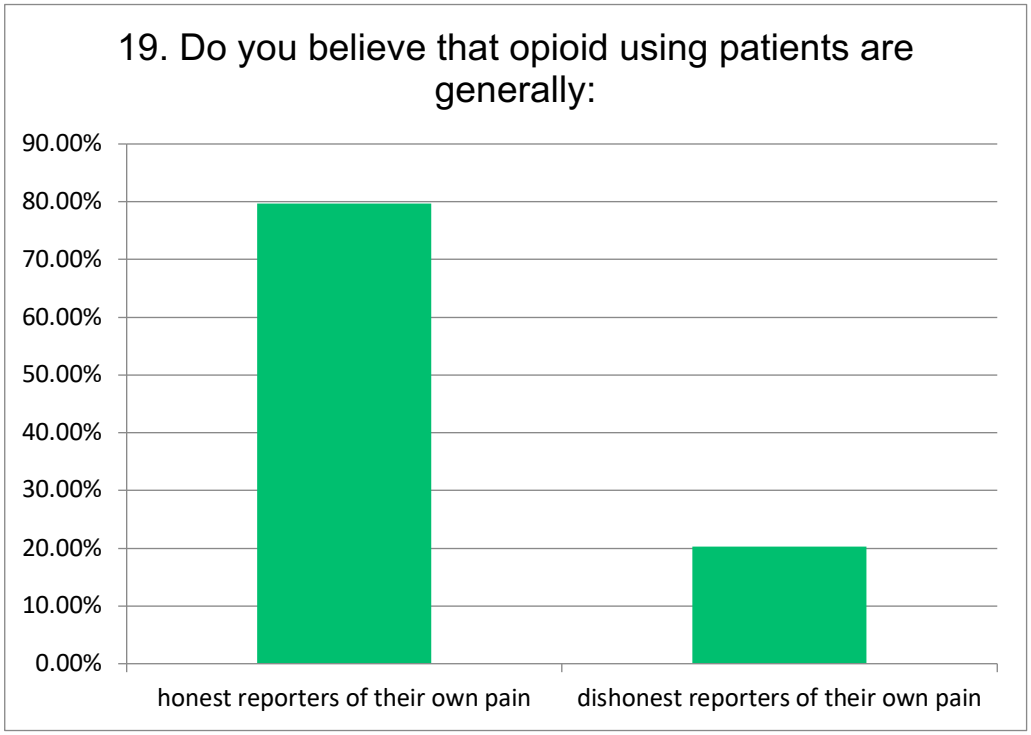

14. To what extent are people who are addicted at fault for their addiction?
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Very much at fault
somewhat at fault
Not at fault at all

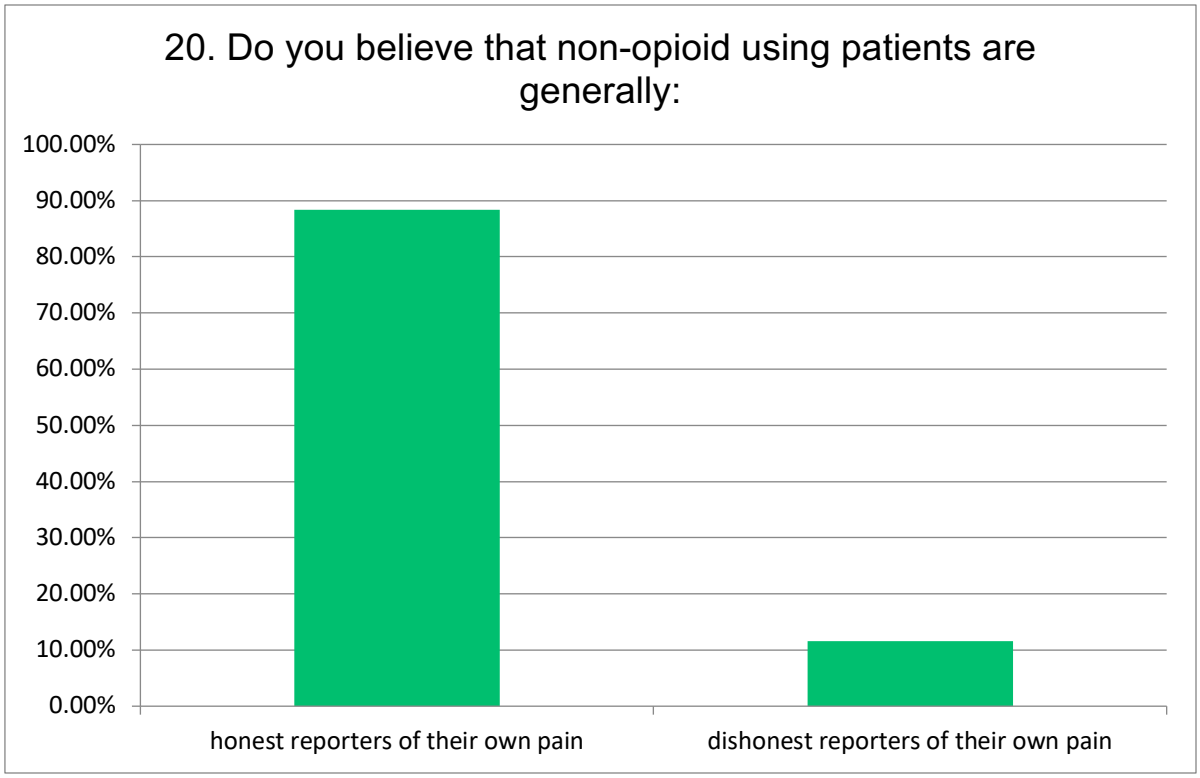

15. Do you think physician stigma towards opioid addiction impacts quality of care for patients?
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Yes
No

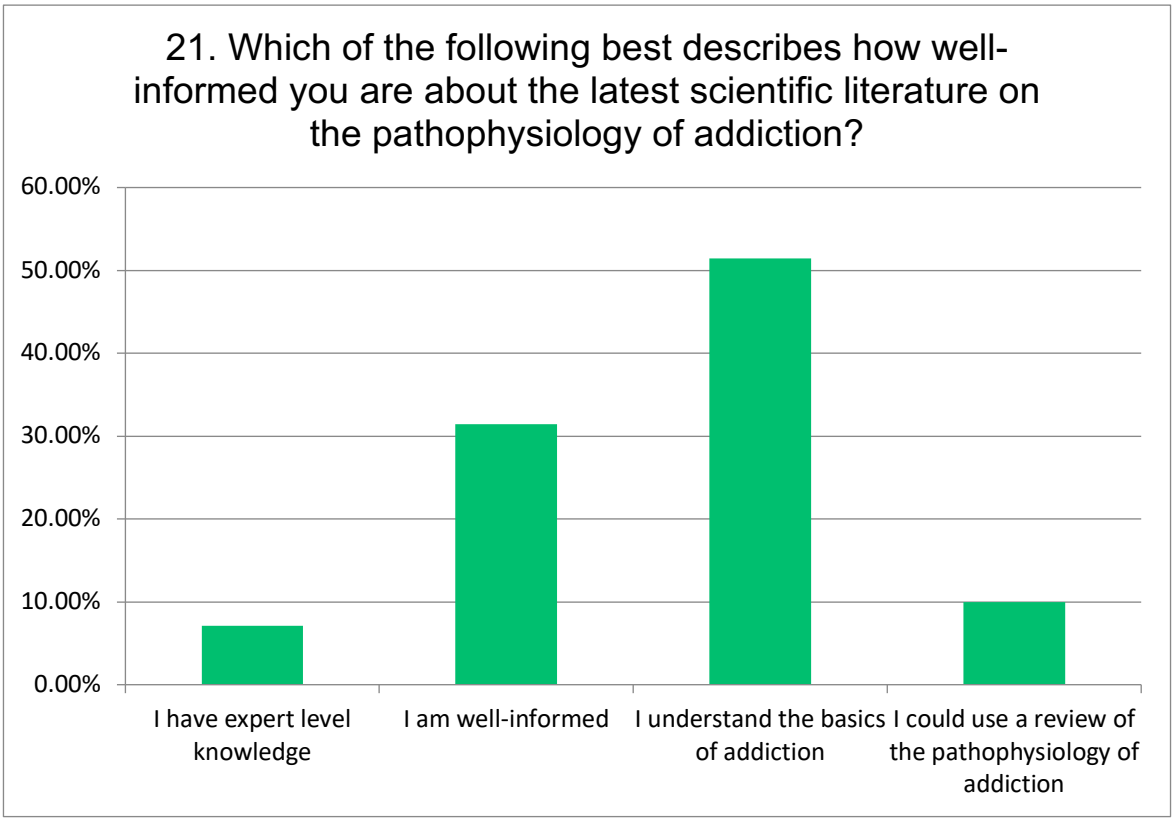

16. Prescription opioids should be prescribed for:
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Only after all other analgesic options are attempted
Acute pain only
Acute, and chronic pain from cancer or palliative care
Acute and chronic pain


17. Do you believe that opioid-addicted patients are:
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
less trustworthy than non-opioid addicted patients
About as trustworthy than non-opioid addicted patients
More trustworthy than non-opioid addicted patients

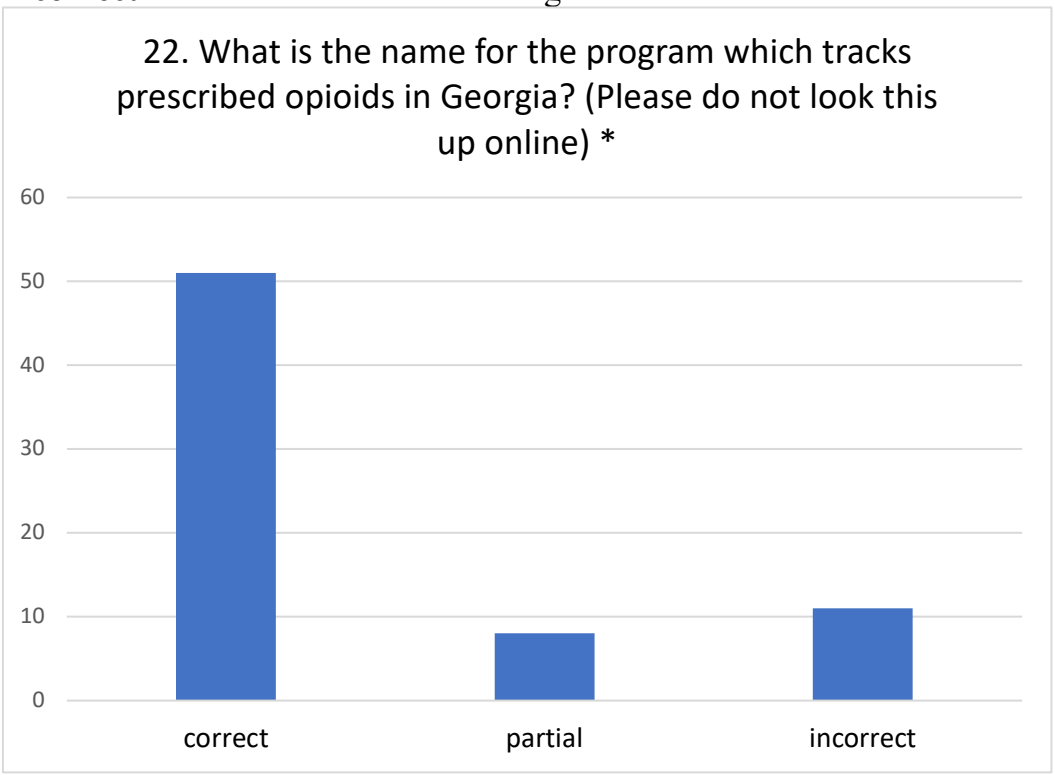

18. Do you believe that opioid-addicted patients are:
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
less compliant than non-opioid addicted patients
About as compliant than non-opioid addicted patients
More compliant than non-opioid addicted patients

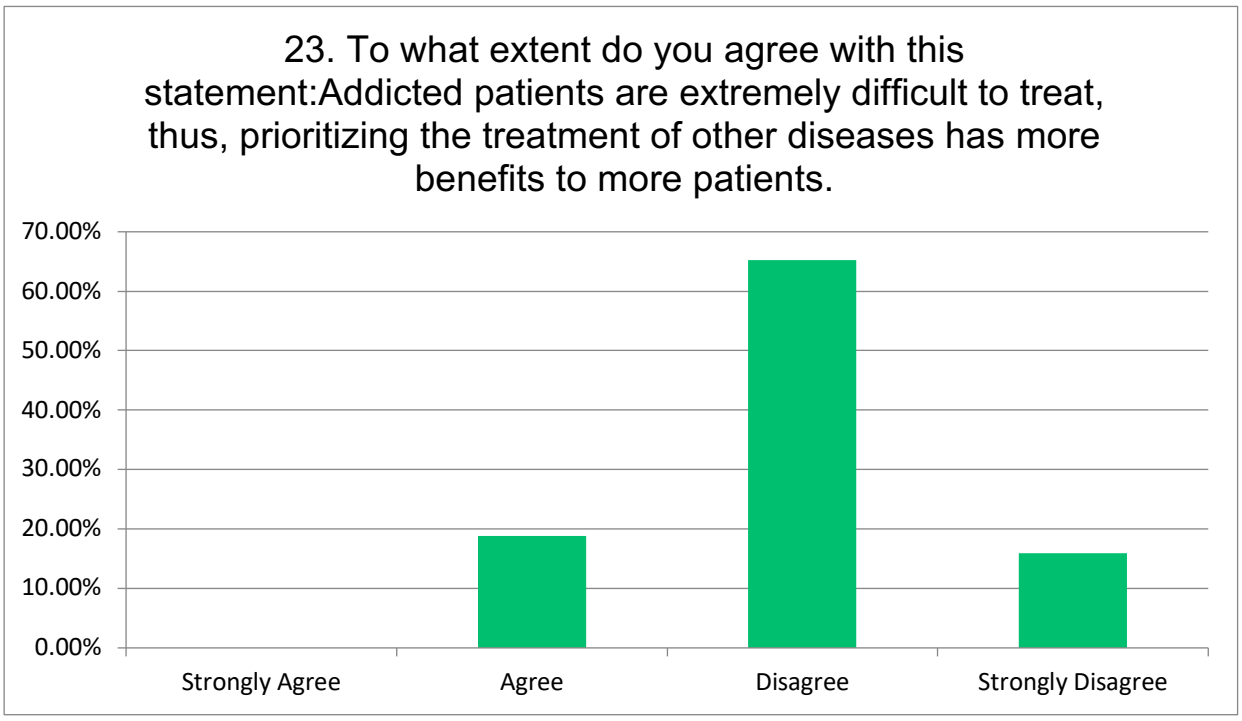

19. Do you believe that opioid using patients are generally:
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
honest reporters of their own pain
dishonest reporters of their own pain

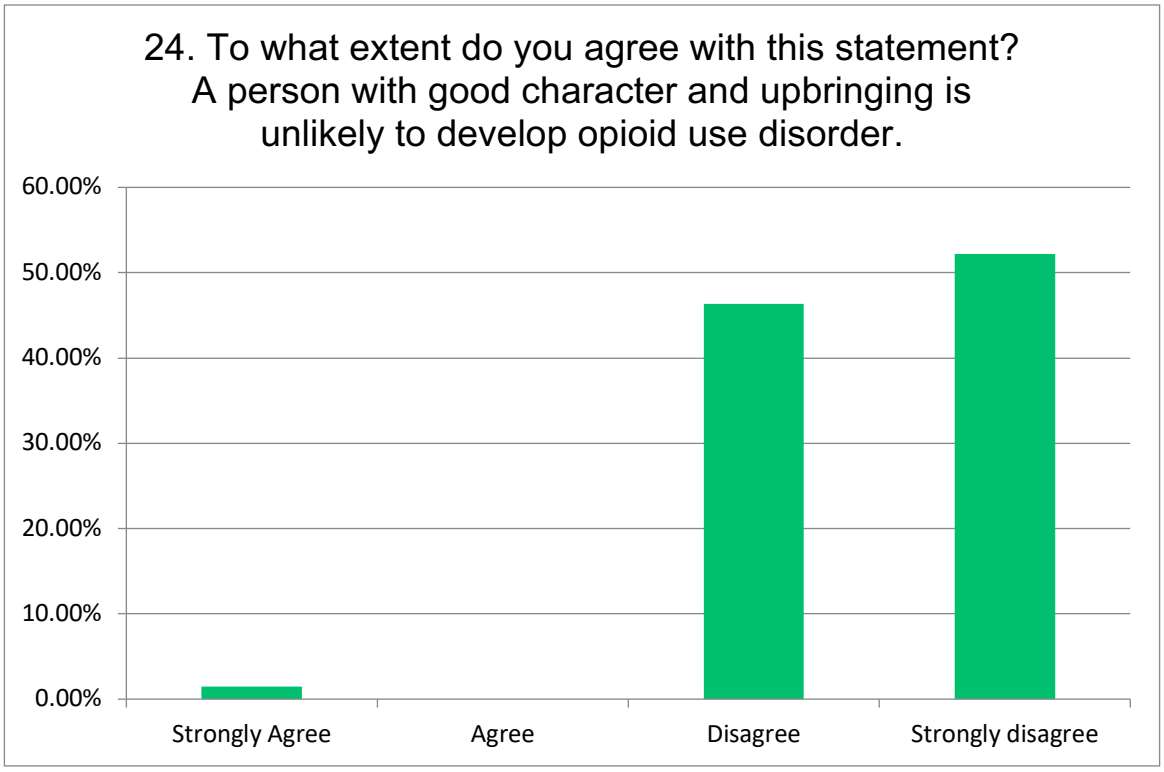

20. Do you believe that non-opioid using patients are generally:
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
honest reporters of their own pain
dishonest reporters of their own pain

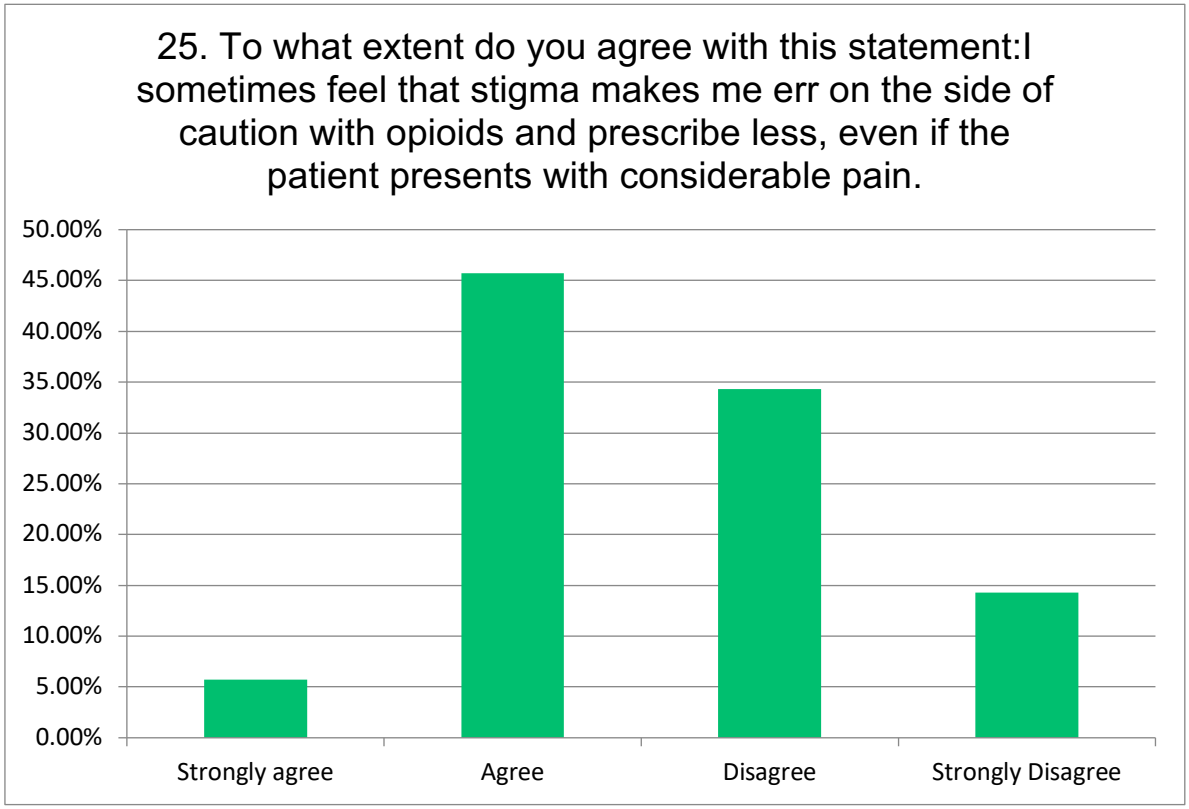

21. Which of the following best describes how well-informed you are about the latest scientific literature on the pathophysiology of addiction?
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
I have expert level knowledge
I am well-informed
I understand the basics of addiction
I could use a review of the pathophysiology of addiction

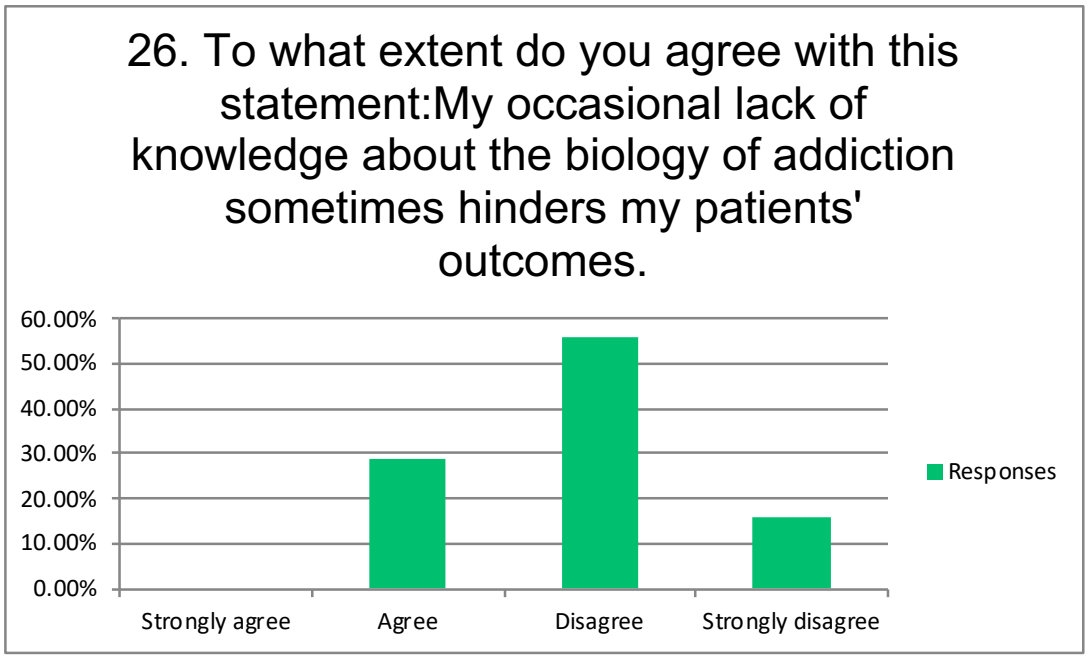
***Correct** = accurate abbreviation or full name (PDMP, Prescription Drug Monitoring Program)
**Partial**= missing one word/one extra word, one missing/extra letter in acronym
**Incorrect**= more than one word missing




24. To what extent do you agree with this statement? A person with good character and upbringing is unlikely to develop opioid use disorder.
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly Agree
Agree
Disagree
Strongly disagree


25. To what extent do you agree with this statement:I sometimes feel that stigma makes me err on the side of caution with opioids and prescribe less, even if the patient presents with considerable pain.
50.00%
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Strongly agree
Agree
Disagree
Strongly Disagree




**27. How did you hear about this survey?**

| | EMAIL | REFERRED BY SPECIFIC PHYSICIAN OR COLLEAGUE, OTHER |
|---|---|---|
| **TOTAL** | 49 | 13 |

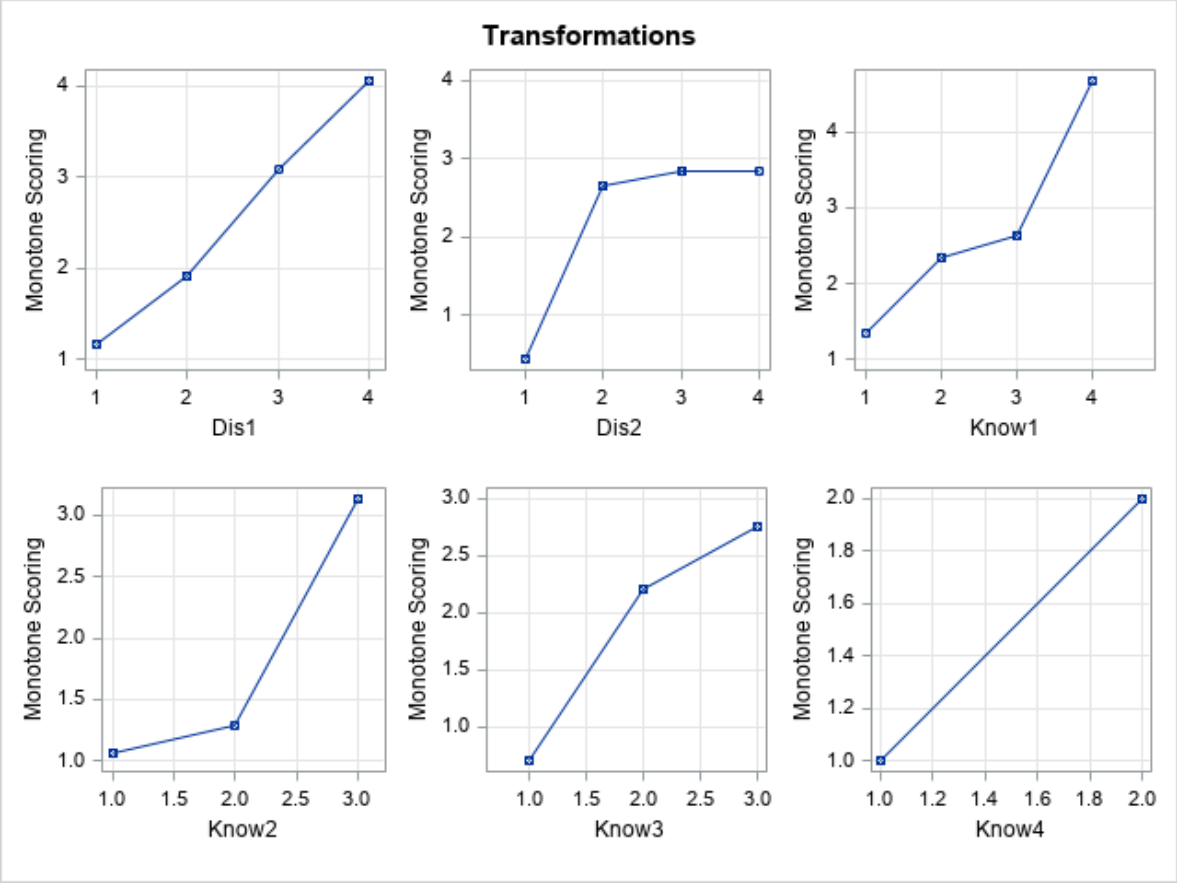



**Fig. A2.1: Transformations**

Monotonic transformations are conducted to allow our ordinal data to behave as continuous data, which further permitted us to use linear regression. It also helps to see if response patterns are significantly different among questions. Significantly different response patterns allow analysis of trends because answers are distinct, which allow us to draw finer distinctions in respondents' attitudes.

**Interpretation of graphs:**

| | | |
|---|---|---|
| Dis1: | Opioids for how much pain? | Each answer is unique. |
| Dis2: | Stigma err side of caution presc. | Answers disagree to strongly agree similar. |
| Know1: | Knowledge of lit | Answers mostly unique, but "expert" is strongest. |
| Know2: | Name of monitoring program | Correct and partial are similar. |
| Know3: | My lack of know. Hinders pt out. | Answers mostly unique |
| Know4: | Addition training? | Binary, untransformed. |

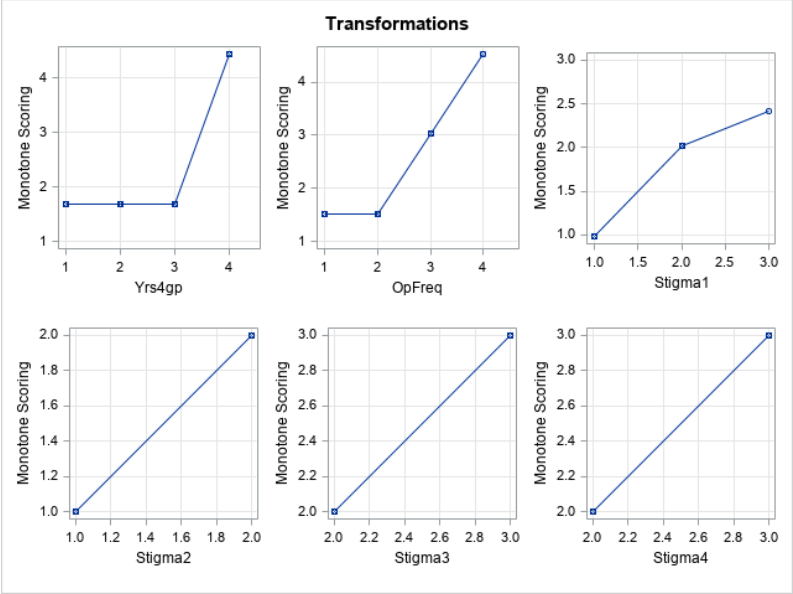



**Fig. A2.2: Transformations, interpretation of graphs**

| | | |
|---|---|---|
| Yrs4gp | Years practice: 20+, 10-19, 5-9, 0-4 | 5-40 years identical. 0-4 years different. |
| OpFreq | Freq prescribing 1: often, 2: some, 3: rarely, 4: never | 1-2 similar |
| Stigma1 | Extent ppl at fault for addiction | Each answer different |
| Stigma2 | Phys stigma affect pt qual of care? | Binary; untransformed |
| Stigma3 | OUD pt less trustworthy? | Binary; untransformed |
| Stigma4 | OUD pt less compliant? | Binary; untransformed |

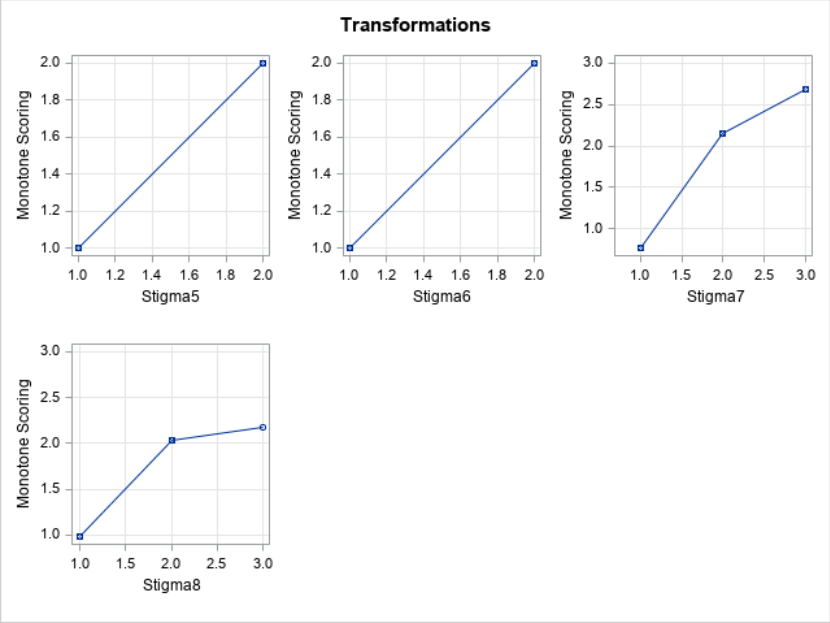



**Fig. A2.3: Transformations, interpretation of graphs**

| | | |
|---|---|---|
| Stigma5 | Op pt dishonest reporters of pain | Binary; untransformed |
| Stigma6 | Non-op pt dishonest reporters of pain | Binary; untransformed |
| Stigma7 | Prioritize non-OUD pt | Each answer different |
| Stigma8 | Good upbringing don't become OUD pt | Agree similar to disagree |

```
proc prinqual data=op out=op_prinqual3 plot=all
       maxiter = 100 standard scores n=3 replace;
       * Out: name of output dataset.
       * Maxiter: maximum iternations (default=30)
       * standard: Standardize output to Variance = 1 N=3 means make 3 axes;
       * replace:  Replace original values;
       * scores: outputs principal component scores;
       transform monotone (Dis1-Dis2 Know1-Know4 Yrs4gp OpFreq Stigma1-Stigma8);
       * Transform monotone for ordinal data.
       * Transform opscore for nominal data;
       * id ID; /* Use ID as the patient ID.
       * But this makes the graphs messier */
run;

* Export Prinqual file to Excel;

* Step 2 to obtain Scree plot and exact values for PC loading;
Title "3.4 Proc Princomp Step 2";
proc princomp data=op_prinqual3 out=op_p34 outstat = op_p34stat;
       ods select ScreePlot;
       var Dis1-Dis2 Know1-Know4 Yrs4gp OpFreq Stigma1-Stigma8;
       * This data is already transformed from Model 3.2;
       where _TYPE_ = 'SCORE';
       * Where: Only use the transformed data;
       * Ignore the correlations that are also output in this dataset;
run;

* General Linear Model (here: simple linear regression);
Title "Model 4.1 Outsum vs PC1";
proc glmselect data=op_p;
       class GenderF2 Race3gp Spec3gp;
       * Which of our variables are categorical?;
       format GenderF2 Gender. Race3gp Race3gp. Spec3gp Spec3gp.;
       * Add the values of each variable instead of just the number;
       model outsum = PQ_Prin1 / stats=all;
       * model y = x1 x2...  stats: print all statistics;
       * PQ_Prin1 is PC1;
run;

* Kruskal-Wallis Test (non-parametric equivalent to ANOVA);
* for PC1 as a function of physician specialty;
Title "Model 6.1 PC1 vs Specialty";
proc npar1way data=op_p Wilcoxon;
       class Spec3gp;
       var PQ_Prin1;
       * PQ_Prin1 is PC1. Spec3gp is physician specialty in 3 groups;
       format Race3gp Race3gp. GenderF2 Gender. Age4gp Age4gp. Spec3gp Spec3gp.;
run;

Title "Spearman Rank Correlation";
proc corr data=op_p Spearman;
       var PQ_Prin1 PQPrin2 PQPrin3 outsum;
run;
```

**Fig. A3 Sample SAS Code**

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