POST-SURGICAL PAIN-RELATED OUTCOMES AMONG ETHNICALLY DIVERSE EMERGING ADULTS

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Abbreviations

CDC – Centers for Disease Control

CPSP – Chronic post-surgical pain

CUD – Cannabis use disorder

DSM-5 – Diagnostic and Statistical Manual 5th edition

EAs – Emerging Adults

ENT – Ear-Nose-Throat

ICU – Intensive Care Unit

MDMA – 3,4-methylenedioxy-N-methylamphetamine

MEIM – Multigroup Ethnic Identity Measure

NCHS – National Center for Health Statistics

NIDA – National Institute on Drug abuse

NRS – Numerical rating scale

OUD – Opioid use disorder

PEDQ-CV – Perceived Ethnic Discrimination Questionnaire-Community Version

RA – Research Assistant

REDCap – Research Electronic Data Capture

ROAM – Research on the Adolescent Management of Pain

SUD – Substance use disorder

SAMSHA – Substance Abuse and Mental Health

SAPS – Short Assessment of Patient Satisfaction

SDOH – Social determinant of health

SPSS – Statistical Packages for the Social Sciences

UNODC – United Nations Office on Drugs or Crime

Abstract

This study focused on a diverse sample of Emerging Adults (EAs) in order to identify unique risk and protective factors associated with post-surgical outcomes, specifically pain-related functioning, prescription opioid use, and cannabis use. EAs are in a unique developmental stage, facing developmentally specific risk and resilience factors, and routinely receive opioid prescriptions as part of medical care. Research with EAs shows a steady increase in reports of cannabis use and misuse, but findings related to the impact of cannabis on post-surgical outcomes are mixed. Moreover, racial/ethnic minorities are at risk for poorer health and are also underrepresented in pain and substance use research. The aims of this study were to 1) To evaluate associations among ethnic identity and both post-surgical pain outcomes and substance use (opioids and cannabis) in an ethnically diverse sample of EAs receiving opioid medication for post-surgical pain, and 2) Utilize a mixed-method analysis approach to more fully characterize EA experiences and examine the role of perceived ethnic discrimination and perceived support from the healthcare system as it relates to ethnic identity and pain-related post-surgical outcomes in EAs.

Methods. Aim 1 utilized a sample of n=144 diverse EAs aged 19-25 recruited from ambulatory surgery settings at Oregon Health & Science University. Data collection occurred at T1 (baseline, within one month post-surgery) and T2 (3 months post-surgery) and self-report measures were administered electronically via REDCap. Aim 2 utilized a mixed-methods study design with n=35 (100% racial/ethnic minorities) who were recruited as part of the expanded data collection effort to specifically examine racial/ethnic discrimination. Thirteen participants completed qualitative interviews.

Results. Ethnic identity was not associated with pain ratings, pain interference, number of days an opioid prescription was used, nor number of prescription pills taken after surgery. There was no

association between ethnic identity and the number of reported cannabis use days, but ethnic identity was found to be a significant predictor of endorsing past 30-day cannabis use. Racial/ethnic discrimination was not associated with pain interference, but higher rates of discrimination were associated with higher pain frequency. Higher discrimination was associated with more days of opioid use, but not number of pills taken. Several themes were developed in the qualitative analysis, e.g. a fear of opioids, avoiding negative side effects from opioids, using cannabis for pain relief, an awareness of minoritized identity, intersectionality in the healthcare context, and systemic barriers impacting the healthcare experience.

Conclusion. Ethnic identity was not associated with pain or prescription opioid use, but ethnic discrimination might be more indicative of risk for pain intensity, and prescription opioid use for racial/ethnic diverse EAs reporting pain. The qualitative analysis revealed that many felt fearful about using their opioid prescription due to messaging about the opioid crisis, and this sample reported high use of cannabis. Consistent with previous research, high ethnic identity might be protective against cannabis use. The acute post-surgical period offers a unique window to exploring supportive and preventative interventions that can improve surgical outcomes. Future research should examine use of non-pharmacological interventions for post-surgical pain in diverse EAs since some are averse to opioids, including detailed measures of past and current cannabis use.

Chapter 1: Introduction and Background

1.1 The EA developmental stage

Emerging Adulthood is a developmental stage between ages 18-29 with five proposed features, including identity exploration, instability, self-focus, feeling in-between, and possibilities or optimism (Arnett, 2000). This is a transitional period, with changes to social lives, social supports, self-identity, career formation, finances and changes to access to resources. This life stage carries implications for health behaviors and health outcomes, including high rates of depression and anxiety, inadequate social support, under- or unemployment and/or financial instability. Thus, many EAs are in a role-changing phase of life with more independence, but might not yet have developed skills necessary to cope independently with health-related problems (Forgeron et al., 2017; Higginson et al., 2019; Palit et al., 2020). Additionally, research suggests this developmental stage involves a tendency to ignore long-term outcomes related to behaviors and health due to underdeveloped cognitive maturation, leading to riskier health-related behaviors, and a lower likelihood of seeking out medical care (Cousijn et al., 2018).

While EAs are less likely to seek routine or preventative healthcare, they do undergo common surgical procedures. The window of time following a surgery offers a unique window into health-related coping, including pain management and medication use behaviors. Specifically focusing on EAs who are in a unique developmental period is an opportunity to identify unique risk and protective factors associated with post-surgical outcomes. This study capitalizes on the window when EAs receive an opioid prescription following outpatient or day surgery; these prescriptions occur in the context of biopsychosocial risk and protective factors for developing persistent or hazardous opioid use. Furthermore, this period is also one of stress related to social roles and belonging, including ethnic group belonging (Matud et al., 2020). EAs identifying with minoritized racial/ethnic groups in the U.S. are increasing, but relatively little is known about ethnic identity, ethnic belonging, discrimination and related health outcomes for this population (Jacobs et al., 2024).

1.2 Post-surgical pain

   Acute post-surgical pain occurs when tissue is injured during a surgical procedure; this acute

pain is generally expected to resolve during the healing process (Small & Laycock, 2020). Acute pain

occurs in approximately 75% of patients who undergo surgical procedures (Bansal et al., 2024; Chou et

al., 2016). A portion of acute post-surgical pain develops into chronic post-surgical pain (CPSP). CPSP is

defined as pain that persists after a surgical procedure, has lasted at least 3 months, and for which other

causes for the pain have been ruled out (Schug et al., 2019). Rates of CPSP observed in the literature

vary depending on the surgical procedure, surgical technique, study design and study population (Katz &

Seltzer, 2009; Macrae, 2008; Simanski et al., 2014; Yang et al., 2019). However, the overall rates for

chronic post-surgical pain for both major and minor surgeries are high, with examples ranging from

hernia repair (up to 63%), Caesarean section (up to 55%), thoracotomy (up to 65%) and up to 85% for

limb amputations. And despite the development of improved surgical techniques (e.g. laparoscopic

surgery), high rates of CPSP are reported following minor procedures (Allen et al., 2022; Glare et al.,

2019; Schug et al., 2019). Post-surgical pain can adversely impact individuals' function long-term,

including reduced quality of life, poor long-term physical- and psychological health outcomes, and

personal and societal financial costs (Rabbitts et al., 2020). Moreover, inadequately controlled acute

post-operative pain is a risk factor for CPSP (Ishida et al., 2022), and it is widely accepted that

biopsychosocial factors are also involved in the development of CPSP across multiple surgical domains

(Garman et al., 2019; Rosenberger & Pogatzki-Zahn, 2022).

   While Emerging Adults (EAs) may be included in adult post-surgical pain samples, these samples

are typically comprised of older adults (mean ages of samples range from 45 to 70). The research that

does specifically focus on EAs primarily centers on post-operative surgical complications such as

infections and length of hospital stays (Debopadhaya et al., 2024; Zheng et al., 2024). Furthermore,

while several studies that examine surgical outcomes in younger adults, the mean and median ages of

study participants were in the 30s (e.g., Cheng et al., 2020; Culvenor et al., 2024), and the research did

not focus specifically on the EA developmental context. Additional research is needed to further

examine biopsychosocial factors and post-surgical pain outcomes, in order to inform interventions with

this developmentally distinct age range.

1.3 Prescription opioids

Prescription opioids can be an effective intervention for acute post-surgical pain, in particular

when treating moderate to severe postoperative pain. Opioids are generally contraindicated for

management of chronic pain, due to poor pain management outcomes and increased adverse risks

(Chou et al., 2022; Chou et al., 2015). Guidelines for opioid treatment are outlined in the 2022 CDC

Clinical Practice Guideline for Prescribing Opioids for Pain (Dowell, 2022). Potential negative effects of

opioids include constipation, nausea and vomiting, respiratory depression, and increased analgesic

tolerance and subsequent addiction and physical dependence (Paul et al., 2021). Adverse outcomes of

opioid use involve considerable risk for misuse, dependence and overdose. Dependence is defined as

the tolerance of and withdrawal from the opioid after use; misuse is either use without a prescription,

or use with a prescription but the medication is used for a reason other than directed, or in greater

amounts, more frequently or for longer duration than prescribed (Han et al., 2017). The opioid epidemic

has grown in part out of misuse of prescription opioids, which can lead to use of more potent and risky

opioids (e.g. heroin; Kolodny et al., 2015). Hazardous opioid use is now a national health crisis, resulting

in at least 500,000 opioid-related overdose deaths since 1999 (Centers for Disease Control and

Prevention, 2021). Data from 2022 shows overdose deaths involving any opioid for all ages had

increased to 81,806, up from 49,860 in 2019. Overdose involving prescription opioids for all ages has

increased steadily since 1999, reaching 16,416 reported deaths in 2020, with a pattern showing that

since about 2014, overdose deaths typically involve prescription opioids in combination with a synthetic

opioid (National Institute on Drug Abuse, 2022). The yearly cost of the cost of prescription opioid misuse

is very high, with significant costs related to healthcare ($35 billion), loss of productivity ($92 billion),

and criminal justice involvement ($14.8 billion) (Fairley et al., 2021; Florence et al., 2021). Consequently,

significant efforts have been targeted towards opioid prescription risk awareness, with several states

establishing restrictions and monitoring processes for prescribers (Blackman & Smith, 2017). In 2020,

prescription opioids were the most commonly misused prescription drug in the U.S, with misuse most

often being attributed to motivation to "relieve physical pain" (Substance Abuse and Mental Health

Services Administration, 2021).

1.4 Post-surgical prescription opioids

For post-surgical pain management, use of prescription opioids to treat post-surgical pain has

been shown in a recent review to be connected to persistent pain and opioid misuse and dependence

(Marshall et al., 2019). National population data from the National Survey on Drug Use and Health

outlines prevalence of misuse for all adults who are prescribed an opioid to be between 6-13% (Han et

al., 2017; Li et al., 2019), however the studies did not differentiate between opioids following surgery or

other acute pain reasons (Porter et al., 2022). In post-surgical studies examining the role of type of

surgery, results are mixed. For example, Brummett et al. (2017) found that in a sample using national

claims data (n=36,177) comparing minor surgery (e.g. varicose vein removal, thyroidectomy) to major

surgery (e.g. bariatric surgery, colectomy), type of surgery did not predict persistent opioid use (>90

days) after surgery. However, higher rates of persistent opioid use were found to be associated with

behavioral factors identified at baseline, such as tobacco use, alcohol and substance use disorders,

mood- and anxiety disorders and pain disorders. Conversely, a study with opioid naïve patients found

that type of surgery made a difference for potential prolonged opioid use, with open and minimally

invasive thoracic procedures carrying higher likelihood of prolonged use compared to open radical

prostatectomies (Clarke et al., 2014). In general, opioid naïve patients have been found to be at higher

risk for chronic opioid use following surgery (Sun et al., 2016).

EAs and opioid misuse

Epidemiological data show initiation of opioid misuse typically begins in adolescence, increases

and peaks during emerging adulthood before rates drop off (Bonar et al., 2020). There is evidence from

national population data that young adults (18-34) are more likely to report misuse of opioids than

other ages (Li et al., 2019). At the same time, data from 2022 show that EAs report a steady decrease in

opioid use in the past 10 years (Patrick, 2023). Furthermore, EAs routinely receive opioid prescriptions

as part of medical care (Anastas et al., 2018), at a developmental time when they are particularly

vulnerable to substance use problems. The developmental stage of EAs carries higher risk for misuse of

opioids, and little is known about EAs use of prescription opioids in the post-surgical context.

1.5 Cannabis use among EAs

Cannabis is the most frequently used recreational drug in the US, with estimates indicating that

10% of the population reports using cannabis products monthly (United Nations Office on Drugs and

Crime, 2022). Cannabis use prevalence rates are higher for young adults, with 43.6% reporting use in the

past year, and 28.8% reporting past month use. Data from 2022 show the highest levels of cannabis use

recorded since national data monitoring began in 1988 (Patrick, 2023). Rates of reported use for EAs are

even higher in states where cannabis is recreationally legal, and the past-year rate of cannabis use in

2021 and 2022 in Oregon where the current study was conducted, is 51% among 18-25 year olds

(Patrick, 2023). EAs who were adolescents when cannabis became legal show a higher likelihood of

using cannabis (Stormshak et al., 2019), and this age group perceive cannabis as less harmful than older

age cohorts (Johnston et al., 2022). Relatedly, EAs are likely to have different driving factors for cannabis

use that differ from the general adult population, including more exploratory/experimental purposes, as

opposed to preventive/avoidance of negative symptoms (Feldstein Ewing et al., 2022). For EAs, pain

relief from cannabis use has emerged as a motivator for use (Hayaki et al., 2024; Magnan & Ladd, 2019).

In addition to reporting cannabis use to manage psychological distress, physical distress and pain was

reported as a reason for self-medication with cannabis in 18–25-year-old college students (Wallis et al.,

2022). In studies with younger age cohorts, national surgery data shows that adolescents undergoing

inpatient surgery had higher prevalence rates of cannabis use disorder (CUD) in 2022 compared to 2009,

and CUD is associated with increased risk for respiratory complications, ICU admission and mechanical

ventilation, and extended hospital stays (Willer et al., 2024).

1.6 Cannabis use in the post-surgical period

The potential medicinal effects of cannabis in the perioperative setting are not well understood

(Shah et al., 2023). Research suggests cannabis is increasingly being used to self-medicate for a variety

of somatic and pain conditions (Alford et al., 2016; Asselin et al., 2022; Wallis et al., 2022). However,

research is limited and results mixed, and conclusions difficult to draw due to the small and

heterogenous studies currently available (Ladha et al., 2019; Shah et al., 2023). One study found that

preoperative cannabis use might increase orthopedic postoperative pain levels and be associated with

poorer postoperative sleep (Liu et al., 2019). There is also evidence that for regular cannabis users,

higher levels of opioids are needed to manage post-operative pain (Jamal et al., 2019; Jefferson et al.,

2013). In summary, research with EAs shows a steady increase in reports of cannabis use and misuse,

with higher rates of use in states where cannabis is legal. However, findings related to the impact of

cannabis on post-surgical outcomes are mixed, and few studies examine this relationship among EAs.

1.7 Racial/Ethnic discrimination and pain disparities

Race is defined as the phenotypical classification of human and is rooted in the observable physical differences between humans (Hirschman, 2004). Meanwhile, the term ethnicity refers to the dynamic process of making meaning of belonging to an ethnic heritage (Phinney, 2006). Taken together, ethnic-racial identity captures one's ethnic heritage (e.g., traditions, language, etc.) and the racialized experience associated with socially constructed groups belonging to a sociohistorical context (Umaña-Taylor et al., 2014). For simplicity, "ethnic identity" will be used here to encompass ethnic heritage, racial phenotype, and cultural background (Phinney, 2006).

Racism and ethnic discrimination at the individual level and structural level is pervasive in the U.S. and is regarded as a major public health concern (Paine et al., 2021; Pew Research Center, 2021). At the societal level, structural racism operates by fostering racial discrimination though systems such as education, employment, criminal justice system and health care. As a result, research consistently shows that racial discrimination affects both physical and psychological health outcomes. As a Social Determinant of Health (SDOH; Braveman & Gottlieb, 2014), it impacts racial minoritized individuals' access to medical care, quality of treatment, and post-treatment trajectories (Carter et al., 2017). Recent guidelines urge researchers to incorporate behavioral, social, systemic environmental and biomedical factors in order to promote improved public health research and policies related to surgical health outcomes (Allar et al., 2023).

In pain research, differential pain ratings and pain reduction are consistently found for racial/ethnic minorities (Anderson et al., 2009; Donaldson et al., 2020; Goyal et al., 2020; Perry et al., 2019). Compared to White Americans, Black Americans with chronic pain are at risk for increased levels of pain, pain-related disability and other pain-related health outcomes such as poor sleep (Maly & Vallerand, 2018; Morales & Yong, 2021; Schubiner et al., 2023). A large part of these disparities are attributed to the reduced likelihood of Black Americans to receive pain screenings, pain management

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referrals, and adequate pain management (Knoebel et al., 2021; Meghani et al., 2012; Tait & Chibnall, 2014). Additionally, a study with nationally representative data shows higher rates of acute pain in African Americans and Hispanics (Riskowski, 2014). Experimental pain sensitivity studies reveal that rates of clinical pain are greater among racial/ethnic minorities compared to Whites, with African Americans, Asians and Hispanics reporting lower pain tolerance and higher pain ratings across 41 experimental studies (Kim et al., 2017). Related to post-surgical pain, a recent systematic review revealed that Black/African Americans were often more likely to experience more severe postoperative pain than Whites (Thurston et al., 2023). Similarly, Perry's 2019 review found that both Hispanic and African Americans reported higher preoperative and post-operative pain intensity (Perry et al., 2019). Multiple factors contribute to disparate experiences in health- and pain-related care, such as biased assessments, stereotype-based judgment and decision making, and psychosocial elements of practitioner-patient interactions (Hirsh et al., 2020; Tait & Chibnall, 2014).

1.8 The protective role of ethnic identity

Research suggests that ethnic identity can serve as a protective factor for individuals. A protective pattern emerges in substance use research when nuanced measures of ethnic identity are included. Ethnic identity has been found to predict lower alcohol and substance use among African American adolescents, EAs and adults (Bowman Heads et al., 2018; Brook & Pahl, 2005; Maclin-Akinyemi et al., 2021; Zapolski et al., 2017), and to moderate the association of racist experiences and substance use among African American adult women (Stevens-Watkins et al., 2012). Similarly, among ethnically diverse college students, ethnic identity functioned as a protective factor for less use of non-medical prescription drug use compared to White participants (Carter et al., 2019). However, these studies did not analyze opioids separately from other substances, and prevalence of opioid use in the samples are not always clear (Bowman Heads et al., 2018; Stevens-Watkins et al., 2012), or are reported as low (1%)

compared to other drugs (Maclin-Akinyemi et al., 2021). Additionally, minoritized racial identities have demonstrated to be a protective factor against prescription opioid misuse for adolescents and EAs (Miech et al., 2015; Palamar et al., 2016). Taken together, these data suggest ethnic identity emerges as an important factor to study in the context of substance use.

1.9 Opioid Use among racial/ethnic minoritized individuals

Research on racial and ethnic differences in opioid use among adults and youth suggest Whites are more likely to be prescribed an opioid than Blacks and Hispanics (Groenewald et al., 2018; Mills et al., 2011; Moriya & Xu, 2021; Muench et al., 2020; Thurston et al., 2023). Conversely, there is evidence that among adolescents, Black and Hispanic adolescents are at slightly higher risk for prescription opioid misuse than Whites (Ford & Rigg, 2015). A similar trend has been observed among adults, where overall opioid misuse prevalence rates remaining the highest for Whites, but rates appear to be increasing for Black/African Americans (Pouget et al., 2018). Moreover, recent data suggests that while White patients are prescribed both more frequent initial and refill prescriptions, they are also at higher risk for OUD diagnosis (Flores et al., 2024). These data also suggests that the less frequent opioid prescription refills for racial/ethnic minorities indicates lower quality of pain care. Relatedly, in a national sample of Black/African Americans, racial discrimination was associated with lifetime prescription opioid misuse. Furthermore, for Black individuals with chronic pain, perceived discrimination was associated with higher rates of opioid misuse (Doorley et al., 2023). To this end, White individuals are consistently prescribed opioids at higher rates than minorities and carry higher risk of opioid misuse. However, racial discrimination plays a role in misuse for some minority groups.

1.10 Substance use among racial/ethnic minoritized individuals

Emerging adults have high rates of alcohol, nicotine use, and are more likely than other age groups to use illicit substances such as cannabis, hallucinogens, amphetamines, non-medical use of prescriptions and MDMA (Substance Abuse and Mental Health Services Administration, 2019). Cannabis is consistently found to be the most used substance, with a steady increase for use among young adults in particular (Patrick et al., 2024). The increase in cannabis use prevalence also shows evidence of racial/ethnic differences, with higher cannabis use for Black/African Americans compared to White individuals (Chen et al., 2017; Hamilton et al., 2019; Mitchell et al., 2020), with a notable difference for Black/African American emerging adults in particular (Keyes et al., 2017; Reboussin et al., 2019; Richter et al., 2017). Asian Americans show the lowest rates of cannabis use and misuse, but data show increased rates for young adults (Lu et al., 2023; Tucker et al., 2019). Use of substances that meets criteria for Substance Use Disorders (SUD) have increased among EAs, but with lower rates for Hispanic, Black and Asians (Lu et al., 2023).

Research suggests an association between racial discrimination or race-related-stress with Black/African Americans' cannabis use. Results are consistent from studies with from incarcerated African American men (N=177), national surveys with Black men (N=1,833) and (Dogan et al., 2021; Parker et al., 2017). Findings suggest cannabis is used as a coping strategy to handle race-related discrimination. However, strong racial identity also emerges as a a protective factor against increased cannabis use in Black young adults (Banks et al., 2021). This research has been replicated in diverse youth samples in school-aged African Americans, Hispanic and multiracial youth (Zapolski et al., 2017). Findings are similar across racial/ethnic groups for other substances, with discrimination being associated with increased tobacco and cannabis use disorders, but with stronger effects found for Black adults (Mattingly et al., 2023). For other racial minorities, discrimination emerges as a risk factor for cannabis use which has been observed in Latinx samples (Bakhtiari et al., 2020). Conversely, a strong

cultural identity serves as a protective factor against cannabis use for American Indician/Alaska Natives (Unger et al., 2020).

The literature suggests that ethnic identity and racial/ethnic discrimination appear to play a role in substance use across ages, but its role has yet to be investigated specifically among EAs and for prescription opioid use in the context of post-surgical pain. This current study aims to fill these gaps by investigating associations between ethnic identity and discrimination among EAs prescribed an opioid after surgery.

1.11 Theoretical Model

This study uses a novel integrated model of post-surgical pain (PSP) in EAs which is based on existing models of pain-related psychosocial factors (Stone & Wilson, 2016; Weinrib et al., 2017), surgical and medical experiences (Katz & Seltzer, 2009), and risk-related factors in the context of opioid prescriptions (Dash et al., 2018). The model (Figure 1) proposes that contextual mechanisms of risk and resilience impact surgery (perioperative) and post-surgical outcomes. In addition to psychological factors and pain learning, the model highlights race/ethnicity and related discrimination as key components. Furthermore, ethnic identity may serve as a protective moderator of associations between these mechanisms and outcomes (pain-related factors and opioid use). Studying ethnically diverse EAs through this lens will result in data that can be used to promote health equity, identify malleable risk and resilience factors, and lead to improved interventions for this understudied and underserved population.

Qualitative Studies

A small body of work has used qualitative approaches to characterize the experiences of EAs who have received opioid prescriptions for acute or post-surgical pain. Among patients undergoing elective

surgery, research revealed that patients had an awareness of the negative consequences (e.g., risk for

misuse, addiction and overdose) and preconceptions about opioids that informed their use after surgery

(Anand et al., 2022; Johnson et al., 2023). Similarly, qualitative research examining patients' experiences

following bariatric surgery also highlighted the theme of an awareness of opioids, while also expressing

confidence in post-operative pain management (Olausson et al., 2024). Moreover, in work with patients

undergoing spinal surgery, fear of dependency was found to be a motivator for tapering off opioids,

while participants also expressed they experienced stigma related to their pain experience and opioid

use from their social circles and providers (Uhrbrand et al., 2020).

1.12 Significance and Aims

This research aims to uncover previously unexplored aspects of ethnic identity and perceived

racial discrimination in a post-surgical EA sample. These elements have not been examined in the

context of health-related outcomes of pain persistence, psychological functioning and opioid use. Since

EAs are particularly vulnerable to substance use problems, examining trajectories of opioid prescriptions

and cannabis use, and the role of race/ethnicity following surgery is critical. The acute post-surgical

period also offers a unique window to exploring supportive and preventative interventions that can

improve surgical outcomes. This study will capture biopsychosocial factors related to post-surgical pain

experiences and opioid- and cannabis use not only during the understudied emerging adult period, but

also ethnic minorities in the EA period. This period is pivotal as it sets the foundation for expectations of

health services and pain treatment in adulthood.

Methodologically, the proposed mixed-methods approach offers a unique opportunity to

investigate post-surgical pain. The proposed design will enable findings that can promote health equity

and identify risk and protective factors, which can lead to improved interventions for this understudied

population. Thus, the aims of the study are 1) To evaluate associations among ethnic identity and post-surgical pain outcomes surgical pain outcomes (pain intensity, pain-related functioning) and substance use (opioids and cannabis) in an ethnically diverse sample of EAs receiving opioid medication for post-surgical pain, and 2) To utilize a mixed-method analysis approach to more fully characterize EA experiences and examine the role of perceived ethnic discrimination and perceived support from the healthcare system as it relates to ethnic identity and pain-related post-surgical outcomes in EAs.

Chapter 2: Methods

2.1 Overview and Study Design

109 participants were recruited as part of a completed NIDA-funded R01 supplement, Research on the Adolescent Management of Pain (ROAM; RO1DA044778-02S1; PI Wilson). This study examined opioid use in EAs in general and was not designed to answer specific questions related to racial/ethnic identity and discrimination. This sample is composed of EAs (ages 19-25, n = 109, 25% identified as a racial/ethnic minority), recruited from day surgery settings, who received an opioid prescription for post-surgical acute pain. This sample will be referred to as Sample 1. To have the ability to examine ethnic identity and its association with post-surgical pain functioning, opioid- and cannabis use, an expanded sample of racial/ethnic minority EAs was recruited (n = 35; Sample 2). Together, Sample 1 and Sample 2 combined to make up Sample 4 (see Figure 2).

Data collection for Sample 1 occurred at two time points: T1 (baseline, within one month post-surgery, with the majority of the data collected 2 weeks after surgery), and T2 (3 months post-surgery). Data collection for Sample 2 followed the same timeline and included a number of additional measures selected to represent domains of the theoretical model proposed here (Figure 1). A sub-sample (n = 13; Sample 3) of Sample 2 was selected for the qualitative portion of the study. The qualitative study used purposive sampling and participants completed semi-structured interviews used in analysis of Aim 2. With N=13 we achieved maximum variation (Morse, 2000) in areas such as surgery type, age, substance use and racial/ethnic identity.

2.2 Procedures

Participants for all samples were recruited through Oregon Health & Science University from ambulatory surgery settings. Potentially eligible participants were identified via electronic health

records based on their age, self-reported race/ethnicity, presenting with non-cancer pain, and receipt of an opioid prescription following day surgery. They were invited to participate in a study about pain and pain treatment in young adults. Eligible participants were enrolled in the study within 72 hours of being prescribed an opioid. All participants were followed prospectively over 3 months. They completed online questionnaires and phone surveys at T1 (baseline; one week post-surgery) and at T2 (3 months post-surgery). All quantitative self-report measures were administered electronically via Research Electronic Data Capture (REDCap).

2.3 Quantitative Measures

Race/ethnicity characteristics

Race/Ethnicity. Participants reported race as either "White", "Asian", "Black/African American", "Native Hawaiian/Pacific Islander", "Multiracial" or "Other" with a write-in option. Ethnicity was reported as either "Hispanic or Latino", "Non-Hispanic or Latino" or "Unknown".
Racial/ethnic minority status: Due to the small number of participants in each racial/ethnic minority group, the subgroups were not powered for between-groups analyses. Therefore, a variable was created to categorize those participants identifying as either 1) White/Non-Hispanic, or 2) Other racial and ethnic minorities (e.g., all non-White identities as with either Hispanic or non-Hispanic designation).

Racial-Ethnic Identity. The Multigroup Ethnic Identity Measure (MEIM; Roberts et al., 1999) was used to assess ethnic identity. Originally created by Phinney (1992), later revisions have developed a two-factor model of ethnic identity (Feitosa et al., 2017; Roberts et al., 1999), that consistently shows robust validity across racial/ethnicities, as well as different demographic and health-related populations (Avery et al., 2007; Lee & Yoo, 2004; Lin et al., 2019). Example items include "I feel a strong attachment towards my own ethnic group", and "I have a clear sense of my ethnic background and what it means

for me", and it is measured on a 4-point Likert scale. Item responses range from 1= "Strongly agree" to 4= "Strongly disagree", and includes reverse-scored items. A higher total score means endorsing higher levels of ethnic identity, total score is a mean score of all items with items ranging 1-4. The items make up two subscales, which are also mean scores: *Ethnic Identity Exploration (Exploration),* and *Affirmation, Belonging and Commitment (Commitment)*. Based on previous research comparing these two factor structures, the Commitment subscale has been found to have the most significant associations with variables used in this study (Zapolski & Deppermann, 2023), and is therefore the scale used in this study's analyses. Internal consistency for this sample was excellent (α=.91).

      Racial/ethnic discrimination. The Brief Perceived Ethnic Discrimination Questionnaire-Community Version (Brief PEDQ-CV; Brondolo et al., 2005) was used to measure levels of ethnic discrimination and race-based maltreatment. The measure is comprised of 17 items and has 5 subscales: 1) Lifetime Exposure (17 items, range 5-85; Example item: "Because of your ethnicity/race, have others hinted that you are dishonest or cannot be trusted?"); 2) Exclusion/rejection (4 items, range 5-20; Example item: "Because of your ethnicity/race, have people been nice to your face, but said bad things about you behind your back"), 3) Stigmatization/devaluation (4 items, range 5-20; Example item: "Because of your ethnicity/race, have others hinted that you must not be clean"), 4) Discrimination at work/school (4 items, range 5-20; Example item: "Because of your ethnicity/race, have others thought you couldn't do things or handle a job?") and 5) Threat/aggression (4 items, range 5-20; Example item: "Because of your ethnicity/race, have others threatened to hurt you?"). All items are measured on a 5-point Likert scale ranging from 1= "Never happened" to 5= "Happened very often", with higher total scores indicating more experiences of ethnic/racial discrimination. The measure has been validated across multiple settings and racial/ethnic samples (Keum et al., 2018). Internal consistency for this sample was excellent (α=.93).

Pain Characteristics

Pain intensity. Participants reported on their past average 7-day pain intensity (NRS-11; 0-10 Numerical Rating scale) (Ferreira-Valente et al., 2011; Gagliese et al., 2005). Item responses range from "0 = No pain" to 10 = "Worst pain possible". Cutoffs scores were 0 = No pain, 1-2 = Mild pain, 3- 6 = Moderate pain, 7-10 = Severe pain (Hirschfeld & Zernikow, 2013; Li et al., 2007; Woo et al., 2015).

Pain frequency. Pain frequency was measured asking "In the past month, how many days have you had aches or pains?". Item responses were measures on a 6-point Likert scale, with 0 = "Not at all", 1 = "1-3 times/month", 2 = "1 day/week", 3 = "2-3 days/week", 4 = "4-6 days/week", 5 = "Daily".

Pain Interference. Pain-related interference was measured using the PROMIS Pain Interference scale (Hays et al., 2018). It is a short-form measure using 6 items that assesses past 7-day interference from pain on a 5-point Likert scale ranging from 1= "Not at all" to 5 "Very much". The total raw score is converted to a standardized T-score with a mean of 50 and a standard deviation of 10. Higher scores represent more pain interference, and can be categorized into symptom levels (Within Normal limits: T-score =<54, Mild: T-score =55-59, Moderate: T-score =60-69, Severe T-score =<70). It has been well validated with diverse populations (Askew et al., 2016). Reliability for this sample was excellent (α=.92).

Persistent Pain. The presence of persistent pain pre-surgery was determined by creating a variable that asked participants to report on pain duration for >= 90 days before the surgery date. The pain was not specific to body location, but asked about the worst pain that the participants were experiencing and what date that pain started.

Substance Use

Opioid prescription use. Use of opioid prescription was assessed using a timeline recall. This was completed by a trained study staff over the phone within 2 weeks of being prescribed an opioid for surgery. The survey followed the Timeline Followback (Sobell & Sobell, 1992) format and assessed

detailed information about the prescribed opioid and participants' use of it, e.g. if a prescription was filled, if and how often it was taken, and how many pills were taken. It was assessed within the first 30 days following the surgery and opioid prescription, with the majority of participants responding <2 weeks after surgery.

Cannabis use. Participants completed a modified version of the Timeline Followback (TLFB) assessment over the phone with a Research Assistant (RA) (Sobell & Sobell, 1992). It is a calendar-based measure used to capture past 30-day substance use. Trained study staff collected information on whether any substances were used on a given day, the frequency of use over the 30-day period and the quantity of the substance used from participant self-report. The TLFB was completed a mean of 10 days (SD=7) after surgery, capturing primarily pre- and some post-surgical days, with most of the 30 days falling within the 2-3 weeks prior to surgery.

Opioid Use Disorder (OUD). To assess for Opioid Use Disorder (OUD), participants completed the 11-item Opioid Use Disorder checklist (American Psychiatric Association, 2013). The checklist can be used to determine if DSM-5 criteria is met for a probable use disorder, and assess the severity based on symptom count (e.g., "Mild" = 2-3, "Moderate" = 4-5, "Severe" = 6+). Internal consistency for this sample was good (α=.81).

Cannabis Use Disorder (CUD). To assess for Cannabis Use Disorder (CUD), participants completed the 12-item Cannabis Use Disorder checklist (American Psychiatric Association, 2013). The checklist can be used to determine if DSM-5 criteria is met for a probable use disorder, and assess the severity based on symptom count (e.g., "Mild" = 2-3, "Moderate" = 4-5, "Severe" = 6+). Internal consistency for this sample was good (α=.82).

Substance Use History. Substance use was assessed using the Lifetime Use History Interview derived from the Adolescent Brain Cognitive Development (ABCD) Study (Lisdahl et al., 2018). Participants self-report lifetime use (i.e., "ever" using) and age of first use for cannabis.

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Satisfaction with healthcare experience

The Short Assessment of Patient Satisfaction (SAPS) scale assessed participants satisfaction with their healthcare experience (Hawthorne et al., 2014). The measure captures seven domains of patient satisfaction (treatment satisfaction, explanation of treatment results, clinician care, participation in medical decision-making, respect by the clinician, time with the clinician, and satisfaction with hospital/clinic care. Item responses were measures on a 5-point Likert scale. Scores ranging 0-10 can be interpreted as "Very Dissatisfied", 11-18 = "Dissatisfied", 19-26 = "Satisfied", 27-28 = "Very Satisfied". Internal consistency for this sample was not adequate (α=.40).

2.4 Aims and Analytic plan

All statistical analyses were run using SPSS v.29. Descriptive statistics characterized demographic, pain, prescription opioid and cannabis use variables (See Tables 1-4b).

Aim 1. To evaluate associations among ethnic identity and both post-surgical pain outcomes and substance use (opioids and cannabis) in an ethnically diverse sample of EAs receiving opioid medication for post-surgical pain.

Hypothesis 1a: Ethnic identity will be associated with pain-related functioning within 1 month after surgery such that stronger ethnic identity will be protective and be associated with lower pain intensity ratings and higher pain function.

Hypothesis 1b: Stronger ethnic identity will be associated with less opioid use within the immediate post-surgical period (within 1 month after surgery; T1).

Hypothesis 1c: Stronger ethnic identity will be associated with less opioid use 3 months after surgery (T2).

Hypothesis 1d: Stronger ethnic identity will be associated with less cannabis use 3 months after surgery (T2).

Tests were conducted to assess the regression model assumptions and evaluate the validity of results. Assumptions of normality and homoscedasticity were met, and there was no concern for multicollinearity among predictors. Assumptions of linearity were met for all models, except for past 30-day cannabis use, which had a bimodal distribution. For covariates, sex was added into the model per consistent evidence in the literature of females reporting higher pain rating than males (Bartley & Fillingim, 2013). Exploratory analyses using bivariate correlations were used to determine final covariates for the models (See Table 5a). The final models included sex, age, race/ethnicity (using binary minority status) and pain persistence. Pain persistence was added to control for any contribution ongoing pain might have on pain ratings post-surgery. Pain intensity was also added to models predicting pain interference and opioid use days in order to control for the association between those variables.

Aim 2. To utilize a mixed-method analysis approach to examine the role of perceived ethnic discrimination and perceived support from the healthcare system as it relates to ethnic identity and pain-related post-surgical outcomes in EAs.

Hypothesis 2a: Reports of discrimination and perceived support in racial/ethnic minorities during the acute post-surgical period will be associated with pain outcomes such that higher discrimination and lower perceived support will be associated with higher pain ratings and pain interference.

Hypothesis 2b: Reports of discrimination in racial/ethnic minorities will be associated with higher levels of prescription opioid use during the acute post-surgical period.

Hypothesis 2c: Reports of discrimination in racial/ethnic minorities will be associated with higher levels of *cannabis use* during the acute post-surgical period. The qualitative portion of Aim 2 utilized semi-structured open-ended interviews. The interview was comprised of open-ended questions which allowed the interviewer to ask follow-up questions and expand on areas of interests that emerged

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during the interview. Topic areas included post-surgical experiences, prescription opioid use, cannabis

use, and experiences of racial/ethnic discrimination in the healthcare system.

Chapter 3: Results

3.1 Aim 1 Descriptive results

Participant demographic characteristics

Participants were N=144 EAs (ages 19-25 years, Mage=22.17, SD=2.07) who were recruited

after receiving an opioid for day surgery. 62% were female, and gender identity was reported as cis-

gender man (33%), cis-gender woman (36%), trans man (15%), trans woman (2%) and

nonbinary/genderqueer (10%), multiple genders (1%), prefer not to answer (1%) and missing/unknown

(2%). Fifty-eight percent (n=86) of EAs identified as White non-Hispanic and 42% (n=61) identified as a

racial/ethnic minority (defined as non-white race and/or Hispanic/Latino). See Table 1 for breakdown of

reported race and ethnicity for this sample and additional demographic characteristics.

Surgical and pain characteristics

Thirty-three percent (n=48) of participants underwent orthopedic surgery, 27% (n=39) Ear-Nose-

Throat (ENT) surgery and 22% (n=32) underwent plastic surgery. Twenty-three percent (n=33)

underwent a surgery related to gender affirming care. Participants reported an average 7-day pain

intensity (NRS=0-10) of 4.28 (SD=2.26). Average pain interference was a T-score of 63.53 on the 0-100

PROMIS scale (SD=6.84), with participants falling into symptom levels reflecting mild (15%), moderate

(66%) and severe (12%) pain interference. Nearly half (48.6%; n=70) of participants reported

experiencing persistent pain prior to their surgery date. Seventy-five percent (n=108) were retained at 3

months (T2). At T2 mean pain intensity on a 0-10 NRS was 2.35 (SD=2.32; range=0-8) with 38% reporting

pain intensity of NRS>= 3. Fifteen percent (n=22) reported no pain over the last 30 days, with 41%

(n=44) reporting pain ranging from 2-3 days/week to daily. See Table 2 for additional surgical and pain

descriptive characteristics.

Opioid Use

Participants were prescribed an average of 18.45 (SD=10.17) pills following surgery, range 2-50 pills. Ninety-four percent (n=136) filled their prescription, and 83% (n=119) of participants reported taking their prescription. Average number of pills taken after surgery was 10.7 (SD=9.9, 0.5-49) and average number of days the prescription was taken was 4 days (SD=3.31, 0-15 days). Fifty-three percent reported using opioids for 1-5 days, 25% reported using 6-10 days, and 5% reported using 10-15 days. Opioid use was reported at a relatively short range at T1 (max = 15 day), and at very low levels at 3 months after surgery (T2; n=1 reported use). See Table 3 for additional opioid use descriptives.

Cannabis Use

At the baseline assessment, seventy-one percent of participants endorsed having ever used cannabis products in their life, and 50% (n=72) reported they used cannabis in the past 30 days. Of those who used in the past 30 days, participants reported an average of 13.5 days of use (range 1-30), with 36% reporting using through multiple means of administration. The most common type of use was edibles/ingesting (47%) and smoking a joint (35%). Of all participants, 16.7% met DSM-5 clinical criteria for mild levels of use, 10% met criteria for moderate use, and 13% met for severe use. At 3 months, 66% of those retained reported ever having used cannabis in their life, and 39% (n=42) reported they had used cannabis in the past 30 days. See Table 4a and 4b for additional cannabis use descriptives.

Ethnic Identity

Ethnic identity (MEIM) average total score was 2.57 (SD-0.66, range 1-4) and the Affirmation and Belonging Scale was 2.7 (SD=0.75). Exploratory analyses were conducted to examine minority status with primary study variables. Independent t-tests examining minority status with pain intensity, pain frequency pain interference/pain-related disability, revealed no difference between groups. Moreover,

mean scores of prescription pills prescribed, prescription opioids taken and days of opioid use were

higher for minorities than for White non-Hispanics, but differences were not significant (See Table 5b).

3.2 Aim 1: Analytic results - Examining the association of ethnic identity with post-surgical pain and sucbstance use outcomes

For Hypothesis 1a, two stepwise linear regressions were used to examine associations of ethnic

identity with pain intensity (Model 1) and pain interference (Model 2). Model 1 had two steps, with age,

sex, minority status and persistent pain added in step 1, and ethnic identity added in step 2. Ethnic

identity was measured using the MEIM Affirmation and Belonging score. Model 2 had pain intensity

added in the first step as well. Results revealed that contrary to hypotheses, ethnic identity was not

associated with pain intensity or pain functioning. Findings testing sex as a predictor of pain were not

significant in the overall model, but inserted at the first step, sex was a significant predictor of

differences in pain intensity. Post-hoc t-tests revealed that females reported higher levels of pain

intensity, t(142)= -2.65, p=.009. Pain intensity also contributed to associations in pain interference, R^2 =

.29, F(5, 136) = 10.77, p < .001 (Table 6a).

To analyze hypothesis 1b, the same covariates of age, sex, minority status, persistent pain and

pain intensity (step 1), and ethnic identity (step 2) were added to the models to examine the association

of ethnic identity with prescription opioid use. Model 3 tested ethnic identity as a predictor of number

of days opioids were used. Contrary to hypotheses, ethnic identity was not associated with number of

days the prescription was used. However, pain intensity as a predictor was significant for contributing to

number of days prescription opioids were used. Model 4 examined ethnic identity as the predictor of

the number of prescription pills used as the dependent variable. Contrary to hypotheses, ethnic identity

was not associated with number of prescription pills taken in the 1 week after surgery, but pain intensity

as a predictor did contribute to higher reports of number of pills used (See Table 6b).

For hypothesis 1d, out of the retained 35 participants at 3 months, n=1 participant reported they had used opioids from the prescription they received following surgery. Due to the low level of endorsement for opioids at 3 months, analyses including opioids as outcomes were not conducted. See Table 3 for additional descriptives of opioid use.

To analyze hypothesis 1d, the association of ethnic identity measured at baseline as the predictor of cannabis use at 3 months was tested in two models (Model 5 and 6). Using past 30-day cannabis use (number of days) as the dependent variable, and the same covariates as in previous models (age, sex, minority status, chronic pain and pain intensity), results showed that the model was not significant. There was no association between ethnic identity and the number of reported cannabis use days (see Table 6b, Model 5). Additionally, past 30-day cannabis use (yes/no) was utilized in a binary logistic regression (see Table 6c, Model 6). The regression included predictor variables of age, sex, minority status, chronic pain and pain intensity (Block 1), and ethnic identity (Block 2), with past 30-day cannabis use as the dependent variable. Ethnic identity was found to be a significant predictor of endorsing past 30-day cannabis use (OR 0.36, 95% CI .17 to .75). Consistent with the hypothesis that higher ethnic identity would be associated with lower rates of cannabis use, this model showed that for with higher rates of ethnic identity, the odds of past 30-day cannabis use decreased, holding all other independent variables constant. The results suggest that higher ethnic identity decreased the likelihood of endorsing past 30-day cannabis use.

3.3 Aim 2: Descriptive Results

Out of the 144 participants that were enrolled, n=35 completed measures related to Aim 2 (See Figure 2). Due to the low completion rate (n=35) of main study variables, descriptive statistics, correlations, t-tests and a regression were conducted to investigate associations between racial/ethnic discrimination and pain functioning, opioid use and cannabis use, as well as perceived satisfaction with

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healthcare experience following surgery. Tests were conducted to assess the regression model

assumptions and evaluate the validity of results. Additionally, of the n=35 participants who completed

T1 surveys, only 51% (n=18) completed T2 surveys data at 3 months. Therefore, analyses were

conducted exclusively using baseline data.

Assumptions of linearity, normality and homoscedasticity were met for all study variables except

cannabis use, which revealed a bimodal distribution. Due to the limited sample size, only one covariate

(pain intensity) was added to the model. This was chosen based on exploratory statistics showings its

association with some dependent variables (Table 7.).

Participants were ages 19-25 years, Mage=22.34, SD=2.26. All participants identified as a

racial/ethnic minority. Average scores of racial/ethnic discrimination Lifetime Exposure were 1.87

(SD=0.74, range 1-3.82). For the subscales, the highest means reported for Exclusion/Rejection (M=2.22,

SD=.93) and Discrimination at Work/School (M=2.20, SD=1). Patient satisfaction with healthcare

experiences were rated on average as 20.14 (SD=2.43, range 15-24). Twenty-four percent (n=7) of scores

were in the "Dissatisfied" category, and 75% were in the "Satisfied" category. Seventy-seven percent

(n=27) of participants reported taking their opioid prescription, and 46% (n=16) reported past 30-day

cannabis use.

In this sample, ethnic identity (Affirmation/Belonging) was negatively correlated with pain

frequency, i.e., higher scores of ethnic identity were associated with lower pain frequency in the past 30

days (r_s = -.36, p <.01). Related, ethnic identity (MEIM total score) was correlated with number of

prescription pills taken after surgery, with higher ethnic identity associated with more pills taken, r_s =

.48, p <.01. Additionally, in this sample, number of cannabis use days was associated with taking fewer

prescription opioid pills, r_s = -.56, p <.01. Additionally, number of prescription use days was negatively

associated with satisfaction with healthcare experiences, with higher satisfaction correlation with fewer

days of using opioids, r_s = -.38, p <.01. See Table 7 for additional descriptives and bivariate correlations.

T- tests, chi square tests, and one-way ANOVAs were used to compare sociodemographic factors between participants who were and were not retained at T2. There were no significant differences among baseline sociodemographic factors, surgery type, pain, opioid use or cannabis use between those who were and were not retained.

3.4 Aim 2: Analytic Results - Examine the role of perceived ethnic discrimination as it relates to ethnic identity and pain-related post-surgical outcomes

Hypothesis 2a

Hypothesis 2a was carried out using bivariate correlations and a linear regression. Two regressions were tested using ethnic/racial discrimination as the predictor with pain frequency (Model 1) and pain interference (Model 2) as the outcome variables. Results revealed that partially consistent with the hypothesis, racial/ethnic discrimination was associated with pain frequency. Thus, higher rates of discrimination was associated with higher pain frequency in the past month, while controlling for pain intensity. However, racial/ethnic discrimination was not associated with pain interference (see Table 8a).

Hypothesis 2b

To examine Hypothesis 2b, two linear regressions were used to examine associations of ethnic/racial discrimination and outcome variables – specifically the number of days the opioid prescription was used following surgery (Model 3), and the total number of pills taken (Model 4). Consistent with the hypothesis, racial/ethnic discrimination as a predictor was associated with number of days opioids were used, in that higher reports of discrimination contributed to the variance of more days of opioid use. However, contrary to the hypothesis, racial/ethnic discrimination was not associated with total number of pills used (see Table 8b).

Hypothesis 2c

To investigate associations of racial/ethnic discrimination and cannabis use, correlations and t-tests were used. Reports of racial/ethnic discrimination were not correlated with past 30-day use. Results from non-parametric independent t-tests revealed that contrary to hypotheses, reports of racial/ethnic discrimination did not differ between the two groups of users vs. non-users (Y/N to past 30-day use).

3.5 Aim 2: Qualitative Study Results

3.5.1 Methods

The qualitative analysis explored post-surgical experiences and the role of perceived ethnic discrimination and perceived support from the healthcare system. Thematic analysis was used to explore and best maximize the complementary nature of the quantitative and qualitative data (Bryant & Charmaz, 2019). The iterative process of the qualitative analysis allowed for the utilization of mixed-methods integration with the quantitative data, which is recommended for analyses with data from purposively selected samples (Fielding, 2012).

3.5.2 Procedure

A subsample of Sample 2 (n=13; Sample 3) participated in a semi-structured interview that was approved by the institutional review board (IRB). Consent review for the qualitative interview was done during the consent for the larger study. The qualitative interview was described as optional and as a separate activity from the main study tasks. Only participants with a complete survey at T1 were contacted for the interview. This was to aid in purposive sampling relating to demographics as well as concepts related to the aims of the study. The interviews were conducted between 2 weeks and 3 months following surgery, with the majority conducted approximately around 6 weeks after surgery. Participants offered more detailed and richer responses the closer they were to surgery date. Therefore, the decision was made to complete all interviews within 3 months of surgery. Interview duration lasted

between 25 -75 minutes (Mean duration = 43 min) and were recorded via secure IRB-approved

asynchronous video call (Webex). Participants were compensated $20 for their time. The video software

generated a verbatim transcript that was edited and checked for errors by three research assistants and

EB. Identifying information was removed from all transcripts prior to analyses.

3.5.3 Structured Interview

The interviews were conducted by a researcher trained in clinical interviewing, qualitative

research methods and pain research (EB). The interview schedule was developed by EB (see Appendix

1), and it was designed with an exploratory purpose. Related to the Aims outlined in Chapter 2, these

questions targeted concepts related to opioid use, pain, ethnicity, discrimination and healthcare

experiences related to their surgery. The interview was comprised of open-ended questions which

allowed the interviewer to ask follow-up questions and expand on areas of interests that emerged

during the interview. The concurrent collection of quantitative data allowed for an iterative process that

resulted in 1) adding questions related to reasons for stopping opioid use (since opioid use was lower

than expected in this sample) and similarly 2) due to endorsement of high levels of cannabis use,

questions relating to use in the context of post-surgical pain were added and explored when applicable.

3.5.4 Analysis

All transcripts were reviewed by EB for accuracy. Although a pre-existing framework related to the

overall Aims of the study existed, the analysis relied on inductive thematic analysis, and was based on

the process suggested by Braun and Clarke: familiarization with the data, generating initial codes,

identifying themes, reviewing themes, defining and naming themes, generating a report (Braun &

Clarke, 2006; Braun & Clarke, 2021). The lead researcher (EB) coded the interviews and met frequently

with a second researcher (NJ) who also coded some interviews. This allowed for a collaborative and

reflexive approach, in order to develop a rich interpretation of the data (Braun & Clarke, 2021).

3.5.5 Results

Demographic characteristics of those completing interviews (Mage=22.9 years) were consistent with the main sample (Mage=22.17 years). Participants reported a wide range of socioeconomic backgrounds in their interviews and on demographic questionnaires, ranging from working full time, part time, attending college, or being on medical leave/disability. Many participants were working while at the same time pursuing higher education. Responses from the interviews related to how participants experiences with systemic privileges and/or barriers were often tied to their vocational status, either describing how their job or college were very helpful in providing accommodations for surgery and recovery, or how insurance challenges that affected their care were often tied to their job. The results from this study reflect the diverse vocational and socioeconomic contexts of EAs, and the added vulnerabilities that can arise when transitioning into adulthood and working often lower-paying jobs without high quality health insurance.

Four domains were developed from the data, including Opioid Use, Cannabis Use, Race/Ethnicity Minority Experience, and Systemic Processes. Within each domain, several themes and sub-themes were identified.

Opioid Themes

Opioid Theme 1: A fear of opioids. Many participants described feeling fearful about using the opioids they were prescribed after surgery. This sentiment was often communicated with contextual explanations and reasons for feeling fearful. Several participants spoke directly or indirectly about the current opioid epidemic and expressing a strong awareness of the potential addictive risk of opioids. Participants relayed what they had read in the news, or what they had learned in school about the opioid epidemic.

"So many issues with them [opioids] throughout the country, like the opioid epidemic, people get hooked on to these drugs pretty substantially. And I've read about it in my public health classes, there's plenty of documentaries about the addiction throughout the country that we've been seeing, especially among young people who have been prescribed these medications. So, I was definitely wary of that. And I knew not to abuse it or not want to abuse it."

Moreover, participants reported a family history of addiction as a concern, and as a central reason for avoiding prolonged opioid prescription use. Notably, many participants expressed fear related to opioids generally and spoke of a specific fear that affected how they used their opioid prescription after surgery. They expressed that they would rather endure pain following surgery than manage that pain with opioids, describing that the pain was worth the lowered risk of developing an addiction. These participants were all individuals who had undergone a significant day surgery, with reports of post-surgical pain, like this participant:

"My family has a really, really long line of addiction that goes from my grandpa and my dad to my siblings. And I'm very cautious about how long I'm on medication, and personally, I don't like using it any longer than I have to. I felt like at those two weeks that I would be able to manage my pain as is without it. And so for my comfortability, I stopped it even if I was in excruciating pain. I expressed that it's not something I want to continue for the sheer purpose of I'm scared of what I'm unable to control."

Opioid sub-theme 1a: Fear messaging from parents. Several participants were living at home with their parents, and many described one or more parents as having active roles in their post-surgical care. Many participants identified their parents as their main support during their recovery from surgery, either on the day of (driving them home), or while recovering at home (for those living with parents). They expressed how grateful they felt for the support, and they also described how their parents' attitudes towards medications and the explicit and implicit messaging they received from

parents during the recovery phase affected their fear-based attitudes about opioids. One participant shared:

"I didn't use it [the opioid prescription]. I think my mom was also very against me taking it out, but I hadn't planned on taking it out initially. But I recall there was one day when my mom saw me, I guess I was just chilling out, that she thought I was on oxy. She got mad at me and she's like, "are you on the prescription drugs!?" [I responded] "No, just chillin'", but I thought that was really interesting […] My mom works at a nursing home so she's just like, familiar with how strong opiates are so I think our language about opiates is very much that they're addictive."

Opioid Theme 2: Choosing to endure pain to avoid negative side effects from opioids. Participants discussed the negative effects they experienced with the prescription opioids they used following this surgery (as well as previous times they had been prescribed opioids). Participants described a range of negative effects stemming from using their opioid prescription (e.g., drowsiness, poor cognition, constipation etc.), and opted to endure the pain to avoid these negative physical effects. Many of the participants who expressed these negative effects also described they had a direct impact on their use, stating they stopped their use when effects were impacting them too much. Using similar reasoning as those limiting their use due to fear of opioids (and some experienced both fear and negative physical effects), the participants chose to stop taking their prescription because the negative effects outweighed the benefits they felt from pain reduction.

"And I know like those harsh opioids aren't good for you to take for any longer than you need it. And I didn't feel like I needed it for the pain […]. After those first few days it made me very dizzy and so sleepy. And I was trying to get caught up on some schoolwork too. So, I would have rather had maybe just a little bit more pain without having to take the opioid than to take it and be dysfunctional the whole day".

Cannabis Themes

Cannabis Theme 1: Positive mental health effects from cannabis use. Participants who used cannabis regularly often described that using cannabis made them feel more relaxed, happy, more socially motivated, more engaged with their surroundings, and more productive:

"Mentally, it just puts you in a lighter, more happier mood. And because I smoke a sativa, I smoke stuff that's supposed to uplift you and get you a little bit more energized and whatnot. So, I like how it makes me feel more mentally comfortable and just at ease with everything."

Mental health functioning was also perceived to be linked to pain, and several participants noted an association between their mood and its impact on their pain experience, like this participant:

"It affects the pain, which really helps my mood in particular. It's the pain that causes the grouchiness [...]. It is usually the pain that causes all of the negative things and when I have cannabis, it's like the pain's not there so I can continue being the normal person I normally am."

Cannabis Theme 2: Using cannabis for pain relief. Participants shared many examples of how cannabis affected their pain experience. Patterns centered around descriptions of how cannabis did not remove pain per se, but was related to a feeling of numbness and disconnection from the pain experience:

"I am present and aware of the pain, but it is not connecting to me. It's more sort of turned down, like I know I'm in pain and I should be careful, but it doesn't hurt".

Pain was often perceived as present and could be felt but was described as "dialed down" and more manageable.

"The best way to explain it is that it numbs the feeling. So, from, my chest to my stomach, it's no longer like this stabbing, 'oh my God, you're annoying' pain […] I know the pain is here, but it's something I can push off to the side. It's not something that's right there in my face anymore."

Cannabis sub-theme 2a: Contradictory perceptions about effects on pain*. In addition to a pattern of pain relief, many people discussed the effects of cannabis and were either contradictory or unsure of how it impacted them. These were often participants who used cannabis daily who both expressed feeling pain relief, while also denying that pain was reduced. Or they expressed that they were unsure and were unable to explain how cannabis affected their pain experience. In previous descriptions of their use, frequent users had typically been using for several years starting in their mid-teens, and tended to struggle in explaining the cannabis-pain relationship, for example:

"I don't think it necessarily lessened pain a ton. It's just helped me get through. I think it did help obviously probably. That's an interesting question. I actually don't know how much lower pain, but maybe it did."

Cannabis Theme 3: Changing cannabis use around surgery. Cannabis users described different ways their use during the perioperative stage, and often described an intentionality about their cannabis use and reasoning for it, some speaking to change in use before surgery:

"Before I was using it in the morning, and I was usually inhaling it through smoke and then once I realized surgery was coming around I had to switch. I was forced to figure something else out. So I had switched over to tinctures or edibles, something that would not cause coughing or any sort of disruption for my lungs. And I realized when I switched over to edibles, I needed a little less. […] When I came out of surgery, I didn't really need any sort of marijuana for those two weeks, I had way too much medication".

Others intentionally increased their use after surgery specifically to target pain:

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"I did it more at night, you know, doubled up on what I would do at night to kind of help me go to bed at first, but not that I was smoking more or less because of the surgery. It was just kind of a little bit more, I needed to kind of help with the pain."

Meanwhile, there were also reports of participants doing their own research about cannabis use during surgery online and basing their use on the information they found. Some participants were open about their use with providers, and had conversations specifically related to cannabis use. The purpose of these conversations appeared to be specifically to minimize risk in the perioperative stage:

"I didn't want to [stop for surgery]. It is recommended not to start smoking again until a month after surgery. Didn't listen to that [...] I was transparent with my anesthesiologist too and he was like "It's okay", the main concern that they had with after surgery was coughing and the expansion of your diaphragm and so I was very wary of that."

Race/ethnicity Themes

Minority Theme 1: Awareness of minoritized identity in the healthcare context. Several participants spoke about their race/ethnicity and revealed insights and an awareness of how those identities showed up in the context of receiving healthcare. Most participants did not have a particular incident from the surgical visit in this study in mind, but spoke to more broad experiences with healthcare providers and past experiences, that affected their perceptions of their healthcare experience.

"I'm very aware of medical trauma and my body, where I'm very aware of how [people of my ethnicity] have historically been the testing grounds for a lot of heinous, medical atrocities. And so I feel panic in my body, and a lack of care and respect and then, I think also anxiety like they're going to uncover a problem in my body that I have because of my family's historical negligence […] I have these problems that are from historical traumas against my family who are Black, and who are indigenous, and so I notice myself having to expand the energy of calming down."

Minority sub-theme 1a: Uncertainty. The awareness of identity also brought up several instances of uncertainty related to how others were perceiving them. Reports of feeling uncertain about if providers' behaviors were motivated by racially based undertones, and internally having a dialogue internally of "what if?". This was reflected in what this participant shared:

"I think there was a little bit of discomfort on my hair, like, touching my hair, even though they had to for surgery. I noticed some hesitation around that, but I couldn't tell if it was because my hair isn't textured, really straight or if it was just, you know, a student being nervous about touching another person's body for the first time. So I don't know".

Minority Theme 2: Intersectionality in the healthcare context. Many shared that aside from racial/ethnic identity, there were multiple aspects of their identities that were more salient to how they were or have been treated in healthcare settings. Participants were aware of how they presented and might be perceived by others, and some integrated that into their racial/ethnic presentation. The privilege that was associated with certain identities, in particular indicators of class differences that might be perceived by providers:

"I carry so much privilege, especially my educational background, especially in being a native English speaker, especially in the way I look and the way that I dress and everything. I know that I carry a lot of privilege in those scenarios compared to other Latinx people who speak with an accent and Latinx people who have different markers of class, race, all these different things".

Minority Theme 3: Making medical decisions in the context of perceived racial discrimination*.* Some participants had perceived discriminatory experiences related to their surgery that took place in the perioperative stage. No one shared any incidents from the day of surgery, but there were experiences pre-operatively that impacted their medical decision-making, for example:

"My dad was also there too, and [he] is an immigrant to this country. He speaks English well, but he also has an accent too, and he was asking these questions, and it felt in a way that the doctor's answers were condescending, sort of like he wanted to rush the answers. I don't know if it had to do with his accent or him being an immigrant, but it felt that way to me. This was one of the reasons I did not want to continue seeing that doctor [and sought a second opinion at this hospital], and it was like night and day, the experience between the two".

Systemic Processes Domain

Participants reported varied experiences with the healthcare system for the surgery. For example, the range of surgery types, etiologies, socioeconomic status, medical literacy, insurance status all contributed to varied healthcare experiences related to surgery. Analyses revealed two broader themes of systemic barriers and systemic privilege.

Systemic Theme 1: Systemic Barriers. Several participants discussed how long wait times, multiple pre-surgical appointments, insurance authorizations, and navigating a complex medical system as things they wish had been different and less challenging**.** Different types of surgeries and accompanying wait times was often brough up. For those receiving gender-affirming surgeries in particular, long wait times, sudden last-minute openings and having very little control over choosing when to have surgery was common. One participant stated:

"I knew that part of the reason I wasn't getting penciled in for a revision is because there were so many people on backlog that had to wait. And even now I had to schedule out my follow up […] But everyone has been really good about managing expectations of these things will take time. Like, we are not going on the schedule we want or on the timeline that we need or you deserve."

Systemic Theme 2: Systemic Privileges. Many participants were college students and spoke about how their education affected their medical literacy and ability to navigate the healthcare system benefited them. Several students also shared that although there was added work in getting appropriate medical leave from their studies, they shared that they were able to navigate it, and were afforded those protections from their schools. Additionally, some students were in the medical field and were aware of the privilege that afforded them:

"As a medical student on the day of surgery, I know it's in my chart and a few health care

providers brought it up just like as a bonding point [that I was a medical student] [...] I appreciated that,

and I think it also made me feel more comfortable to ask pointed questions."

Moreover, the participants who reported being part of school-based athletic teams and

undergoing surgery for sports-related injuries reported a significant amount of support in the

perioperative stage and throughout recovery. They were aware of that their experience might not be

common and was unusual:

"Everything was pretty smooth and straightforward I would say. The biggest memories is

everything being pretty easy [...] Communication was pretty clear, I think me being part of athletics made

everything go pretty smoothly as well. I didn't I really didn't have to coordinate a lot of stuff it was kind

of coordinated for me. I guess I'm pretty lucky to be in that situation just because everything has moved

along pretty quickly. I got a lot of support from the coaches, the athletic training staff and the doctors. I

felt like I was kind of like a priority, so that was nice".

5.6 Mixed Methods and Integrated Results

Among individuals participating in qualitative interviews (n=13), scores on ethnic identity were

reported as *M*=3.00, and scores on the Commitment Scale ranging 1.43-4 (*M*=3.2, SD=.84). These scores

are slightly higher compared to the overall sample mean. This is consistent with post-hoc analyses for

the full sample (n=144) revealing significantly higher means for ethnic identity for racial/ethnic

minorities compared to Non-Hispanic whites in the larger sample $t(142) = 5.7$, $p < .001$. Eight identified

as Hispanic or Latino, which is representative of the relatively higher number of Hispanic/Latino

individuals in the larger sample. For racial/ethnic discrimination, scores ranged 1.12-3.48, with average

score of 1.91 (*SD*=0.68) for this sample, which is very close to the larger (n=35) sample. This range is

congruent with reports from the interviews that included responses ranging from low levels or no experiences of racial discrimination to very high and impactful experiences of discrimination.

For surgery types, 8 participants underwent orthopedic surgery, 4 plastic surgery (3 related to GAS), and one person underwent ENT surgery. Mean number of pills take after surgery was 9.2 (Range=3-29, SD=6.7). 7 participants reported they experienced pain for at least 90 days before their surgery date. This is reflected in interview responses where participants discussed their post-surgical pain in the context of the pain they had previously been managing, and identifying the surgery as a point of relief.

The overall study sought to examine the extent to which ethnic identity was associated with prescription opioid use, but no association in the quantitative results was identified. Similarly, the qualitative results found that many ethnic minorities expressed fear about opioid use and cited this as a reason for taking less than was prescribed, discontinuing opioid use earlier than indicated, and even expressing that enduring post-surgical pain was preferable to the risks that came with continued prescription opioid use.

This study also aimed to examine associations between ethnic identity and cannabis use. Although quantitative findings revealed that ethnic identity served as a potential protective factor against reporting lifetime use of cannabis, cannabis use was reported at high frequencies overall in the sample, with a notable subsample of EAs reporting risk for hazardous use. Consistent with overall reports of high use, the qualitative data reflected this frequent cannabis use. Nine people reported past 30-day use in surveys, and the mean number of cannabis use days in the past month was 17.22. For cutoffs using the Cannabis Use Disorder checklist, of those who reported past 6-month use (n=9) at baseline, 4 reported they smoked more than 20 days in the past month. 5 participants reported scores that fell within the "Severe" category on the checklist for Cannabis Use Disorder (>6 items). This is

congruent with reports from the interviews that reflected frequent cannabis use before and after surgery.

Related to exploratory study questions about satisfaction with healthcare experience, responses ranged from 15-24, with 4 participants' scores falling in the "Dissatisfied" category, and 5 reported being "Satisfied" with their healthcare experience. Of note, the range for "Satisfied" is 19-26, while "Very Satisfied" is 27-28. In context of the interviews, many people reported positive interpersonal experiences with providers during the perioperative stage and the day of surgery. The lower scores could potentially be related to the systemic barriers people spoke of during the interviews, such as wait times, insurance issues and navigating complex medical systems with little support.

Chapter 4: Discussion

This study captures biopsychosocial factors related to post-surgical pain experiences in emerging adulthood among a diverse sample of participants who recently underwent surgery. The EA developmental stage is previously understudied in the post-surgical context, in particular among racial and ethnic minorities. This study utilized mixed methods to examine aspects of ethnic identity and perceived racial discrimination in a post-surgical EA sample. This work can be used to promote health equity, identify risk and protective factors, and lead to improved interventions for ethnically diverse EAs.

Overall, results highlight that ethnic identity might play a role in EAs cannabis use, mirroring previous work that shows it serves as a protective factor against use. Meanwhile, racial/ethnic discrimination emerged as a potential risk factor for both pain frequency and opioid use. Both quantitative and qualitative analyses revealed that EAs in this sample were averse to using opioids for pain relief but had more lenient attitudes and behaviors towards cannabis use.

4.1 Ethnic identity and pain variables

Contrary to our hypothesis, while controlling for minority status, ethnic identity was not associated with pain intensity or pain interference. Studies examining ethnic identity as a protective factor of adverse health outcomes have largely focused on substance use and misuse (Bowman Heads et al., 2018; Brook & Pahl, 2005; Maclin-Akinyemi et al., 2021), and to our knowledge no study to-date has examined the association of ethnic identity and pain experiences. It is possible that the mechanisms that are involved in buffering against risky substance use do not affect pain experiences in the same way. Future research with larger samples should examine the relationship between minority status and ethnic identity, ideally with larger sub-samples of minorities that allow for between-group comparisons. Moreover, ethnic identity was also not associated with number of days or number of prescription pills

taken after surgery. These findings are inconsistent with past research, which has found that ethnic identity serves as a protective factor against opioid prescription misuse (Appiah et al., 2023; Carter et al., 2019). However, these studies include only college students or younger adolescents, and focus on non-medical opioid prescriptions. It could be that the medical and post-surgical context offers other processes that impact the ways in which EAs are using opioids (Kapos et al., 2024). It is also possible that the short range of days of reported use restricted the analyses and results. Future research should examine reasons for prescription opioid use after surgery more closely, attitudes related to opioids before and after surgery, and more fully explore other pain-management strategies that EAs employ in lieu of opioids.

Research shows that pain ratings are often higher for racial/ethnic minorities (Anderson et al., 2009; Overstreet et al., 2023; Perry et al., 2019), but in this sample, average pain reports were similar and not significantly different by race/ethnicity at either timepoint. Several reasons could explain these findings, for example the heterogeneity of both surgery types and the heterogeneity of the racial/ethnic breakdown. Studies that reveal differences in pain reports are typically comparing one racial minority (e.g. Black/African Americans) to White samples (Perry et al., 2019), and the sample size for each racial/ethnic category in this sample was not powered to complete analyses comparing all minority groups. The between-group differences are important to highlight in research about several racial/ethnic groups and is a major limitation of this study. Future research should focus on this unique developmental stage and continue to examine if differences found in other studies are not representative in EAs, or if there are other factors driving the differing pain experiences.

4.2 Ethnic Identity and Opioid Use

Results did not support the hypothesis or previous research about ethnic identity and opioid use. In this study, ethnic identity was not associated with prescription opioid use days or number of pills taken after surgery. The findings could be explained by that the analyses were potentially underpowered due to small the small sample size and overall low reports of prescription opioid use. Moreover, the majority of previous work focuses on all adults of all ages, in particular studies focused on adults aged 65+ (Joo et al., 2024). These age cohorts represent a significantly different developmental stage than EAs, with the opioid epidemic contributing to attitudes about opioid prescribing, in particular for EAs (Adams et al., 2021; Anand et al., 2022). Moreover, recent prescribing changes, e.g. using the Enhanced Recovery After Surgery (ERAS) protocol might not be captured in available large population data yet, but recent studies suggest that implementation of ERAS eliminates racial disparities in pain reports (Felder et al., 2021) and opioid use (Hootsmans et al., 2023; Levytska et al., 2022).

Areas of future study include investigating surgeries that EAs are more likely to have, and the risk of opioid use and misuse that might be associated with those procedures (Hah et al., 2017). Similarly, identifying procedures that carry lower risk for opioid misuse is advantageous, and is potentially what this study is capturing. This sample had diverse day procedures and not a large enough sample for each category to examine differences between surgeries.

The qualitative results from this sample revealed fear of opioids, which likely is part of the explanation for the low rates of reported opioid use after surgery. Many of the participants interviewed reported the fear of the addictive properties of opioids even outweighed the risk of experiencing post-surgical pain. These results mirror previous qualitative work with arthroscopic knee surgery patients that found similar themes of fear of addition and external messaging about the opioid crisis (Anand et al., 2022). Since the acute postoperative timeframe is crucial not only for the immediate post-surgical

experiences, but has also been shown to impact longer-term outcomes (Gan, 2017; Giordano et al., 2022), future research should continue to examine EAs averse attitudes towards utilizing opioids, and assess if they are receiving optimal pain management support in lieu of opioid prescriptions.

4.3 Ethnic Identity and Cannabis Use

As expected, ethnic identity was a predictor of reporting past 30-day use in the hypothesized direction. Higher ethnic identity scores lowered the likelihood of endorsing past use at 3 months. This relationship is not causal, but the association could speak to the potential protective nature of ethnic identity that has been outlined in previous work with opioid- and other substance use (Banks et al., 2021; Lu et al., 2023). However, there was no association between ethnic identity and the number of reported cannabis use days at 3 months. This suggests that in this sample, the effect of ethnic identity is protective and relevant for non-cannabis users, but the effect disappears when use is endorsed. The findings of likelihood of past use are consistent with many other studies with adults and EAs (Montgomery et al., 2022), in particular for Hispanic and Asian EAs, which comprise a significant portion of this sample. Suggested mechanisms at play in these findings are that strong ethnic identity is adaptive in coping with minority stress (Banks et al., 2021; Unger et al., 2020), as a marker of psychological wellbeing and positive self-image (Saint-Fleur & Anglin, 2021). Moreover, the strength of this study is the relatively high use of cannabis reported in this sample. Since it is similar to recent population-based rates for EAs, the findings of ethnic identity are likely generalizable to EAs undergoing surgery. Moreover, this study replicates other research in that it combined all racial/ethnicities while measuring ethnic identity using the MEIM (Fisher et al., 2020; Rahim-Williams et al., 2007). The MEIM measurement has been validated across racial/ethnic groups and has shown its utility and appropriateness with measuring white ethnic identity (Fisher et al., 2020). Further research is needed to

determine if mechanisms for this protective effect operates in the same manner across racial/ethnic groups. This would require more nuanced approaches with larger samples. Findings could result in understanding potential subtypes of ethnic identity and additional risk and protective factors that might be at play, that can contribute to developing interventions for EAs at-risk for cannabis use.

Among cannabis users in this sample, there was no difference in ethnic identity between low and high users. Moreover, no associations between cannabis use and pain were revealed, which contributes to the mixed data on cannabis as a pain reliever (Hameed et al., 2023; Pantoja-Ruiz et al., 2022). Recent reviews highlight the many limitations of existing studies, and many are focused on chronic pain (Hameed et al., 2023; Hayaki et al., 2024). For this sample, results could reflect that reasons for cannabis use among EAs might differ from other medical and surgical samples. For example, of those who used, average age of first use was 17 years, with a range of 11-22. This suggests many cannabis users in this sample were using before their surgery, and likely had use patterns that were unrelated to pain. Future research should continue to examine factors related to reasons and motivations for use, including related to pain management.

Qualitative findings revealed that several people were using cannabis in the perioperative stage and some specifically for pain relief. The reports of use were high in this sample, but rates for these EAs were comparable to other similar age cohorts in states where recreational cannabis is legal (Stormshak et al., 2019). Mixed methods analyses showed that of those who used, many reported they were high frequency users. Some cannabis users changed their use in the perioperative stage from their regular use. Very little is known about how cannabis use and its postoperative impacts among EAs. Future research should conduct preoperative screenings in order to determine if there are differences in outcomes by level of use, then eventually focus on guidelines for perioperative cannabis in this age group. Additionally, our findings related to cannabis use and managing mental health symptoms

highlights the need to integrate psychological measures (anxiety, depression) into work that assesses

cannabis use in post-surgical samples. Since psychosocial variables, e.g. anxiety, depression, are

predictors of pain experiences, future research should focus on this context with cannabis and pain

outcomes.

4.4 Racial/ethnic discrimination

Results were mixed for associations of racial/ethnic discrimination and pain variables, with

higher discrimination showing an association with pain frequency only. Due to the small sample, these

results should be interpreted with caution. The relationship could be spurious and would need to be

replicated in a larger sample. However, the finding is consistent with previous work showing that

discrimination is associated with poorer health outcomes and substance use (Allar et al., 2023; Carter et

al., 2017). Similar mixed results were revealed for racial/ethnic discrimination predicting opioid use only

for days used. The contradictory findings could be due to sensitivity of the data in this smaller sample.

Further, the null findings from cannabis use and discrimination could reflect the very small sample as

only 16 individuals reported using cannabis in the past month. Additionally, the sample is diverse in its

racial/ethnic breakdown, and previous research that shows strong evidence for discrimination predicting

cannabis use is typically assessed with one or two larger ethnic groups, e.g. African Americans

(Montgomery et al., 2022). Notably, existing research uses widespread measures of cannabis use (e.g.,

CUD, misuse and lifetime use), with the majority of research with EAs examines CUD in non-surgical and

non-pain samples. Therefore, this research should be replicated in larger samples where between-group

comparisons of ethnic groups can be made, and nuanced measures of cannabis use are utilized.

The qualitative findings highlight to the diversity in reports of racially based discrimination in the

healthcare setting. For several participants, there was an awareness of how their racial/ethnic identity

affected their experience when interacting with providers. However, the theme of intersectionality was

salient for many people, highlighting that beyond only race/ethnicity, participants were aware of the

complexities of identities (e.g., social class, education, insurance status) and they affected their

healthcare experience, either creating barriers or favorable circumstances. Future studies should hone

in on social determinants of health (SDOH) and measure those factors relevant to the post-surgical

experiences. Previous work shows that SES, racial minority status and female sex in particular are

predictor of poorer postoperative pain management (Thurston et al., 2023). There is also evidence from

large cohort data that racial discrimination and social class discrimination both contribute to an increase

in cannabis use (Ahuja et al., 2022). Studies that integrate SDOH and intersectionality of identities

warrant future examination among diverse EAs undergoing surgery.

4.5 Limitations and future directions

Strengths of this study include a novel mixed-methods investigation of several factors relevant

to a diverse sample of EAs receiving an opioid following day surgery, such as the role of pain, substance

use and racial/ethnic discrimination in the post-surgical period. The theoretical biopsychosocial

framework that informs this study has allowed for both theoretical and practical integration of a study

design which includes ethnic/racial minorities. Since minoritized populations have historically been

underrepresented in post-surgical outcomes research, this study offers insights to pain and substance

use within the post-surgical period that have previously not been examined. Additionally, the inclusion

of ethnic identity and racial discrimination as applied to these post-surgical outcomes is crucial as it has

been shown to impact health outcomes. Relatedly, the methodology used in this study allowed for

exploratory analyses that uncovered underrepresented voices and perspectives. Considering that little is

known about racial/ethnic minorities' surgical experiences, obtaining the perspective of a diverse

surgical sample is crucial for future work with EAs. Moreover, the longitudinal design utilized in this

study has offered insights to pain, opioid and cannabis use trajectories that are relevant to the post-surgical experience.

While this study has several strengths, the data should be considered in the context of several limitations. First, the sample is comprised of a wide range of surgical types, ranging from orthopedic surgeries, gender affirming surgeries, to Ear-Nose-Throat surgeries. The differences inherent in these surgical experiences, including variations in expected pain and recovery times, might affect this study's results. Second, although the final sample was racially and ethnically diverse, there were not enough participants within to conduct meaningful between-groups analyses. The analyses for this study were only able to compare White non-Hispanic participants with all other races and ethnicities. Thus, the important heterogeneity that exists in the experiences of racially minoritized groups could not be examined, and important unique ethnic and cultural aspects of racial discrimination could potentially have been missed. Additionally, many participants identified as mixed race/ethnicity, and that experience carries unique nuances related to ethnic identity (Ferguson, 2016; Zamora & Padilla, 2024) that were not adequately measured in this study. With individuals in the U.S. increasingly reporting a mixed-race identity (Grilo et al., 2023), this is highly relevant to the EA population and warrants further study. Moreover, low retention rate at T2 resulted in a small sample size for 3-month outcome data, therefore existing results need to be interpreted with caution due to the small sample. Since the small sample did not allow for enough power to run more complex analyses, future research should investigate these study questions with a larger sample.

Future research should expand on this work and with a larger sample size investigate within-group and between-group characteristics related to ethnic identity and discrimination that might be impacting the post-surgical experience. Studies should also build on the findings of this study and examine at a deeper and more nuanced level what aspects of ethnic identity and racial discrimination

are the most salient to study outcomes. Additionally, due to this study's design and focus, White

participants were not included in the qualitative phase of the study. Conducting more qualitative

interviews with a broader demographic would be an additional area for future study. Similarly, with

regards to substance use, additional questions related to reasons for use ought to be included in future

work. This study was able to capture some aspects of this in its qualitative portion, but quantitative

questions about reasons for using and not using prescription opioids, along with questions about

reasons for using cannabis in the post-surgical period, would further illuminate patterns related to use

that could impact health outcomes.

4.6 Implications of this study

The results of this study illustrates several areas of practical implications where additional work

can be done. Our study showed that prescription opioid use (in particular long-term prescription use)

was low in this sample, without any demographic characteristics emerging as risk- or protective factors

for use. Providers prescribing opioids following day surgery to EAs might include screening questions

related to attitudes about opioid use, including questions about fears about opioids. Potentially, risk

factors for use might not be tied to race/ethnicity, but among a generation growing up with fear

messaging about opioids, providers might approach post-operative pain management differently. First,

providers should focus on providing appropriate education about opioids including risks, benefits and

dispelling myths (Battaglia et al., 2023). Additionally, future research should examine whether EAs are

receiving optimized pain management or sufficient pain control if they are opioid averse. Since poorly

managed pain in the acute pain phase can be a risk factor for CPSP, findings could inform providers as to

what non-pharmacological pain management strategies might be more suitable for this population in

the perioperative stage. These might include non-invasive physical interventions (e.g. transcutaneous

electrical nerve stimulation, heat therapy and cryotherapy music), psychological interventions (e.g. Cognitive Behavioral Therapy, mindfulness-based therapy, clinical hypnosis for pain), and complementary therapies (e.g. yoga, acupuncture, music, biofeedback) (Langlois et al., 2022; Patterson & Jensen, 2003; Shi & Wu, 2023; Tola et al., 2021).

EAs in this sample were using cannabis at high rates in the post-surgical period. Therefore, future studies with EAs and post-surgical pain should examine cannabis use in the context of pain management and self-management of pain more broadly. Since this study showed that EAs are using a broad range of strategies beyond opioids to manage their pain, examining motivations for cannabis use and other pain management strategies will be key to inform clinical practices. For example, a deeper understanding of EA cannabis use for pain can inform screening tools and education about cannabis use in the recovery phase following surgery. This work should also integrate psychological measures (anxiety, depression) into work that assesses cannabis use in post-surgical samples. Since psychosocial variables, e.g. anxiety, depression, are predictors of pain experiences (Weinrib et al., 2017), future research should focus on this context with cannabis and pain outcomes.

In the context of substance use more broadly, examining how surgery-related pain might impact cannabis use and trajectories will be important for this population. With regards to ethnic/racial identity and discrimination, these findings point at least in part to the existing literature about minoritized identity as protective against cannabis use. Future targeted interventions may include patient screenings related to ethnic identity, creating pathways for brief intervention, and referral to treatment (Gette et al., 2023), as well as education to health providers about unique biopsychosocial risk and protective factors that ethnically diverse EAs experience.

Table 1

Participant demographic characteristics

Characteristic	M (SD) or %	Range
Age (years)	22.17 (2.07)	19-26
Sex in medical records		
Male	55 (38.2%)	
Female	89 (61.8%)	
Self-reported Gender[1]		
Cis man (male/masculine)	48 (33.3%)	
Cis woman (female/feminine)	52 (36.1%)	
Trans woman/female/feminine	3 (2.1%)	
Trans man/male/masculine	21 (14.6%)	
Nonbinary/genderqueer/agender/gender nonconforming	14 (9.7%)	
Two-spirit	0 (0)	
Multiple Genders selected	2 (1.4%)	
Prefer not to answer	1 (0.7%)	
Missing	3 (2.1%)	
Race		
White	104 (72.2%)	
Asian	10 (6.9%)	
Black/African American	4 (2.8%)	
Native Hawaiian/Pacific Islander	2 (1.4%)	
Multiracial	13 (9%)	
Other	9 (6.3%)	
Ethnicity		
Hispanic or Latino	32 (22.2%)	
Non-Hispanic or Latino	110 (76.4%)	
Unknown	2 (1.4%)	
Combined race/ethnicity self-report		
White non-Hispanic	83 (57.6%)	
Racial/Ethnic Minority	61 (42.4%)	
Highest education level		
Did not complete High School	4 (2.8%	
Graduated High School	48 (33.3%)	
Vocational school/some college	42 (29.2%)	
College degree (BA, BS)	47 (32.6%)	
Graduate/professional degree	3 (2.1%)	

Note. N = 144. [1] Self-reported gender exceeds 100%.

Table 2a

Surgical and pain descriptive statistics for participants (n=144) at one-week post-surgery (Time 1)

Variable	*M (SD) or %*	*Range*
Surgery Type		
Orthopedics	48 (33.3%)	
Ear Nose Throat (ENT)	39 (27.1%)	
Plastic Surgery	32 (22.2%)	
Urology	9 (6.3%)	
OB/GYN	11 (7.6%)	
Other	5 (3.5%)	
Gender Affirming Surgery		
No	111 (77.1%)	
Yes	33 (22.9%)	
Pain Intensity (Past 7-day; NRS=0-10)	4.28 (2.26)	0-10
NRS: 0-2	31 (21.5%)	
NRS: >=3	113 (78.5)	
Pain frequency (Past 30 days)	2.75 (1.80)	
Not at all (0 days)	22 (15.3%)	
1-3 times/month	25 (17.4%)	
1 day/week	11(7.6%)	
2-3 days/week	30 (20.8%)	
4-6 days/week	21 (14.6%	
Daily	35 (24.3%)	
PROMIS Pain Interference (T-score)	63.53 (6.84)	41-76
Normal Limits (T=<54)	9 (6.3%)	
Mild (T= 55-59)	22 (15.3%)	
Moderate (T=60-69)	95 (66%)	
Severe (T=>70)	17 (11.8%)	
Pain >3 months before surgery		
Endorsing current chronic pain history	70 (48.6%)	
No current chronic pain history	69 (74.9)	
Missing/Unknown	5 (3.5%)	

Note. N = 144

Table 2b

Pain descriptive statistics for participants (n=108) at 3 months post-surgery (Time 2)

Variable	M (SD) or %	Range
Pain Intensity (Past 7-day; NRS=0-10)	2.35 (2.32)	0-8
NRS[a]: 0-2	67 (62%)	
NRS: >=3	41 (38%)	
Pain frequency (Past 30 days)	1.97 (1.8)	
Not at all (0 days)	35 (24%)	
1-3 times/month	18 (12.5%)	
1 day/week	11 (7.6%)	
2-3 days/week	18 (12.5%)	
4-6 days/week	11 (7.6%)	
Daily	15 (10%)	
PROMIS Pain Interference (T-score)	53.33 (9.50)	41-73
Normal Limits (T=<54)	48 (33%)	
Mild (T= 55-59)	24 (16.7%)	
Moderate (T=60-69)	33 (23%)	
Severe (T=>70)	2 (1.4%)	
Missing	37 (25.7)	

[a] NRS = Numerical Rating Scale.

Table 3a

Opioid use descriptives

T1 (Baseline)	M (SD) or %	Range
Number of pills prescribed (n=139)	18.45 (10.17)	2-50
Prescription filled (Yes)	136 (94%)	
Prescription filled (No)	5 (3.5%)	
Total # prescription pills taken since surgery at T1 (n=119)	10.7 (9.9)	0.5-49
Ranges of # prescription pills taken:		
0.5 - 5	42 (35%)	
5-10	39 (33%)	
11-20	21 (18%)	
21-30	10 (8%)	
31-40	2 (2%)	
41-50	4 (3%)	
Total # days prescription was used at T1 (n=144)	4.03 (3.31)	0-15
Ranges:		
0	25 (17%)	
1-5	76 (53%)	
6-10	36 (25%)	
10-15	7 (5%)	
Opioid use disorder (OUD) checklist for DSM-5 (0-11)	.62 (1.5)	0-11
None/Absent (0-1)	126 (87.5%)	
Mild (2-3)	9 (6.3%)	
Moderate (4-5)	7 (4.9%)	
Severe (>6)	2 (1.4%)	

Table 3b

T2 Opioid use descriptives (n=117)

Variable	Yes=1
Prescription recall: "You started this study with (prescription name/dose); did you take this today?"	1
TLFB[a]: "Have you used Hydrocodone recreationally?"	0
TLFB: "Have you used Oxycodone recreationally?"	0

[a] TLFB = Timeline Followback past 30-day recall.

Table 4a

Cannabis use history and current use (T1)

Variables	n/M (SD) or %	Range
Endorsed ever using cannabis/cannabis products	102 (71%)	
Age of first cannabis use	17.10(2.25)	11-22
Endorsed past 30-day cannabis use	72 (50%)	
Total cannabis use days (past 30 days)	13.50(11)	1–30
Route of administration (n= 72) [a]		
Pipe	9 (13%)	
Bong	18 (25%)	
Joint	25 (35%)	
Vape/Dab	13 (18%)	
Edible/Ingested	34 (47%)	
Multiple routes (>1)	26 (36%)	
Cannabis use disorder (CUD) checklist for DSM-5 (0-11)	2.22 (3)	0-13
None/Absent (0-1)	86 (59.7%)	
Mild (2-3)	24 (16.7%)	
Moderate (4-5)	15 (10.4%	
Severe (>6)	19 (13.2%)	

[a] % totals >100.

Table 4b

T2 Cannabis characteristics (n=107)

Variables	n/M (SD) or %	Range
Endorsed ever using cannabis/cannabis products (lifetime)	71 (66%)	
Endorsed past 30-day cannabis use	42 (39%)	
Total cannabis use days (past 30 days)	17.86 (11.3)	1–30
Route of administration (n= 42) [a]		
Pipe	8 (19%)	
Bong	10 (24%)	
Joint	13 (31%)	
Vape/Dab	8 (19%)	
Edible/Ingested	16 (38%)	
Multiple routes (>1)	13 (31%)	
Cannabis use disorder (CUD) checklist for DSM-5 (0-11)	2.24 (3)	0-13
None/Absent (0-1)	73 (51%)	
Mild (2-3)	22 (15%)	
Moderate (4-5)	15 (10.4%)	
Severe (>6)	14 (9.7%)	

[a] % totals >100.

Table 5a

Baseline descriptives and bivariate correlations main study variables

Variable	M	SD	Min	Max	1	2	3	4	5	6
1. Pain Intensity (Past 7-day; 0-10)	4.28	2.26	0	10	—					
2. PROMIS Pain Interference [a]	63.53	3.8	41	76	0.50**	—				
3. MEIM Total Score	2.57	0.66	1	4	0.13	0.06	—			
4. MEIM (Commitment)	2.7	0.75	1	4	0.09	-0.01	.92**	—		
5. # prescription opioid pills after surgery	10.7	9.9	0.5	49	-0.03	0.16	-0.04	-0.03	—	
6. # prescription opioid use days after surgery	4.03	3.31	0	15	.35**	.18*	0.02	-0.05	.26*	—
7. # past 30-day cannabis days	13.5	11	1	30	.09	0.08	0.09	0.04	0.01	0.14

[a] PROMIS raw scores were converted to T-scores.

p < .05; **p* < .01.

Table 5b

Independent t-tests for pain and substance use at baseline based on minority status

	Racial/Ethnic Minority (n=61)		White/non-Hispanic (n=83)			
	M	*SD*	*M*	*SD*	*t/U*	*p*
Pain Intensity (Past 7-day; 0-10)	4.36	2.5	4.22	2.1	-0.38	0.71
Pain frequency (past 30 days)	2.77	1.87	2.78	1.75	-0.12	0.91
PROMIS Pain Interference	63	7.5	63.9	6.3	0.8	0.44
# of total prescription opioid pills taken after surgery [a]	9.88	9.07	11.3	10.48	1598	0.48
Total # opioid use days [a]	3.9	3.5	4.1	3.12	2359	0.19

[a] Mann-Whitney U test.

Table 5c

Independent t-tests for pain and substance use at 3 months based on minority status

	Racial/Ethnic Minority (n=42)		White/non-Hispanic (n=66)			
	M	*SD*	*M*	*SD*	*t*	*p*
Pain Intensity (Past 7-day; 0-10)	1.76	1.79	2.11	1.8	0.95	0.34
Pain frequency (past 30 days)	2.57	2.59	2.21	2.13	-0.78	0.44
PROMIS Pain Interference	52.98	9.5	53.55	9.54	0.3	0.76

Table 6a

Summary of Stepwise Linear Regression Analyses - Pain variables (T1)

Variables	Model 1 Pain Intensity			Model 2 PROMIS Pain interference		
	B	β	95% CI	*B*	β	95% CI
Step 1						
Sex	0.97**	0.21	0.19, 1.75	0.63	0.05	1.48, 2.75
Age	-0.03	-0.03	-.21, 0.15	-.02	-0.01	-.51, 46
Minority Status	0.19	0.041	-.57, 0.94	-1.2	-0.09	-3.21, .81
Persistent pain	0.32	0.08	-0.34, 0.99	-1.41	-0.12	3.18, .36
Pain intensity	N/A	N/A	N/A	1.57***	0.52	1.12, 2.02
R2	0.58			0.29***		
Step 2						
Sex	1.03**	0.22	-2.96, 6.7	0.57	0.04	-1.57, 2.71
Age	-0.02	-0.02	.25, 1.81	-0.03	-0.01	-.52, .45
Minority Status	-0.74	-0.02	-.90, .75	-0.98	-0.07	-3.20, 1.23
Persistent pain	0.37	0.09	-.29, 1.04	1.45	-0.12	3.24, .33
Pain intensity	N/A	N/A	N/A	1.58	0.52	1.13, 2.04
MEIM (Commitment) [a]	0.41	0.14	-1.14, .96	-0.36	-0.04	-1.85, 1.1
R^2 Δ	0.014			0.001		
Total R^2	0.07			0.29***		

[a] Multigroup Ethnic Identity Measure (MEIM) Affirmation, Belonging and Commitment scale. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 6b

Summary of Stepwise Linear Regression Analyses: Opioid and cannabis use (T1)

Variables	Model 3			Model 4			Model 5[a]		
	#days used opioid prescription			#prescription pills used			Past 30-day cannabis use (T2)		
	B	β	95% CI	*B*	β	95% CI	*B*	β	95% CI
Step 1									
Sex	0.34	0.05	-.78, 1.46	-0.19	-0.01	-3.88, 3.51	-11.84*	-.47	-21.10, -2.62
Age	-0.01	-0.01	-.26, 25	-0.03	-0.01	-.91, .85	-1.3	-.19	-3.46, .86
Minority Status	-0.29	-0.04	-1.35, 77	-1.52	-0.08	-5.06, 2.01	4.04	0.17	3.59, 11.67
Persistent pain	0.48	0.08	-.46, 1.4	-0.93	-0.01	-3.21, 2.83	-2.7	-.12	10.21, 4.81
Pain intensity	0.47***	0.32	.24, .71	1.66***	0.36	.86, 2.46	1.3	0.3	-.41, 3.06
R^2	0.13**			.14**			0.07		
Step 2									
Sex	0.29	0.04	-.84, 1.4	-0.045	-0.01	-3.78, 3.68	-11.8*	-.48	-21.14, -2.46
Age	-0.01	-0.01	-.27, .24	-0.02	-0.01	-.90, .866	-1.29	-.19	-3.48, .90
Minority Status	-0.13	-0.02	-1.31, 1.04	-2.03	-0.1	-5.94, 1.89	3.52	.15	-4.6, 11.64
Persistent pain	0.44	0.07	-.50, 1.4	-0.12	-0.01	-3.16, 2.90	-2.67	-.12	4.94, .87
Pain intensity	0.48***	0.33	.24, .72	1.61***	0.35	2.43, .94	1.3	0.29	3.06, .610
MEIM (Commitment)[b]	-0.25	-0.06	-1.04, .54	0.82	0.06	1.88, 3.5	1.11	0.07	.87, 1.15
R^2 Δ	0.003			0.003			0.004		
Total R^2	0.13**			.14**			0.255		

[a] n=40. [b] Multigroup Ethnic Identity Measure (MEIM) Affirmation, Belonging and Commitment scale. *p < .05; **p < .01; ***p < .001.

Table 6c

Binary Logistic Regression Results: Past 30-day cannabis use [a] at T2 (Model 6)

Variables	*B*	SE	OR: Exp (B)	95% CI for Exp (B)
Block 1				
Age	0.25	0.11	1.29	1.03, 1.61
Sex	0.5	0.49	1.66	.64, 4.30
Minority Status	0.23	0.45	1.25	.52, 3.00
Chronic pain hx	0.14	0.44	1.15	.48, 2.73
Pain intensity (T2)	0.11	0.09	1.12	.93, 1.34
Block 2				
Age	0.25	0.12	1.23	1.02, 1.63
Sex	0.42	0.51	1.52	.57, 4.14
Minority Status	0.79	0.52	2.2	.80, 6.10
Chronic pain hx	0.09	0.46	1.09	.44, 2.72
Pain intensity (T2) [b]	0.11	0.1	1.11	.91, 1.35
MEIM (Commitment)	-1.03**	0.38	0.36	.17, .75

[a] Past 30-day cannabis use (y/n) at T2. *$p < .05$; **$p < .01$; ***$p < .001$.

[b] T2 Pain intensity was added

Table 7

Baseline descriptives and bivariate correlations main study variables (T1)

Variable	*n*	*M*	*SD*	Min	Max	1	2	3	4	5	6	7	8	9
1. Racial/ethnic discrimination [a]	35	1.87	0.74	1	3.82	—								
2. Satisfaction with healthcare experience [b]	35	20.14	20.14	15	24	-0.31	—							
3. Pain Intensity (Past 7-days; NRS= 0-10)	35	2.89	1.8	0	5	0.25	-0.18	—						
4. Pain frequency (past 30-days, NRS=1-10)	35	4.89	2.36	0	10	.49**	-0.24	0.11	—					
5. PROMIS Pain Interference (T-score)	34	65.24	6.9	41	76	0.25	-0.03	.55**	0.01	—				
6. Ethnic Identity (MEIM Total Score)	35	3.05	0.62	1.52	4	0.06	-0.07	0.17	-0.27	-.05	—			
7. Ethnic Identity - Commitment scale [c]	35	3.17	0.73	1.43	4	-0.03	0.04	0.11	-.36*	-01	.93**	—		
8. # prescription opioid pills taken after surgery	27	10.46	9.4	1	44	.24	-0.12	0.3	0.01	.33	.48*	0.36	—	
9. # prescription opioid use days after surgery	35	4.08	3.96	0	15	.39*	-.38*	0.24	0.32	0.19	0.23	0.07	.79**	—
10. # past 30-day cannabis days	16	15.13	11.6	1	30	.18	0.02	0.13	-.08	0.04	0.16	0.24	-.56*	-.32

*p < .05. **p < .01. [a] Racial/ethnic discrimination (B-PEDQ); [b] Satisfaction with healthcare experience (SAPS); [c] MEIM Commitment scale.

Table 8a

Summary of Linear Regression Analyses: Pain variables (T2)

Variable	Model 1 Pain Frequency			Model 2 PROMIS Pain interference		
	B	β	95% CI	*B*	β	95% CI
Pain intensity	0.11	0.14	-.77, 2.9	1.63**	0.54	.73, 2.5
Discrimination [a]	**0.93***	0.38	-.26, .28	2.06	0.22	-.68, 4.8
Total R^2	0.15			0.40**		

[a] Racial Discrimination (B-PedQ). *p < .05; **p < .01; ***p < .001.

Table 8b

Summary of Linear Regression Analyses: Opioid variables (T2)

Variable	Model 3 # days used opioid prescription			Model 4 # prescription pills used		
	B	β	95% CI	*B*	β	95% CI
Pain intensity	0.13	0.08	-4.65, -.44	1.14	0.25	-.75, 3.04
Discrimination [a]	2.26*	0.42	.47, 4.04	0.05	0.04	-4.56, 5.57
Total R^2	.20*			0.70		

[a] Racial Discrimination (B-PedQ). *p < .05; **p < .01; ***p < .001.

Figures

3-MONTH OUTCOMES
Pain
Pain interference

Opioid and Cannabis Use

Perioperative   Acute Pain to Chronic Pain Trajectory

Opioid Rx

Race/Ethnicity

Ethnic Identity

Racial/Ethnic Discrimination

Psychological Factors • Pain-specific Social Learning

Social Determinants of Health • Healthcare Experience

RISK & RESILIENCE FACTORS

Figure 2.


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                                    ┌──────────┐
                                    │  Aim 2   │
                                    └────┬─────┘
                                         │
          ┌─────────────────────┐  ┌─────▼──────────────┐  ┌──────────────────────┐
┌──────┐  │ Existing sample     │  │ Additional sample  │  │ Total sample (Sample 4)│
│Aim 1 │─▶│ (Sample 1)          │  │ (Sample 2)*        │─▶│ N=144                 │
└──────┘  │ n=109               │  │ n=35               │  │ 42% (n=61) racial/ethnic│
          │ n=82 (75)% Non-     │  └─────┬──────────────┘  │ minorities            │
          │ Hispanic White      │        │                 └──────────────────────┘
          │ n=27 (25%) racial/  │        │
          │ ethnic minorities   │        ▼
          └─────────────────────┘  ┌────────────────────┐
                                    │ Sub-sample (Sample 3)│
                                    │ n=13               │
                                    │ (Qualitative        │
                                    │ Interviews)         │
                                    │ 100% racial/ethnic  │
                                    │ minorities          │
                                    └────────────────────┘

                                    ┌────────────────────┐
                                    │ *Additional sample  │
                                    │ (Sample 2)          │
                                    │ ACTUALLY ENROLLED = 51│
                                    │ n=35               │
                                    │ 100% racial/ethnic  │
                                    │ minorities          │
                                    └────────────────────┘
```
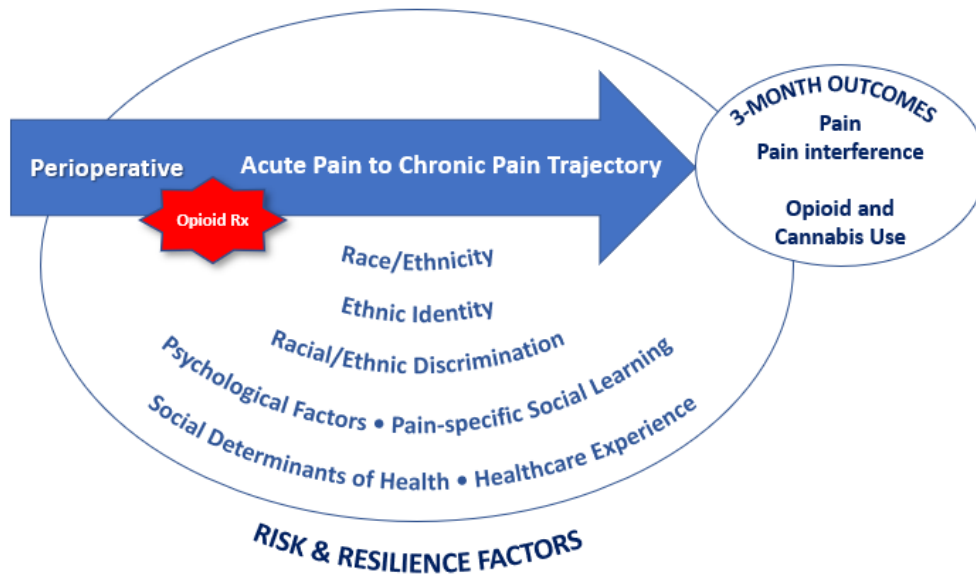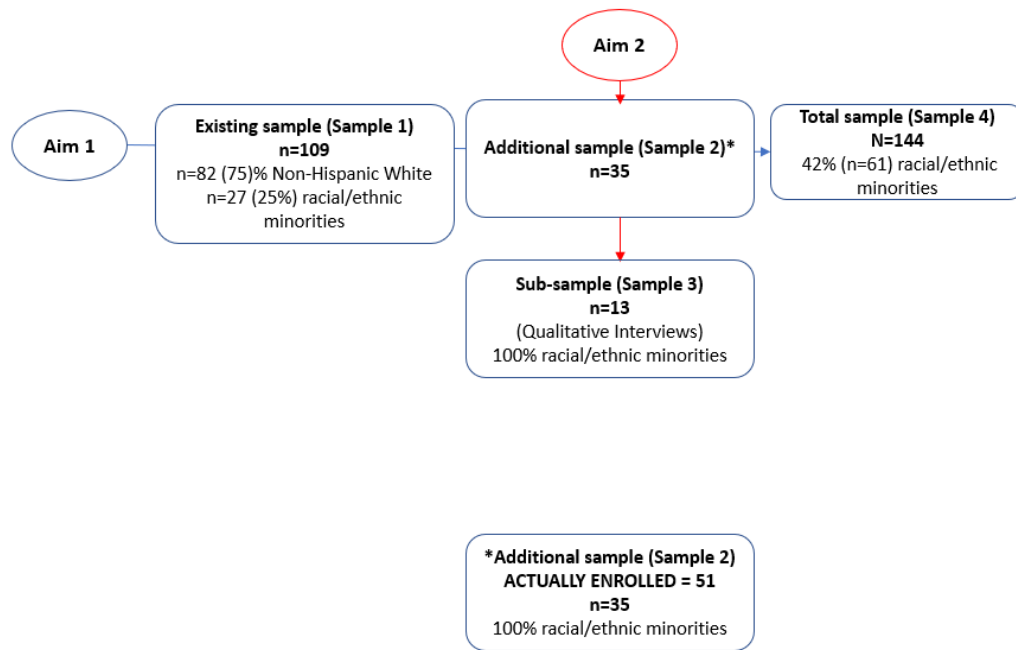
Appendix

Qualitative Methods and Results

Semi-structured Interview:

1. Tell me about the surgery/procedure you underwent on (date)?
2. What is your strongest memory from that day?
3. Tell me how your recovery from the surgery/procedure has been?
4. Was there anything you did not expect as part of recovery process?
5. Are you using any prescriptions to manage pain? Or non-prescriptions? (if yes, tell me about your experience with them)
6. Do you use cannabis/marijuana? If yes, are there specific purposes for your use?
7. Describe the level of support you experienced from hospital staff when you received treatment.
8. Describe any barriers you experienced before/during/after receiving care.
9. Did you have any healthcare experiences from providers that seemed motivated by your race/ethnicity? Did you feel you were treated differently at any point of receiving care based on your race/ethnicity?
10. Is there anything about your treatment you wish had been different?

Representative Quotes Table.

Domain/ Theme	Representative Quotes	Participant
OPIOID USE: *A fear of opioids*	"So many issues with them [opioids] throughout the country, like the opioid epidemic, people get hooked on to these drugs pretty substantially. And I've read about it in my public health classes, there's plenty of documentaries about the addiction throughout the country that we've been seeing, especially among young people who have been prescribed these medications. So, I was definitely wary of that. And I knew not to abuse it or not want to abuse it."	P12
	"I wanted to wean off all the pills because I don't, me personally, I don't like, you know, putting that much stuff into my body […] I thought the pain was manageable enough that I didn't really need it and I can deal with a little bit of pain and I don't want to get dependent on it."	P10
	"My family has a really, really long line of addiction that goes from my grandpa and my dad to my siblings. And I'm very cautious about how long I'm on medication, and personally, I don't like using it any longer than I have to. I felt like at those two weeks that I would be able to manage my pain as is without it. And so for my comfortability, I stopped it even if I was in excruciating pain. I expressed that it's not something I want to continue for the sheer purpose of I'm scared of what I'm unable to control."	P8

	“I was taking an opioid use disorder elective too so I know how addicting they can be from a physical perspective as well, so I think with that background, I was just trying my best to get off as soon as I could, as soon as I felt comfortable to.”	P11
OPIOID USE: *Fear messaging from parents*	“I didn't use it [the opioid prescription]. I think my mom was also very against me taking it out, but I hadn't planned on taking it out initially. But I recall there was one day when my mom saw me, I guess I was just chilling out, that she thought I was on oxy. She got mad at me and she's like, “are you on the prescription drugs?” [I responded] “No, just chillin”, but I thought that was really interesting […] My mom works at a nursing home so she's just like, familiar with how strong opiates are so I think our language about opiates is very much that they're addictive.”	P2
	“My family was pretty careful about it, and they didn't want me to become hooked on it longer than I needed to […] My dad did not want me to take them at all. I had kidney stones back in high school and he did not want me to take them at all then, and he didn't want me to take them at all now. I definitely understand why out of a place of concern.”	P12
OPIOID USE: *Enduring pain to avoid negative effects from opioids*	“Yeah, it was easier to take the Oxy if I could bear the pain. Tiredness was definitely a reason to not take it. I struggled a bit a few days after [surgery] because my husband had to go back to work and it was a little bit of a struggle, and another reason why stopped taking the meds was so I could be more aware [taking care of my child]”	P13
	“People around you are like “Oh wow, you're lucky you get to take oxycodone,” […]but it never really did anything for me, I never thought it was that special […]. It did help with pain, but I was like, look this isn't that special, you're super constipated all the time, it's terrible in that respect, I couldn't wait actually to get off them.”	P12
	“And I know like those harsh opioids aren't good for you to take for any longer than you need it. And I didn't feel like I needed it for the pain […].After those first few days it made me very dizzy and so sleepy. And I was trying to get caught up on some schoolwork too. So, I would have rather had maybe just a little bit more pain without having to take the opioid than to take it and be dysfunctional the whole day”.	P11
CANNABIS USE: *Positive mental health effects from cannabis use*	“Mentally, it just puts you in a lighter, more happier mood. And because I smoke a sativa, I smoke stuff that's supposed to uplift you and get you a little bit more energized and whatnot. So, I like how it makes me feel more mentally comfortable and just at ease with everything.”	P5
	“It affects the pain, which really helps my mood in particular. It's the pain that causes the grouchiness […]. It is usually the pain that causes all of the negative things and when I have cannabis, it's like the pain's not there so I can continue being the normal person I normally am.”	P8
	“Right now it's mostly for productivity [that I smoke]. Sort of like, anxiety management where it's easier for me to get things done and, and because the anxiety that is in my brain saying, hey, this is this could go wrong or I don't want to do this or this could go	P9

	wrong. That's sort of dumbed down. I don't have to focus on that while getting stuff done that I need to get done."	
CANNABIS USE: *Using cannabis for pain relief*	"I am present and aware of the pain, but it is not connecting to me. It's more sort of turned down, like I know I'm in pain and I should be careful, but it doesn't hurt."	P3
	Life just feels more manageable in general. Like, I just feel okay with things. Like things, just the pain doesn't bother me nearly as much like, I could ignore it. It's not. It's still there, it's not like the pain goes away like, like Advil. But it makes it more easy to ignore."	P5
	"The best way to explain it is that it numbs the feeling. So, from, my chest to my stomach, it's no longer like this stabbing, 'oh my God, you're annoying' pain […] I know the pain is here, but it's something I can push off to the side. It's not something that's right there in my face anymore."	P8
	"[Cannabis] definitely made me think less about the pain. I don't know if the pain was still there, but I definitely thought less about it."	P10
CANNABIS USE: *Contradiction about effects on pain*	"I don't think it necessarily lessened pain a ton. It's just helped me get through. I think it did help obviously probably. That's an interesting question. I actually don't know how much lower pain, but maybe it did."	P2
	"I usually use it during periods of like, large pain in my life, and then taper off […] But now, [using cannabis for pain relief] not as often, because I don't really feel like it helps that much, but I will use it especially if I'm going on a hike, we're going out for the day just to kind of moderate my body's reaction to pain."	P3
CANNABIS USE: *Changing cannabis use around surgery*	"Before I was using it in the morning, and I was usually inhaling it through smoke and then once I realized surgery was coming around I had to switch. I was forced to figure something else out. So I had switched over to tinctures or edibles, something that would not cause coughing or any sort of disruption for my lungs. And I realized when I switched over to edibles, I needed a little less. […] When I came out of surgery, I didn't really need any sort of marijuana for those two weeks, I had way too much medication".	P8
	"I did it more at night, you know, doubled up on what I would do at night to kind of help me go to bed at first, but not that I was smoking more or less because of the surgery. It was just kind of a little bit more, I needed to kind of help with the pain."	P10
	"I didn't want to [stop for surgery]. It is recommended not to start smoking again until a month after surgery. Didn't listen to that […] I was transparent with my anesthesiologist too and he was like "It's okay", the main concern that they had with after surgery was coughing and the expansion of your diaphragm and so I was very wary of that."	P9
	"So I stopped smoking weed and stopped using weed […]I tried to stop, I just was like, okay, I'm healing my bones, so I haven't been using marijuana at all for pain	P7

	management. So I kind of planned strict two weeks before no weed. Strict two weeks after no weed, just because I need to have kind of a plan. Then I'm like, okay, I'm allowed to reintroduce slightly. But I'm going to do my 3 to 1 CBD THC edible. So that's kind of my "I'm going to try and kind of keep it light".	
RACE/ETHNICITY: *Awareness of minoritized identity in the healthcare context (#1)*	"I'm very aware of medical trauma and my body, where I'm very aware of how [people of my ethnicity]have historically been the testing grounds for a lot of heinous, medical atrocities. And so I feel panic in my body, and a lack of care and respect and then, I think also anxiety like they're going to uncover a problem in my body that I have because of my family's historical negligence […] I have these problems that are from historical traumas against my family who are Black, and who are indigenous, and so I notice myself having to expand the energy of calming down."	P3
	"I learned through, through being White presenting and with my dad being white that I've learned a major difference with privilege, and where I have major privilege over my other family members. I've had pretty good experiences with doctors, it sounds really bad, but I know how to talk to them. You talk to them like they know everything and, it sounds bad, but you talk to them like they know better than you. It sounds terrible, but it works every time."	P9
RACE/ETHNICITY: *Uncertainty*	"I think there was a little bit of discomfort on my hair, like, touching my hair, even though they had to for surgery. I noticed some hesitation around that, but I couldn't tell if it was because my hair isn't textured, really straight or if it was just, you know, a student being nervous about touching another person's body for the first time. So I don't know".	P3
	"Obviously always like racism is something that is going to play a role in care […] but definitely there have been instances where you're just like, I wonder if this treatment would have been different."	P7
RACE/ETHNICITY: *Intersectionality in the healthcare context*	"I carry so much privilege, especially my educational background, especially in being a native English speaker, especially in the way I look and the way that I dress and everything. I know that I carry a lot of privilege in those scenarios compared to other Latinx people who speak with an accent and Latinx people who have different markers of class, race, all these different things."	P7
	"There's never been like any treatment differently because of that [race/ethnicity]. Definitely more of I haven't really had insurance for a long time […] so they usually are looking at me different because of that, like, 'oh, no insurance, outta pocket? Are you sure…?'There's usually definitely a change in tone or, you know, 'wow, no insurance, out of pocket, can you pay for that?'. Yeah, I [can pay for that]."	P10

RACE/ETHNICITY: *Making medical decisions in the context of perceived racial/discrimination*	"My dad was also there too, and [he] is an immigrant to this country. He speaks English well, but he also has an accent too, and he was asking these questions, and it felt in a way that the doctor's answers were condescending, sort of like he wanted to rush the answers. I don't know if it had to do with his accent or him being an immigrant, but it felt that way to me. This was one of the reasons I did not want to continue seeing that doctor [and sought a second opinion at this hospital], and it was like night and day, the experience between the two".	P12
SYSTEMIC PROCESSES IMPACTING CARE: *Systemic barriers*	"I didn't have health insurance at the time, and then I was navigating and trying to find insurance […] So I got surgery and I got insurance, but unfortunately I did not do, well enough shopping around cause the insurance that I got wouldn't help with a surgery cause technically this ACL surgery is a cosmetic surgery and not like a necessary surgery. They set me up with the financial aid advisor and then they ended up covering the, all the whole surgery for free for me. It was also tough just because, like, I applied for [state insurance] and unfortunately, my income was too high to qualify for that too. So it was not gonna help anyway."	P10
	"I knew that part of the reason I wasn't getting penciled in for a revision is because there were so many people on backlog that had to wait. And even now I had to schedule out my follow up […] But everyone has been really good about managing expectations of these things will take time. Like, we are not going on the schedule we want or on the timeline that we need or you deserve."	P3
	I got my ACL repaired and my lateral meniscus […]and it stemmed from an injury that happened in January, but because of insurance issues and scheduling wise, I couldn't get it scheduled until April so it was quite a bit of a long wait for that."	P10
SYSTEMIC PROCESSES IMPACTING CARE: *Systemic privilege*	"As a medical student on the day of surgery, I know it's in my chart and a few, um, health care providers brought it up just like as a bonding point [that I was a medical student] […] I appreciated that, and I think it also made me feel more comfortable to ask pointed questions."	P11
	"I think overall in this whole experience, and even in the surgery, there's been so much privilege. Navigating the health care systems as someone who has been doing this before. And now also[…] having been in nursing school and the whole bit […] There was a lot of privilege, just knowing how our health care setting works and what the roles are of people. I think that there was a lot of privilege to that I'm sure it's so much that I didn't even know and I think a lot of that comes also from like my education level."	P7
	"Everything was pretty smooth and straightforward I would say. The biggest memories is everything being pretty easy […] Communication was pretty clear, I think me being part of athletics made everything go pretty smoothly as well. I didn't I really didn't have to coordinate a lot of stuff it was kind of coordinated for me. I guess I'm pretty lucky to be in that situation just because everything has moved along pretty quickly. I got a lot	P1

	of support from the coaches, the athletic training staff and the doctors. I felt like I was kind of like a priority, so that was nice".	
	"The barriers I faced were mostly about my insurance, […] my revision was not covered by [state insurance]. So it's out of pocket once again, I was very privileged to have the money to pay for the out of pocket."	P3

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