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QUALITY OF LIFE IN COMMUNITIES NEAR OIL AND GAS DEVELOPMENT:  
A CASE STUDY IN THE EAGLE FORD SHALE

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QUALITY OF LIFE IN COMMUNITIES NEAR OIL AND GAS DEVELOPMENT:  
A CASE STUDY IN THE EAGLE FORD SHALE

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BY THE COMMITTEE CONSISTING OF

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## **Abstract**

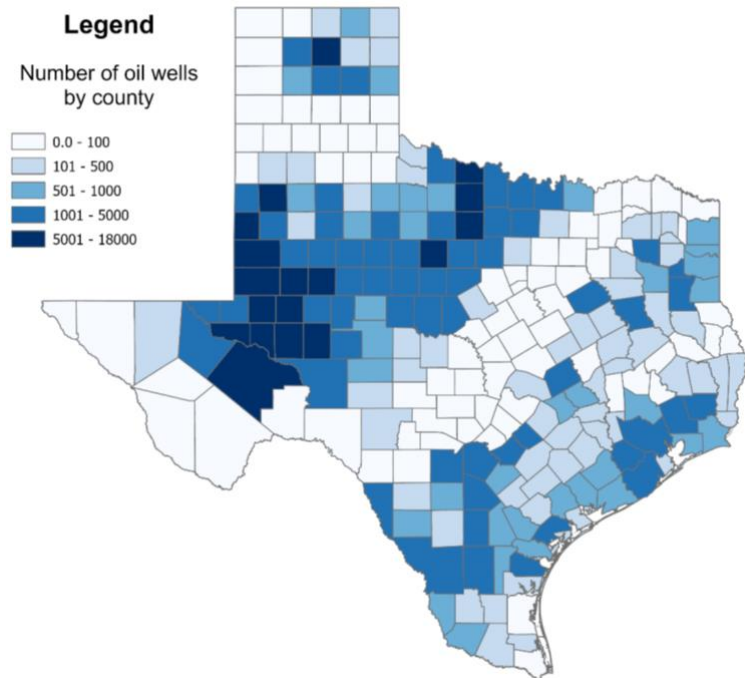
Research on the public health impacts of oil and gas development has consistently found significant physical health disadvantages for communities exposed to activities associated with oil and gas development at all stages of production. However, the holistic health effects, including the combination of physical, mental, and community health outcomes, are severely understudied. I conducted a study on the potential quality of life impacts of living in the Eagle Ford Shale, one of the highest producing oil and gas regions in the U.S. To assess quality of life, I used a mixed-methods approach to evaluate these holistic health variables and assess the potential impact of oil and gas development on physical, mental, and community health. I performed statistical analysis using survey data from respondents located within the Eagle Ford Shale and those located in other parts of Texas. I also conducted interviews with local environmental advocates to help contextualize the survey data and better understand the social and political circumstances surrounding oil and gas development in the Eagle Ford Shale. Survey results were mixed, but largely indicated that physical, mental, and community health impacts are not significantly worse for residents of the Eagle Ford Shale compared to residents in other parts of Texas. However, spatial analysis revealed local-level health disparities that were more heavily concentrated in the Eagle Ford Shale than in the comparison group. Additionally, interview results revealed distributive and procedural injustices that have led to community frustrations over the presence of oil and gas throughout the Eagle Ford Shale region. These results raise awareness for the holistic health impacts of extractive industries such as oil and gas, which carries implications for public health policy and environmental justice in communities that depend on oil and gas to sustain their local economies.

## Chapter 1: Introduction

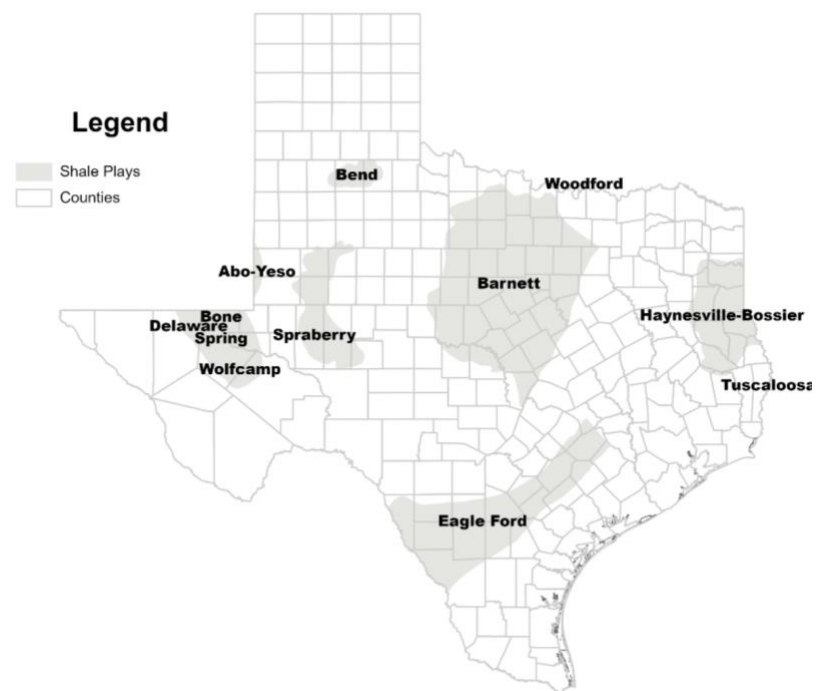
Oil and natural gas extraction have been central to the economy in Texas for decades (Fisk, 2017). In addition to being a large part of state revenue, jobs in the oil and gas industry are abundant and generally pay well (Fisk, 2017). While oil and gas activities are spread across the entire state, the Eagle Ford Shale geologic region in South Texas harbors one of the most productive operations in the United States (Johnston et al., 2020). Hydraulic fracturing, or “fracking,” is a central business in Eagle Ford Shale. This process involves injecting large amounts of water and chemicals into underground shale formations until they break open, allowing drillers to access oil and gas reserves (Davis, 2012). With nationwide increases in oil and gas production over the last decade, industrial activity has expanded closer to residential areas, raising concern for those who live nearby (Adgate et al., 2014; Brown et al., 2015).

The year 2010 marked the beginning of the fracking boom in the Eagle Ford Shale, beginning with Karnes County and quickly expanding to adjacent counties (Vera, 2022). Prior to the boom, the towns in this region had been experiencing significant economic decline. However, the fracking boom brought much-needed economic stability in the form of job opportunities and tax revenue to build up these underdeveloped towns (Vera, 2022). Over the last 10 years, production in the Eagle Ford Shale has been rapidly increasing, rivaling that of much older shales such as the Barnett Shale in North Texas and the Permian Basin region in West Texas. Figure 1a displays a choropleth of oil and gas activity across Texas using data from 2021, with darker green colors representing higher numbers of production, service, storage, and injection wells, and lighter green colors indicating lower numbers of wells. Well data was retrieved from FracTracker Alliance, based on data from the Railroad Commission of Texas (FracTracker Alliance, 2021). Although this data is not a comprehensive representation of oil and gas activity across the state

(i.e., it does not account for all types of infrastructure), it provides an illustration of the distribution of oil and gas activities throughout Texas. Additionally, Figure 1b shows the locations of shale plays throughout Texas, which provides a helpful reference for what regions the colors in Figure 1a belong to.



**Figure 2a.** Choropleth of oil wells per county in Texas.



**Figure 1a.** Shale plays throughout Texas.

Although research on the impacts of oil and gas development on human health is relatively new, early results have found associations between living near oil and gas development and a number of symptoms affecting the respiratory and nervous systems, as well as higher rates of cancer and developmental issues in children (McDermott-Levy et al., 2013; Bamberger & Oswald, 2012; Balise et al., 2016). Within Eagle Ford Shale specifically, oil and gas development has been linked to a host of adverse health outcomes such as premature birth, breathing problems, headaches, and skin lesions (Clough, 2018; Cushing et al., 2020; Wilson, 2013). Early evidence of uneven exposure to fracking infrastructure and its effects, as well as inconsistent enforcement of regulations, leave some communities more vulnerable to these health problems (Johnston, 2016). Thus, fracking poses an environmental justice risk in addition to a public health risk. Policies that limit oil and gas expansion in the name of public health often face lawsuits by oil and gas companies, and therefore require significant evidence to influence court decisions (Wu, 2021). Thus, robust case studies examining the harms posed to fracking communities are necessary to assist policymakers with decisions about the safety of oil and gas development.

While physical health is an important part of the fracking conversation and deserves the attention it receives in the literature (Hays & Shonkoff, 2016), a lack of research on the mental and emotional impacts of fracking development has left gaps in our understanding of the full health and quality of life impacts of living in proximity to oil and gas infrastructure. While the term *quality of life* is used differently across disciplines (Haraldstad et al., 2019), the Centers for Disease Control and Prevention explains that quality of life is evaluated by an individual's physical and mental health through domains such as jobs, housing, schools, their neighborhood, and cultural practices—i.e., components of the social and built environment (CDC, 2018). What sets this study apart is its focus on quality of life indicators as a measure of an individual's health

and well-being. In addition to physical and mental health, this study incorporates aspects from the social and built environment to assess social health. This component of the study draws from prior literature that examines quality of life through physical, social, and psychological domains (Arnold et al., 2004; Sweers, 2013). While prior studies have primarily examined the effects of living in proximity to oil and gas wells on various health symptoms (Blinn et al., 2020; Rabinowitz et al., 2015) this study assessed aspects of perceived physical and mental health that are influenced by one's environment to evaluate the potential impacts of fracking on an individual's quality-of-life. The results of this research provide insight into the holistic health impacts faced by residents of Eagle Ford Shale while also having implications for policy decisions surrounding public health in communities located near fracking activity.

## **Chapter 2: Literature Review**

### **Section 2.1: Health, Wellbeing, and the Environment**

Both the natural and the built environment have long been recognized as determinants of health and wellbeing (De Chalain et al., 2009; Nicholson & Stephenson, 2011). The primary determinants of health and subjective wellbeing (e.g., life satisfaction) in the natural environment include air quality, water quality, and land degradation and contamination (Fajersztain, 2017; Liao, 2015; Markozannes et al., 2022; Nicholson & Stephenson, 2011). Components of the built environment such as housing, transportation, neighborhood walkability, and public open spaces may also have influence on both physical health and psychological wellbeing (Araya et al., 2006; Frank and Engelke, 2001, 2005; Gehl, 2011; Twohig-Bennett & Jones, 2018; Li et al., 2023; Ventriglio, 2021). Still, much of the current research on holistic health and wellbeing focuses on these aspects from an objective standpoint, measuring air and water quality in an attempt to make connections between levels of pollutants and various health outcomes (Fajersztajn et al., 2017; Nagel et al., 2018; Zou et al., 2018). Despite this growing level of attention to the public health impacts of chemicals used for industrial activity, the mental health effects faced by communities infiltrated by industrial activity (such as fracking areas) have been historically overlooked (Hirsch et al., 2017).

While an area's environmental conditions are influenced by many factors, research has shown that living in close proximity to extractive industries negatively impacts an individual's health status (London & Kisting, 2016; Rabinowitz, 2014; Schrecker, 2018). Specifically, several studies have linked exposure to the chemicals used in oil and natural gas extraction to hormonal disruptions that contribute to a number of dermal, respiratory, and nervous system conditions (Balise, 2016; Bolden, 2018; Blinn, 2020). Detectable levels of harmful pollutants—including

particulate matter, nitrogen oxides, ozone, volatile organic carbons, carbon monoxide, and hydrogen sulfide—are routinely identified near well sites and associated infrastructure (Czolowski et al., 2017). Likewise, the impacts of oil and gas development on water quality are of increasing concern to public health officials, as unregulated amounts of chemicals from refineries have been known to leach into groundwater and aquifers (Davis & Hoffer, 2012). Not only is residents' physical health compromised, but psychological stressors associated with proximity to extractive industries also affect residents (Soyer et al., 2020). The socio-psychological effects of decreased physical health and social stressors create a compounding burden on residents' wellbeing.

## **Section 2.2: Environmental Justice Concerns with Fracking**

Hydraulic fracturing has also been criticized from an ethics standpoint using the environmental justice framework (Cotton et al., 2017; Kroepsch et al., 2019). Described in a 2018 review on environmental justice and fracking, distributive justice considers the placement of wells and the associated risks of living near wells; procedural justice examines power dynamics surrounding decisions about wells; and recognition justice considers how different stakeholders are prioritized during decisions (Clough, 2018). Although evidence of environmental injustice with respect to fracking has been mixed, some studies have found that wells are disproportionately located in areas with larger populations living in poverty (Clough, 2018; McKenzie et al., 2016; Ogneva-Himmelberger & Huang, 2015).

Some populations may be disproportionately affected by fracking infrastructure. One notable case study found that oil and gas wastewater disposal wells in Eagle Ford Shale were more than twice as likely to be located in communities of color and high poverty areas (Johnston et al., 2016). Furthermore, prior public health research indicates that residents living in fracking



communities face a disproportionately high risk of cancer, as well as a wide range of respiratory, gastrointestinal, immunological, endocrine, and sensory diseases (Hirsch et al., 2017). These residents are also often members of vulnerable population groups such as low-income and rural groups (Hirsch et al., 2017). Within Eagle Ford Shale specifically, census blocks with a majority Hispanic/Latino population are exposed to twice as many oil and gas flaring events—a process where excess fuel from oil drilling is burned off, releasing harmful pollutants into the atmosphere—as those with less than 20 percent Hispanic/Latino population (Johnston et al., 2020). One report claimed that the Texas Commission on Environmental Quality was treating residents as “guinea pigs” due to several regulatory failures associated with air pollutants in Karnes County, Texas—a county composed of more than 50 percent Hispanic/Latino residents (Wilson, 2013). Lastly, many studies on public health and fracking severely underestimate populations at risk, suggesting a need for improved methodology when assessing a community’s vulnerability to environmental hazards (Czolowski et al., 2017).

Another environmental justice concern is who benefits from oil and gas infrastructure versus who must endure the health burdens of living near oil and gas activity. A 2015 study revealed spatial inequities among people receiving financial benefits of shale gas development in Denton, TX, and those enduring the burdens of living in the area (Fry et al., 2015). Often, those that are least at risk of developing fracking-related health issues benefit the most from the practice, while residents in close proximity to toxic pollutants receive very little compensation for living near these dangerous facilities (Clough & Bell, 2016; Fry et al., 2015). These distributive injustices, combined with unequal decision-making power between residents and oil and gas companies (Cotton et al., 2017; Whitton et al., 2017), present a severe injustice to those who are

forced to live under poor environmental conditions while receiving little to no compensation for doing so.

### **Section 2.3: Regulatory Failures in the Oil and Gas Industry**

While regulations on hydraulic fracturing in the United States are intended to minimize harm and promote safety, the rapid expansion of hydraulic fracturing (and particularly unconventional fracking) has placed great stress on governing bodies and their abilities to enforce regulations (Small et al., 2014). Research has found that many states in the U.S. have insufficient staff and expertise to keep up with the demand for increased regulatory capacities, leading to poor compliance from fracking companies, a lack of monitoring activity at well sites, insufficient violations issued, and a lack of transparency when it comes to keeping the public informed about inspections and other safety matters (Sumi, 2012; Wiseman, 2014). In addition to capacity issues, there is also little disincentive for noncompliance to fracking regulations in several U.S. states (Angeles, 2018), indicating that even states with the capacity to identify violations often do not effectively act against the offending party. As a result, enforcement of fracking regulations has occasionally been taken up at the municipal level (Jaquith, 2017). However, without clear boundaries regarding authority among governing bodies, much conflict can arise when cities and states have opposing rulings.

There is much debate surrounding the role of local, state, and federal powers when it comes to fracking regulations and policy. Unequal decision-making power between these institutions has led to conflicts in regulating the fracking industry throughout the United States. Moreover, these conflicts have led to delays in addressing health concerns of fracking and uneven exposure in certain communities. While federal and state regulations tend to operate on a broader scale (i.e., basing decisions on policies such as the Clean Water Act and Clean Air Act),

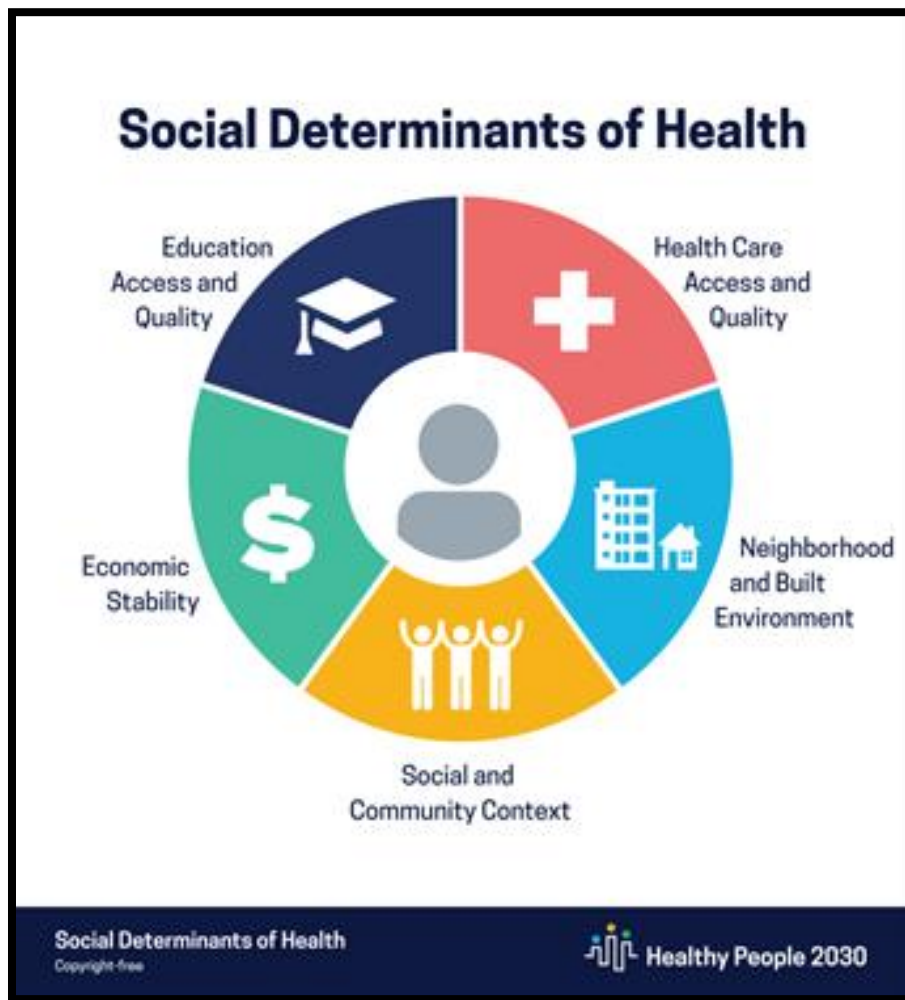
local governments may have more power to control details of fracking activity such as land use and zoning compliance. This means that municipalities may have the power to ban fracking completely within a given jurisdiction, and many towns have exercised this power in the past (Jaquith, 2017). However, this does not stop oil and gas companies from suing local governments on the grounds of implied state preemption to fracking regulations. In 2012 and 2013, such cases occurred in five communities throughout Colorado (Karam, 2018). Ultimately, the state of Colorado pre-empted the local governments regarding the fracking bans.

Jurisdictional disputes surrounding the enforcement of fracking regulations have consequences that can affect public health. Without clear boundaries, accountability lags and punitive actions are delayed when oil and gas companies break environmental regulations designed to protect the health of residents. In addition, issues of capacity within government institutions (Wiseman, 2014) introduce barriers that extend beyond authoritative conflicts. Given evidence linking subjective wellbeing to environmental conditions that are influenced by fracking — such as air, water, and land pollution (Nicholson & Stephenson, 2011; Welsch, 2006) — fracking regulatory failures could have negative consequences for health and wellbeing. Certain groups that have historically faced more environmental burdens than others, such as low-income groups and people of color, may be particularly susceptible to fracking-related health burdens. In Eagle Ford Shale, current research suggests these risks may be disproportionately incurred by Hispanic/Latino communities (Johnston et al., 2020).

## **Section 2.4: Research Questions, Theoretical Framework, and Hypotheses**

With an understanding of the ways in which oil and gas development can impact public health, I asked the following overarching question: **How is an individual's quality of life impacted by living in a community with environmental hazards associated with oil and gas development?** Because quality of life encompasses physical health, mental health, and one's feelings about components of the social and built environment (CDC, 2018), to assess one's quality of life is to understand their physical and mental health, as well as their perceptions of environmental conditions in their neighborhood, or "community health." Because this is a broad definition, I narrowed the focus to only include the components of the social and built environment that have potential to be impacted by oil and gas development. To approach this, I drew concepts from social determinants of health theory (Figure 2), specifically evaluating components of the built environment like neighborhood satisfaction and perception of one's community (i.e., the neighborhood and built environment and the social and community context components shown in Figure 2). Moreover, it is increasingly recognized that environmental factors are an essential part of social determinants of health (Wick, 2020). Thus, this research also considers perceptions of local environmental conditions as a part of one's health and quality of life. I incorporated the economic stability component of social determinants of health theory during parts of the qualitative analysis. In addition to social determinants of health theory, I situate some of my study on health-related quality of life (HRQoL), which encompasses the physical and mental health aspects of quality of life (CDC, 2018). Specifically, I use health concepts from the RAND quality of life assessment, which is widely recognized as the best instrument for assessing health-related quality of life (Hays and Morales, 2001). Both of these

frameworks allowed me to address the nuanced nature of quality of life, and data collection revolved around HRQoL measures as they relate to one's environmental conditions.



**Figure 2.** Components of social determinants of health theory.

*Note.* Figure from Healthy People 2030, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Retrieved [October 28, 2023], from <https://health.gov/healthypeople/objectives-and-data/social-determinants-health>

To address my overarching question, I asked three specific research questions. Since quality of life is inherently subjective, these questions were based upon perceptions of one's health and community. The questions included:

(1) How are quality of life dimensions (physical, mental/emotional, community) affected by oil and gas development?

(2) How are people's perceptions of their environmental conditions affected by living near oil and gas development?

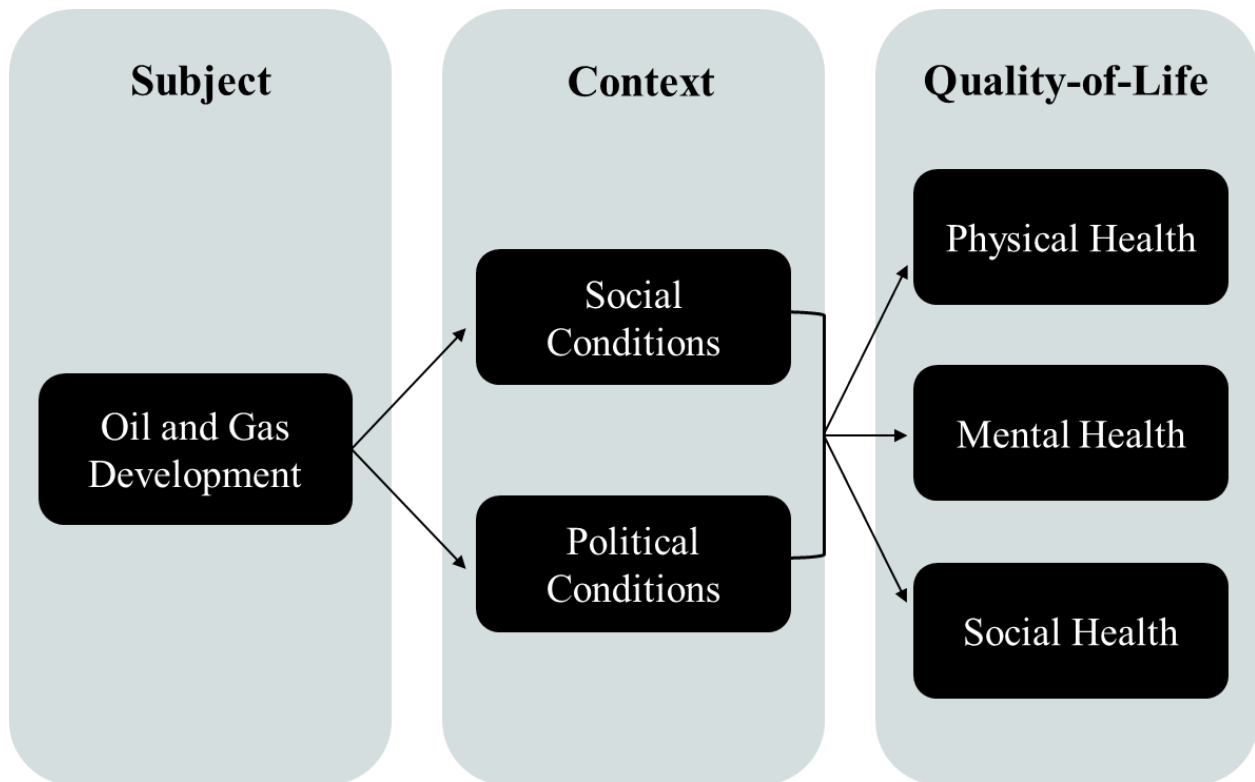
(3) What factors could influence resident perceptions of oil and gas development (e.g., time spent outside, educational attainment, years lived in county)?

While the latter question is not directly related to quality of life, it added important community context to the survey and interview results. Given the purpose of this study to better understand the connections between oil and gas development and resident quality of life, I hypothesized that:

- 1) Residents in Eagle Ford Shale and Eagle Ford Shale-adjacent counties will have more negative responses to the physical, mental, and community health survey questions compared to residents outside of the Eagle Ford Shale.
- 2) There will be differences in opinion across race/ethnicity, socioeconomic status, time spent outdoors, and experience with oil and gas industry

### **Chapter 3: Materials and methods**

This research utilized a case study design to assess various quality of life indicators throughout Eagle Ford Shale (EFS). I used two forms of primary data to fill the gap in scholarship on the effects of fracking-related environmental hazards on subjective quality of life. The first source of data consisted of surveys distributed to three groups: individuals living in counties within EFS, those living in counties adjacent to the Eagle Ford Shale (with strong connections to oil and gas activities in EFS), and other Texas residents located outside EFS. The latter group served as the comparison group, while EFS and EFS-adjacent groups were considered the “fracking communities.” The second source of data included interviews with environmental activists who work in the region. Both forms of data helped determine a potential connection between subjective quality of life and environmental conditions among residents in the EFS, as well as provided sociopolitical context for quality of life outcomes. Figure 3 illustrates how communities are situated within social and political circumstances that allow fracking to happen at various scales, and these circumstances have implications for physical, mental, and social health. This study was reviewed and approved by OU’s IRB (#16091).



**Figure 3.** Connecting quality of life with oil and gas development.

### Section 3.1 Survey administration

I solicited online survey responses through the platform Qualtrics, which specializes in administering surveys to online panels of respondents. After working with a Qualtrics representative to identify response feasibility, the survey was distributed to respondents who met the qualifications (18 years of age or older and living in one of the three qualified location groups). Responses were collected over a 6-week period in November-December 2023. Throughout the process, Qualtrics monitored response collection to ensure quality and accuracy of information. Responses were also routinely shared with me to examine for quality and completeness. Survey administration terminated after 300 complete responses were reached. This



number was agreed upon before response collection began, which balanced needs for statistical thresholds with project budget and feasibility constraints.

### **Section 3.2: Survey design**

When designing the survey, I drew from the subjective well-being literature, including quality of life domains related to the social and built environment. The survey contained six sections, including: *Health and Wellbeing*, *Occupational Information and Leisure Time*, *Neighborhood and Community*, *Environmental Conditions*, *Oil and Gas Policy and Regulations*, and *Demographic and Household Information*. The survey began with questions from the RAND 36-item Health Survey for general information on holistic well-being and health (Hays and Morales, 2001). This first section of the survey provided a baseline for assessing residents' physical and emotional state separate from questions about their environment. It consisted of five questions, with two questions pertaining to physical health, two relating to mental health, and one assessing health in general over the last year. For example, the first question asked: "In general, would you say your physical health is: (1) Excellent (2) Very good (3) Good (4) Fair (5) Poor." The following question contained the same language and choices but asked about mental health. During the past 4 weeks, to what extent has your physical/mental health interfered with your normal social activities with family, friends, neighbors, or groups? The second section, *Occupational and Leisure Time*, consisted of four questions that gathered information about the respondent's employment status and time spent outdoors per day. The next part of the survey, *Community and Neighborhood*, asked 14 questions about the individual's perceptions of their neighborhood, defined as the area within a 10-minute radius of one's home. This section drew questions from prior research on neighborhood quality and satisfaction as they connect to mental health (Araya, 2006). Questions were formatted as a 5-point Likert scale. Examples of the

question prompts include: “I enjoy living around here,” “Litter is a problem around here,” “The area around here is nicely kept by its residents,” “There are not enough green areas or trees around here,” and “I think of this area as a desirable place to live.” The fourth section of the survey, *Environmental Condition*, dealt with perceptions of local environmental conditions, asking a series of open-ended questions related to the individual’s experiences with environmental conditions in the area where they live. For example, two of the open-ended questions asked residents to describe any negative environmental conditions they face in the place where they live, followed by the same question about positive environmental conditions. This pair of questions was followed by a final open-ended question asking the respondent how they feel these positive and negative conditions affect their overall wellbeing. In addition to the open-ended questions, this section included a multiple-choice question that prompted the respondent to rank their overall satisfaction with the environmental conditions in their area.

The fifth section, *Oil and Gas Policy and Regulations*, consisted of five questions meant to assess respondents’ views on the oil and gas industry. Three questions were related to respondents’ awareness and support for oil and gas regulations. These questions were directly followed by a 100-point scale which allowed respondents to rate their views on how beneficial or harmful the oil and gas industry is in their area. While I wrote the questions for Sections 5 and 6, both the *Environmental Conditions* and the *Oil and Gas Policy and Regulations* sections applied concepts from the Environmental Satisfaction Scale (Pelletier, 1996), which attempts to measure one’s perceptions of local environmental conditions and satisfaction with environmental policies. The sixth and final section, *Demographic and Household Information*, asked a set of sociodemographic questions, including age, gender, race, ethnicity, education, total household income, and homeownership status. Together, these components of the survey connected resident

experiences and satisfaction with their environmental conditions to health and wellbeing, which helped me draw conclusions about quality of life in Eagle Ford Shale. Table 1 illustrates the structure of the survey. The full list of survey questions can be found in the appendix.

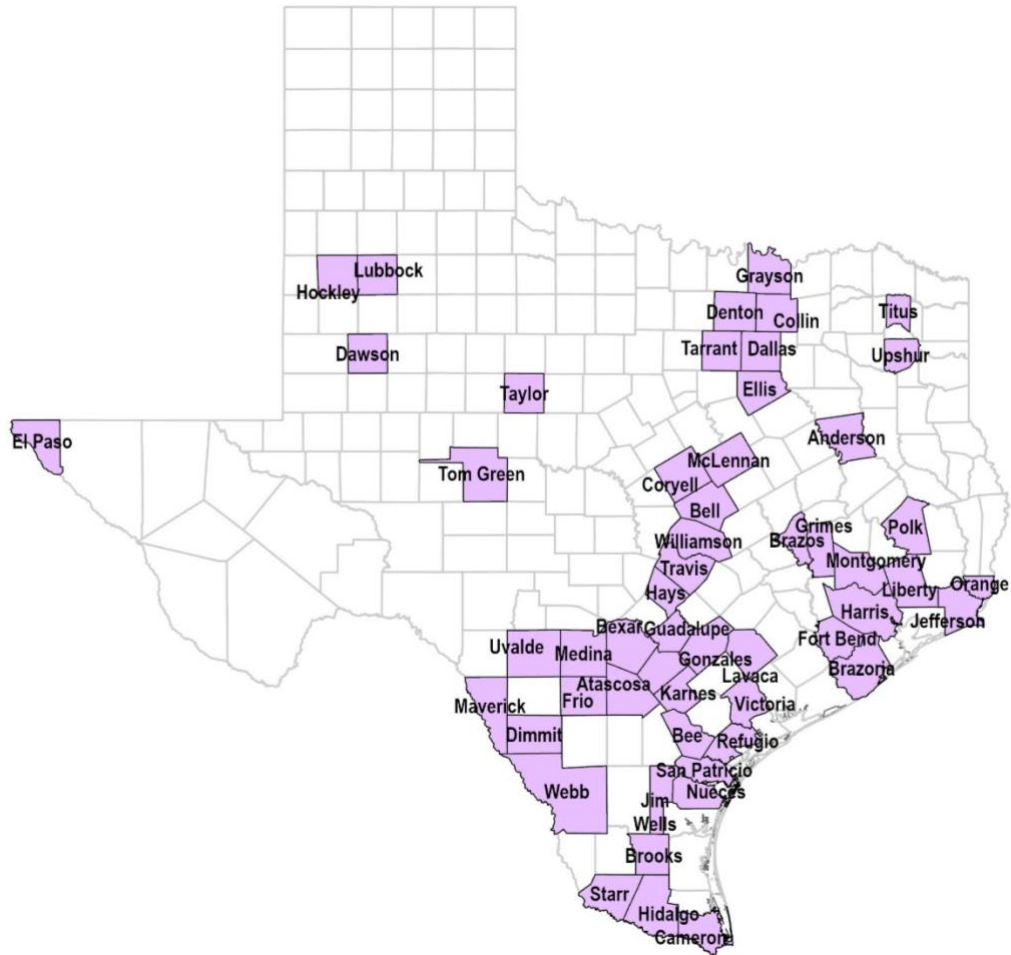
Table 1. Summary of survey sections, sources, number of items, and scale used.

Survey section	Source	# of items	Scale
<b>Health and Wellbeing</b>			
<i>Self-reported physical, mental, and general health in the last year</i>	RAND 36-item Health Survey	5	1-5 Likert
<b>Occupational Information &amp; Leisure Time</b>			
<i>Employment Status and working conditions</i>	N/A	4	Multiple-choice
<i>Leisure Time</i>	N/A		Multiple-choice
<b>Neighborhood and Community</b>			
<i>Perceptions of one's neighborhood and community</i>	Araya, 2006	14	1-5 Likert
<b>Environmental Conditions</b>			
<i>Environmental Satisfaction</i>	Pelletier, 1996	1	Multiple-choice
<i>Descriptions and perceptions of environmental conditions</i>	Pelletier, 1996	3	Free response
<b>Oil and Gas Policy &amp; Regulations</b>			
<i>Awareness and support of regulations</i>	N/A Pelletier, 1996	3	Multiple-choice, 1-5 Likert
<i>Views on the oil and gas industry</i>	N/A	2	1-100, free response
<b>Demographics</b>			
	N/A		

### Section 3.3: Survey sampling

My sample was representative of select sociodemographic characteristics of the targeted counties. This included quotas for income and ethnic groups as follows: 75% of the sample was requested to have incomes below the median for Texas ( $\leq$  \$67,000 per year), and representative of Hispanic/Latino ethnicity per county. Responses were sampled from three location groups: counties in the Eagle Ford Shale, counties adjacent to the Eagle Ford Shale, and counties in Texas outside of the Eagle Ford Shale. Because oil and gas activities vary widely across

counties, responses for the first two location groups were collected from the top sixteen oil and gas producing counties in the region, with ten counties from the Eagle Ford Shale and six counties from the adjacent area, including counties in the Texas Coastal Bend region. These counties included: Atascosa County, Bexar County, Brazos County, Dimmit County, Gonzales County, Jim Wells County, Karnes County, La Salle County, Maverick County, McMullen County, Nueces County, San Patricio County, Uvalde County, Victoria County, Webb County, and Wilson County. To increase survey responses, other responses were solicited as needed from EFS and EFS-adjacent areas outside of these 16 most productive counties, such as Bee County, Frio County, Starr County, Hidalgo County, and Cameron County. The third group, which included responses from individuals outside of the Eagle Ford Shale region, did not include specific county restrictions, but the income and ethnicity parameters still applied. Figure 4 illustrates counties included in survey responses.



**Figure 4.** Counties sampled for survey responses.

### Section 3.4: Survey analysis

My overall approach to data analysis was to assess survey and interview responses for connections between quality of life indicators and environmental conditions in communities in the Eagle Ford Shale and adjacent regions. Statistical analyses included t-tests, analyses of variance (ANOVAs), chi-squared tests, and cross-tabulations. While 300 survey responses were collected, 55 were removed during data cleaning due to inconsistencies in location descriptions

(e.g., county selection did not match closest street intersection, indicating respondent error).

Thus, the final sample size for the statistical analyses included 245 responses.

ANOVAs were utilized to assess differences in self-reported health data across the three location groups (EFS, EFS-adjacent, and non-EFS), while t-tests were used to assess health data when responses from the EFS and EFS-adjacent groups were combined. Because adjacent communities see similar or even greater amounts of oil and gas activity as communities located directly within the shale, these two groups were expected to have similar lived experiences. Thus, grouping them for some of the tests added another layer to the analysis by expanding what could be categorized as an oil and gas community.

For the one-way ANOVA tests, I compared the means of responses to the physical, mental, and social/community health questions (dependent variables) across location groups (independent variables). The t-tests were structured similarly, but compared the means of responses to health questions (dependent variables) to only two location groups, which involved me combining the EFS and EFS-Adjacent groups while leaving the non-EFS group the same. This required me to index questions for each quality of life indicator (physical, mental, social/community). For the factorial ANOVAs, I used select sociodemographic characteristics (race, ethnicity, income) to analyze potential differences in self-reported health data between sociodemographic groups in each location group. While sample size was a limiting factor in some of these tests, I created indices for characteristics as needed to ensure adequate sample size while not sacrificing significant detail.

Next, I utilized chi-squared tests when addressing research questions 2 and 3: *How are people's perceptions of their environmental conditions affected by living near oil and gas development? And, What factors could influence resident perceptions of oil and gas*

*development?* For example, for the survey question which asks respondents to rate their satisfaction with their environmental conditions using the options *Not at all satisfied*, *Somewhat satisfied*, and *Very satisfied*, I used chi-squared tests to analyze differences in responses to this question among different races, ethnicities, income levels, and location group variables. Lastly, I also used chi-squared tests to compare responses to the multiple-choice questions in the *Oil and Gas Policy and Regulations* section to select characteristics. The questions consisted of the following: (1) *Are you aware of any environmental laws or policies that regulate fracking in the area where you live?* (response options are *yes*, *no*, or *unsure*) (2) *If yes, how do you feel about those regulations?* (response options are *I feel that the regulations are effective*, *I do not feel that the regulations are effective*, and *I am not sure*) (3) *How supportive are you of environmental laws or policies that limit the amount of fracking in the area where you live?* (response options use a 1-5 Likert scale ranging from *very unsupportive* to *very supportive*). Sociodemographic characteristics analyzed in these chi-squared tests included the following: EFS location groups, homeownership status, time spent outside per day, years lived in county, educational attainment, and age. These characteristics were chosen because they all have the potential to impact one's knowledge of and support for environmental laws and policies.

For the open-ended survey questions, which asked respondents to describe positive and negative environmental conditions they face, I used an open coding process to categorize the responses into groups that could then be used for a cross tabulation analysis. Due to the variability in descriptions of environmental conditions, the categories were rather broad. However, I provide context in the Results section regarding what descriptions fall into these categories. After categorizing responses, I ran crosstabs to look for significant differences in reported positive and negative environmental conditions across location groups. For the open-

ended question asking respondents to describe their opinions on the oil and gas industry, I categorized respondents' descriptions into four groups based on the number they chose in the previous question that prompted them to rank their views on the oil and gas industry on a scale from 0 (only harmful) to 100 (only beneficial). By doing so, I examined differences in language descriptions across rankings.

Finally, I used the Getis-Ord  $G_i^*$  statistic to perform a hotspot analysis using the k-nearest neighbors (KNN) algorithm to conceptualize respondents' relationship to each other. The purpose of this portion of the analysis was to assess potential patterns in neighborhood-level quality of life outcomes that were too small to detect using the broad location groups. The hotspot analysis assessed clustering of self-reported health outcomes using the two closest intersecting streets to respondents' homes. To respect respondents' privacy, the question asking respondents to identify the intersection closest to their home was not marked as a required question. The 233 respondents identified in this portion of the analysis comprised those who consented to providing this information. Because of the distribution of responses and the types of variables I used, a non-parametric test was most fitting for conceptualizing respondents' relationship to each other. Therefore, I used KNN because it assumes independence of each point rather than placing more weight on neighboring points. To determine the value of K, I started with the commonly accepted formula  $K = \sqrt{n}$ , which produced a value of 15 for K. While this formula provided a helpful baseline for determining a reasonable K value, K=15 was too large, as initial tests counted large gaps across points as nearest neighbors. Thus, I gradually decreased the K value by increments of 1 until the results appeared to be unaffected by outliers.



### **Section 3.5: Interview sampling**

In addition to the survey, I conducted eight interviews with key informants who have extensive knowledge of the oil and gas operations in the Eagle Ford Shale as they relate to public health. Participants included individuals from nonprofits and various non-governmental organizations who have worked closely with residents; public officials; and industry actors. Multiple participants were former industry employees, which provided additional insight into the dynamics of oil and gas operations in the state of Texas. Interviews took place over a three-month period spanning August-November of 2023. I found participants by searching for environmental organizations based in the Eagle Ford Shale or those that have done work in the region. Then, I recruited them through email by explaining the purpose of the study and the structure of the interviews. While this approach was successful, I also utilized snowball sampling by asking participants for recommendations of other individuals with similar expertise. Additionally, some participants expressed interest in connecting me with specific individuals in response to questions I asked them during their interview. Thus, this technique proved equally useful during the interview recruitment process.

### **Section 3.6: Interview design**

Although each interview catered to the expertise of each person, questions shared commonalities. I asked participants about the nature of their work, including their role in their organization and how their organization is involved in the public health impacts of oil and gas development. The next set of questions focused on the policy and governance aspects of oil and gas development; I asked participants about recent legislative decisions or regulations that could affect public health in the region, as well as their views and experiences on the connections between oil and gas activity and human health. These questions often led to conversations about

the structure of the oil and gas regulatory system and the interpersonal dynamics involved in producing policy for oil and gas development. Next, I asked participants what they believed are the main barriers to improving health in oil and gas communities, and what specific solutions they believe will mitigate human health harms. The final set of questions left room for more personal accounts from each person. For these questions, I asked participants what groups of people are especially harmed by the fracking industry and how their organization is involved with these groups, if at all. I also asked participants to describe specific complaints they hear from residents of the Eagle Ford Shale regarding their health, safety, and environmental conditions, and what they believe is the general sentiment surrounding the prevalence of the oil and gas industry in their area. These include asking about the holistic health impacts faced by residents of the Eagle Ford Shale and the conditions that allow for these health impacts. Participants were also asked about policy that has contributed positively or negatively to the fracking-related health concerns in the Eagle Ford Shale and adjacent areas. The interviews were scheduled for one hour, and most took place in this time frame. The minimum amount of time spent with an interviewee was 45 minutes, and the maximum was two hours. All interviews were conducted on Zoom, and participants were not compensated for their time.

### **Section 3.7: Interview analysis**

I used thematic analysis to analyze resident experiences and health-related quality of life impacts in the Eagle Ford Shale. The analysis began with an open coding process, followed by axial coding to guide the generation of themes (Williams, 2019). In the open coding stage, I read each transcript, coding keywords that were relevant to my research questions. This process resulted in the generation of 21 codes, with some codes categorized as keywords mentioned by interviewees (e.g., regulatory loopholes), and others consisting of descriptive statements about a

particular topic or problem (e.g., resident experiences). I also specifically coded for the quality of life dimensions, tracking discussion of physical, mental, and social health. Following the open coding process, I performed a round of axial coding, which resulted in three themes that frame my discussion of the interviews (Saldaña, 2009). In addition to the three themes, I also present environmental justice as a cross-cutting theme because it remained a fundamental discussion topic across all eight interviews. In Chapter 5, I describe the themes and provide direct quotes from participants to illustrate key points. Together, these themes provided an understanding of the sociopolitical circumstances that surround oil and gas development in the Eagle Ford Shale.

## Chapter 4: Survey Results

Table 2 shows the demographic makeup of survey respondents, including race/ethnicity, gender, and household income. While 300 responses were collected, there was a total of 245 complete responses. Thus, frequencies from each category reflect a total of 245 respondents.

Table 2. Sample demographics (N = 245).	
Demographic characteristic	N (%)
<i>Race/Ethnicity</i>	
White, non-Hispanic/Latino	78 (32%)
Black or African American, non-Hispanic/Latino	25 (10%)
Other races, non-Hispanic/Latino	13 (5%)
Hispanic or Latino, all races	129 (53%)
<i>Gender</i>	
Man	71 (29%)
Woman	171 (70%)
Other gender/non-binary	3 (1%)
<i>Household income</i>	
\$30,000 or less	87 (35%)
\$30,001-66,999	73 (30%)
\$67,000-99,999	48 (20%)
\$100,000 or more	37 (15%)
<i>Location groups</i>	
Eagle Ford Shale	59 (25%)
Eagle Ford Shale Adjacent	104 (42%)
Non-Eagle Ford Shale	82 (33%)

Table 3 shows the descriptive statistics for the physical, mental, and community/social health indices, as well as general health in the past year. These indices were created using the average value from the sets of questions described above designed to capture respondents' self-reported health data. The general health category represents respondents' answers to only one question. For the full list of questions comprising the indices, see the "Health and Wellbeing" section of the survey in the appendix.

Table 3. Means, medians, and standard deviations for physical, mental, and community health indices.

Health Index	Mean	Median	Standard Deviation
Physical Health	3.72	4.00	0.90
Mental Health	3.66	4.00	1.05
Community Health	3.35	3.36	0.67
General Health (one question)	3.37	3.00	0.96

#### **Section 4.1: Analysis of quality of life outcomes using self-reported health data**

*RQ1: How are quality of life dimensions (physical, mental/emotional, social/community) affected by oil and gas development?*

Statistical analysis of the survey data began with one-way ANOVA and t-tests to assess quality of life components across location groups. Table 4 displays the results from comparing the means of the health indices between the EFS, EFS-Adjacent, and Non-EFS groups. To more thoroughly answer the research question, Table 5 shows the results from t-tests comparing the means of the health indices between the condensed EFS and Adjacent group and the non-EFS group. The ANOVA tests found no significant differences between self-reported physical, mental, and community health outcomes across location groups, and it also found no significant difference between general health in the past year across groups. While the *t*-tests produced a weak correlation between physical health and EFS/Adjacent and Non-EFS groups ( $p = 0.083$ ), the value was not significant enough to be considered statistically relevant. However, given that Cohen's *d* value (0.21) suggests a small effect size, these results merit consideration.

Table 4. ANOVA tests for health questions by EFS Status.

<i>Physical Health</i>	df	SS	MS	F	<i>p</i> -value
Groups: EFS, Adjacent, Non-EFS	2	2.48	1.24	1.54	0.217
Residuals	242	195.64	0.81		
Groups: EFS & Adjacent, Non-EFS	1	2.32	2.32	2.88	0.091*
Residuals	243	195.80	0.81		
<i>Mental/Emotional Health</i>					
Groups: EFS, Adjacent, Non-EFS	2	3.83	1.92	1.74	0.179
Residuals	242	267.27	1.10		
Groups: EFS & Adjacent, Non-EFS	1	1.58	1.58	1.42	0.234
Residuals	243	269.53	1.11		
<i>Community Health</i>					
Groups: EFS, Adjacent, Non-EFS	2	1.47	0.73	1.65	0.193
Residuals	242	107.18	0.44		
Groups: EFS & Adjacent, Non-EFS	1	0.72	0.72	0.20	0.204
Residuals	243	107.92	0.44		
<i>General Health in the Past Year</i>					
Groups: EFS, Adjacent, Non-EFS	2	2.20	1.10	1.19	0.306
Residuals	242	223.00	0.92		
Groups: EFS & Adjacent, Non-EFS	1	0.38	0.38	0.52	0.523
Residuals	243	224.82	0.93		

\**p* value less than 0.1

Table 5. Welch Two Sample t-test for means of health indices between EFS/Adjacent and Non-EFS.

Dependent Variable	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>	95% CI
Physical Health Index	-1.75	175.16	0.083*	0.21	-0.440, 0.027
Mental Health Index	-1.24	179.30	0.217	0.17	-0.441, 0.101
Community Health Index	-1.20	140.62	0.231	0.12	-0.303, 0.074
General Health	-0.66	173.01	0.514	0.08	-0.334, 0.168

\**p* value less than 0.1

These results suggest that there is no difference in subjective quality of life outcomes between those living in and adjacent to the Eagle Ford Shale and those living in other areas of Texas. However, because prior literature has identified low-income groups and racial and ethnic minority groups as vulnerable to fracking-related negative health outcomes, the next step in survey analysis called for separation of these groups to look for correlations between quality of life components and demographic characteristics. In order to maintain sufficient sample size across groups, the race variable, which included seven response options, was condensed into two groups: white and non-white. Additionally, the income variable, which included four response options, was condensed into two groups: below the state median income and above the state median income (i.e., \$67,000). Table 6 below shows the results of the factorial ANOVA tests.

Table 6. Factorial ANOVA tests for health questions across groups by select demographic characteristics.

<i>Physical Health</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Race	1	6.53	6.534	8.300	0.004***
EFS Status	1	1.82	1.818	2.309	0.130
Race x EFS Status	1	0.06	0.057	0.072	0.788
Residuals	241	189.72	0.787		
Hispanic/Non-Hispanic	1	0.29	0.288	0.357	0.551
EFS Status	1	2.12	2.125	2.628	0.106
Hispanic/Non-Hispanic x EFS Status	1	0.90	0.905	1.119	0.291
Residuals	241	194.81	0.808		
Household Income	1	2.63	2.634	3.274	0.072*
EFS Status	1	1.47	1.466	1.822	0.178
Household Income x EFS Status	1	0.15	0.147	0.183	0.669
Residuals	241	193.88	0.805		
<i>Mental/Emotional Health</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Race	1	3.50	3.496	3.167	0.076*
EFS Status	1	1.27	1.273	1.153	0.284
Race x EFS Status	1	0.29	0.293	0.265	0.607
Residuals	241	266.04	1.104		
Hispanic/Non-Hispanic	1	4.20	4.196	3.806	0.052*
EFS Status	1	0.89	0.889	0.807	0.370
Hispanic/Non-Hispanic x EFS Status	1	0.37	0.368	0.334	0.564
Residuals	241	265.65	1.102		
Household Income	1	3.44	3.439	3.107	0.079*
EFS Status	1	0.79	0.787	0.711	0.400
Household Income x EFS Status	1	0.14	0.136	0.123	0.726
Residuals	241	266.74	1.107		
<i>Community Health</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Race	1	0.38	0.379	0.850	0.357
EFS Status	1	0.80	0.799	1.791	0.182
Race x EFS Status	1	0.01	0.005	0.011	0.915
Residuals	241	107.46	0.446		
Hispanic/Non-Hispanic	1	3.16	3.162	7.249	0.008***
EFS Status	1	0.33	0.328	0.752	0.387
Hispanic/Non-Hispanic x EFS Status	1	0.01	0.012	0.028	0.868
Residuals	241	105.14	0.436		



Table 6. cont'd. Factorial ANOVA tests for health questions across groups by select demographic characteristics.

<i>Community Health</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Household Income	1	2.82	2.819	6.451	0.012**
EFS Status	1	0.26	0.257	0.588	0.444
Household Income x EFS Status	1	0.24	0.243	0.556	0.457
Residuals	241	105.32	0.437		
<i>General Health (Past Year)</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Race	1	7.63	7.627	8.456	0.004***
EFS Status	1	0.18	0.178	0.198	0.657
Race x EFS Status	1	0.04	0.041	0.045	0.831
Residuals	241	217.35	0.902		
Hispanic/Non-Hispanic	1	0.42	0.424	0.455	0.501
EFS Status	1	0.53	0.530	0.569	0.451
Hispanic/Non-Hispanic x EFS Status	1	0.02	0.021	0.023	0.880
Residuals	241	224.23	0.930		
Household Income	1	0.35	0.353	0.379	0.539
EFS Status	1	0.25	0.252	0.270	0.604
Household Income x EFS Status	1	0.03	0.028	0.030	0.864
Residuals	241	224.57	0.932		

\**p* value less than 0.1

\*\**p* value less than 0.05

\*\*\**p* value less than 0.01

Note: All tests passed Levene's test for equality of variance. Indices on 5-point scales.

The results of the factorial ANOVA tests showed no significant associations between race, ethnicity, or income characteristics and quality of life components between groups. These results suggest that residents in the Eagle Ford Shale and adjacent communities do not experience worse subjective quality of life outcomes than residents living outside of the Eagle Ford Shale. While the interactions between demographic characteristics and Eagle Ford Shale status were not statistically significant, the analysis showed significance between race, ethnicity, and income for several health variables across the entire sample. The most significant results were found for community health among Hispanic individuals ( $p = 0.008$ ), as well as physical

health and general health in the past year for the race variable ( $p = 0.004$  and  $p = 0.004$ , respectively). Additionally, the test showed significance for community health across income groups ( $p = 0.012$ ), suggesting that there is a difference between community health outcomes for those living below and above the median income for Texas. There were also weak correlations between mental health and race, ethnicity, and income groups, as well as physical health and income status. While these results were insufficient to conclude statistical significance, they do suggest trends in the data that may warrant further consideration. The overarching conclusion from the factorial ANOVA tests is that living within or near the Eagle Ford Shale does not produce statistically worse subjective quality of life outcomes than outcomes that can be observed on a larger scale, such as poorer outcomes for marginalized and low-income groups.

#### **Section 4.2: Analysis of responses pertaining to environmental conditions**

*RQ2: How are people's perceptions of their environmental conditions affected by living near oil and gas development?*

The next section of the survey sought to make connections between respondents' environmental conditions and their health and well-being. *Environmental conditions* were defined in the survey as *the air you breathe, the quality of food and water you have access to, your proximity to industry, the wildlife and vegetation around you, temperatures, noises and smells around you, etc.* Respondents were asked to rate their satisfaction with their environmental conditions using a 3-point Likert scale to describe the positive and negative environmental conditions they face in their area, and to explain if/how they feel these conditions affect their general health and well-being (i.e., quality of life). Table 7 shows the distribution of responses to the question regarding satisfaction with environmental conditions.

Table 7. Satisfaction with environmental conditions.

<i>Overall, how satisfied are you with the environmental conditions in the area where you live?</i>		
<b>Not at all satisfied</b>	<b>Somewhat satisfied</b>	<b>Very satisfied</b>
21 (8.6%)	137 (55.9%)	87 (35.5%)

Next, I performed a series of chi-squared tests to determine if there was a relationship between satisfaction with one’s environmental conditions and select sociodemographic characteristics. These characteristics included the two sets of location groups, as well as race, ethnicity, and household income factors since prior literature has shown differences in quality of environmental conditions across these groups. Table 8 shows the results of the chi-squared tests. A significant relationship exists between satisfaction with one’s environment and race, and there is a trend towards satisfaction with one’s environment and the two-location group variable.

Table 8. Chi-squared tests for satisfaction with environmental conditions and select respondent characteristics.

<i>Overall, how satisfied are you with the environmental conditions in the area where you live?</i>			
Predicted by	$\chi^2$	<i>df</i>	<i>p</i>
EFS, Adjacent, Non-EFS	5.465	4	0.243
EFS & Adjacent, Non-EFS	4.668	2	0.097*
Race	6.254	2	0.044**
Hispanic/Non-Hispanic	3.254	2	0.197
Household Income	4.192	2	0.123

\**p* value less than 0.1

\*\**p* value less than 0.05

Next, I coded responses to the open-ended positive and negative environmental conditions questions (Tables 9 and 10). For the negative environmental conditions, there are seven categories, shown in the table below. The *Environmental complaints* category refers to comments about issues with the natural environment such as a lack of green space, *industry-related complaints* refers to comments made specifically about the oil and gas industry, and *neighborhood complaints* refers to comments about the built environment and aspects of one’s

community that the respondent deemed undesirable (e.g., complaints about neighbors or crime). Additionally, the *pollution* category contains comments from residents about things related to air and water quality. For the positive environmental conditions, there are five categories. *Green space and recreation* refers to comments about parks, gardens, and community spaces, *natural environment* features comments about one’s landscape that have a positive impact on them, and *neighborhood/community features* refers to positive feedback about local amenities and services, as well as feelings about one’s neighbors. In both tables, the category *none* refers to respondents who did not have any positive or negative conditions to report, and the *unable to categorize* category refers to comments that contained too many typing errors or sentence structure issues to comprehend. Because there were differences in the number of respondents per location group, I also provide the percentage of respondents within each group that fell into each category. Note that the percentages exceed 100% for each location group because responses that contained more than one positive or negative report were placed in each relevant category.

Table 9. Self-reported negative environmental conditions.

Negative environmental conditions	Location Group		
	EFS (25%)	EFS-Adjacent (42%)	Non-EFS (33%)
Environmental complaints	9 (15%)	8 (8%)	9 (11%)
Industry-related complaints	3 (5%)	5 (5%)	5 (6%)
Litter	8 (14%)	17 (16%)	10 (12%)
Neighborhood complaints	14 (24%)	37 (36%)	21 (26%)
Pollution	3 (5%)	14 (14%)	10 (12%)
Weather and Climate Complaints	10 (17%)	14 (13%)	11 (13%)
None	11 (19%)	22 (21%)	24 (29%)
Unable to categorize	4 (7%)	1 (1%)	1 (1%)

Table 10. Self-reported positive environmental conditions.

Positive environmental conditions	Location Group		
	EFS (25%)	EFS-Adjacent (42%)	Non-EFS (33%)
Green Space and Recreation	5 (8%)	9 (9%)	10 (12%)
Natural Environment	18 (31%)	31 (30%)	26 (32%)
Neighborhood/Community Features	30 (51%)	49 (47%)	39 (48%)
Weather and Climate	4 (7%)	15 (14%)	7 (9%)
None	8 (14%)	17 (16%)	6 (7%)
Unable to categorize	4 (7%)	15 (14%)	8 (10%)

Table 11. Exemplar quotes for environmental conditions categories.

<i>Category</i>	<i>Response</i>
<b>Negative environmental conditions</b>	
Environmental complaints	“There aren't enough parks around here.”
Industry-related complaints	“Refinery smog and smoke in the air.”
Litter	“A lot of trash alongside roads everywhere you look.”
Neighborhood complaints	“Recently, a lot more people have been moving here so there's lot more traffic building up.”
Pollution	“The tap water...is undrinkable and I must now buy bottled water to drink and cook with. Air quality also seems not to be what it once was.”
Weather and Climate-Related Complaints	“The extreme heat in the summer.”
<b>Positive environmental conditions</b>	
Green Space and Recreation	“We have a dog park, regular park with swings, and trails nearby. A basketball hoop too.”
Natural Environment	“The Gulf is nearby”
Neighborhood/Community Features	“It's a safe neighborhood with friendly neighbors...a great place for kids to run around and play...”
Weather and Climate	“We have many bright sunny days.”

The third open-ended question, which asked respondents to describe how they believe their reported environmental conditions affect their health and well-being, produced much variance in responses. For this reason, codes could not be created for this question. It appears that many respondents did not fully understand how to connect their environment with their health and well-being. Many respondents answered that they did not feel their environmental

conditions affected their health and well-being. Those who did make connections between their environment and health often did not give details.

### **Section 4.3: Analysis of responses to oil and gas policy and regulations**

*RQ3: What factors could influence resident perceptions of oil and gas development?*

To answer the third research question, the survey asked questions related to resident opinions on oil and gas development and the regulation of fracking. These questions are contextually relevant to the study, particularly as they relate to the interview data analysis. Thus, I performed a series of chi-squared tests using survey responses for the relevant questions. Such questions included: (1) *Are you aware of any environmental laws or policies that regulate the fracking industry in the area where you live?* (2) *If yes, how do you feel about those regulations?* (3) *How supportive are you of environmental laws or policies that limit the amount of fracking in the area where you live?* and (4) *On a scale from 0 (only harmful) to 100 (only beneficial), how do you view the oil and gas industries?* The fourth question was followed by an open-ended question that asked the respondent to expand upon their response: *Why did you select that number?* Table 12 presents the means, medians, and standard deviations for this question across the sample and across subsets for location groups. Then, Tables 13 and 14 test the significance of the means using an ANOVA test for the three-location group scenario and a t-test for the two-location group scenario. In each scenario, there was no significant difference between respondent ranking of the oil and gas industry between location groups.

Table 12. Respondent rankings of the oil and gas industry.

*On a scale from 0 (only harmful) to 100 (only beneficial), how do you view the oil and gas industry?*

Population	Mean	Median	SD
Whole Sample (n = 245)	53.87	50.00	25.16
Subset: EFS (n = 59)	57.69	52.00	23.44
Subset: Adjacent (n = 104)	51.58	50.00	24.08
Subset: Non-EFS (n = 82)	54.02	50.00	27.55

Table 13. ANOVA test for oil and gas ranking by EFS status (EFS + adjacent versus non-EFS).

Dependent Variable	df	SS	MS	F	<i>p</i>
Oil and Gas Industry Ranking (by group)	2	1412	706	1.116	0.329
Residuals	242	153040	632.4		

Table 14. Welch Two Sample t-test for means of oil and gas rankings between EFS/EFS Adjacent and Non-EFS groups.

Dependent Variable	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>	95% CI
Oil and Gas Industry Ranking	-0.065	143.92	0.948	0.233	-7.298, 6.832

After ranking their opinion on the oil and gas industry, respondents were prompted to provide an explanation for their ranking in a free response question. Table 15 includes examples of respondents' reasonings for selecting certain numbers. Quotes are grouped into four ranges based on how respondents ranked their views on oil and gas: 0-25 (most unsupportive), 26-50 (somewhat unsupportive), 51-75 (somewhat supportive), and 76-100 (most supportive).

Table 15. Exemplar quotes for Question 19: Please elaborate on your response to the previous question. Why did you select that number?

Respondent Ranking	Respondent Explanation
<b>0-25</b>	<p>I think oil and gas are still necessary in our society, but there hasn't been enough done to alter our reliance on it. I think that most of the people in my community ignore the consequences of our dependence on it.</p> <p>I feel that if we invested time, effort, and money into finding a good alternative solution for energy we would find that our future would be less dangerous and a lot healthier and safer for future generations. Yet, we cheap out...</p> <p>It should not be relied upon as much as we rely on it now, and the companies that are in charge of handling oil and gas are corrupt.</p> <p>Oil and gas companies have been lying to the public for a very, very long time. It also does not help that greedy capitalists keep the oil going.</p> <p>I don't think they care about the environment. It's all about profits.</p> <p>It produces too much pollution and there are more earthquakes.</p> <p>Until we find something sustainable and reliable that's an alternative to oil and natural gas, we will need it to drive and heat our homes. But it's still harmful.</p> <p>They destroy the environment. They do nothing to keep the earth from declining.</p>
<b>26-50</b>	<p>The oil and gas industries are so deep in the pockets of politicians, that at this point it is almost impossible to rein them in.</p> <p>The oil and gas industry is a dirty business, literally and figuratively. They get the energy we need but they destroy our living conditions in the process.</p> <p>Oil requires machines that produce smoke which is bad.</p> <p>They don't care about environmental issues, just money.</p> <p>Right now gas is the most efficient but I believe we can do better. I wouldn't switch though because nothing has been affordable.</p> <p>I think they are getting rich and don't care about the people.</p> <p>A lot of people depend on it here but it does affect the environment.</p>



Table 15 cont'd. Exemplar quotes for Question 19: *Please elaborate on your response to the previous question. Why did you select that number?*

Respondent Ranking	Respondent Explanation
<b>51-75</b>	There are benefits like providing jobs for the community and negatives like pollution in the air.
	My husband works for an oil chemical treatment company. Without oil our planet would shut down as we now know it.
	Oil and gas industries have become a necessity in our lives and certain innovations allow it to be beneficial to society. The obvious harmful reason would be pollution.
	I know they bring good but not always in the right way. Sometimes they only think about money and not what it does to everyone else.
	Oil and gas industry provides jobs for locals but always at a price that the environment and our health pays.
<b>76-100</b>	I worked in the oil and gas industry for a short time and appreciate what the industry can bring to the economy. However, relying on oil and gas is not sustainable in terms of a healthy planet. The oil and gas industry must evolve.
	I believe "Big Oil" gets by with a lot because they generate so much income.
	We need oil and gas in our lives. I would rather use our oil and gas rather than having to rely on other countries.
	It is a very big thing in my area. My son and many others in our family work in the industry.
	It provides lots of job and business opportunities to grow and strive. It also helps cut down some of our dependency from foreign countries.
	I think it provides a lot of jobs around here...
	I grew up with gas stoves and gas cars. I don't agree with limiting these things.
	They provide us oil and gas to build our economy.
They do harm the environment, but they provide so much of the job market where I live.	
This area depends on oil and gas for people to make a living.	
It is the life blood of Texas.	

While there was variety in responses, a few patterns can be observed. For respondents answering below 50, complaints about oil and gas companies being too profit-focused were prominent, as well as concerns for human health and the environment. For those in the 51-75 category, respondents often recognized the prominent role oil and gas play in everyday life, but still expressed concern for the motivations of the industry and the sustainability of fossil fuels. In the “Most Supportive” category (76-100), respondents praised the job opportunities and economic benefits of oil and gas, as well as noting its importance in their geographical area. However, it is worth noting that similar explanations were sometimes provided for drastically different rankings, as can be observed in the table. Thus, there is a degree of subjectivity in the rankings that cannot be captured with the quantitative analysis. Some respondents also appeared to confuse the extremes of the rankings, listing a low number with a positive explanation or a high number with a negative explanation. Because intentions cannot be determined, these responses were still included in the quantitative analysis. The free-response oil and gas question provides important context to how residents view the industry and their reasoning for finding it beneficial or not.

Frequencies for questions related to oil and gas development are shown in Table 16. As the table illustrates, many respondents across the entire sample answered that they were not aware of any environmental laws or policies related to the regulation of the oil and gas industry in their area (83.3%), and many were also uncertain about their support for such regulations (69%). Answers for the question asking respondents how supportive they are of policies that limit fracking in their area were more mixed, but the majority of respondents were either supportive of such regulations (45%) or indifferent (38%).

Table 16. Frequencies for oil and gas questions (N = 245).

<i>Are you aware of any environmental laws or policies that regulate fracking in the area where you live?</i>		
Aware 41 (16.7%)		Not Aware 204 (83.3%)
<i>Do you feel that oil and gas regulations are effective?</i>		
Yes 36 (15%)	No 40 (16%)	Unsure 169 (69%)
<i>How supportive are you of environmental laws or policies that limit the amount of fracking in the area where you live?</i>		
Unsupportive of Regulations 42 (17%)	Indifferent 93 (38%)	Supportive of Regulations 110 (45%)

Next, to better understand the potential significance of these frequencies, I performed a chi-squared analysis that looked for significant differences in the frequencies of responses to the oil and gas questions between location groups, select lifestyle characteristics, and select sociodemographic data. For the location groups, data for both the three-location group scenario and the two-location group scenario are provided. Categories for the age variable include: 18-24, 25-34, 35-44, 45-54, 55-64, and 65 and over.

Table 17. Chi-squared tests for oil and gas questions.

<i>Are you aware of any environmental laws or policies that regulate fracking in the area where you live?</i>	$X^2$	$df$	$p$
Groups: EFS, Adjacent, Non-EFS	2.763	2	0.251
Groups: EFS & Adjacent, Non-EFS	1.823	1	0.177
Homeownership status	1.006	1	0.316
Time Spent Outside	9.964	3	0.019**
Years Lived in County	1.494	3	0.684
Educational attainment	5.817	5	0.324
Age	2.212	5	0.819
<i>Do you feel that oil and gas regulations are effective?</i>	$X^2$	$df$	$p$
Groups: EFS, Adjacent, Non-EFS	6.833	4	0.145
Groups: EFS & Adjacent, Non-EFS	4.791	2	0.091*
Homeownership status (Rent/Own)	1.705	2	0.426
Time Spent Outside	0.635	6	0.996
Years Lived in County	6.127	6	0.409
Educational attainment	2.963	4	0.564
Age	5.571	10	0.850
<i>How supportive are you of environmental laws or policies that limit the amount of fracking in the area where you live?</i>	$X^2$	$df$	$p$
Groups: EFS, Adjacent, Non-EFS	7.426	4	0.115
Groups: EFS & Adjacent, Non-EFS	2.989	2	0.224
Homeownership status	0.68	2	0.712
Time Spent Outside	1.682	6	0.947*
Years Lived in County	3.634	6	0.726
Educational attainment	7.319	4	0.12
Age	7.929	10	0.636

\* $p$  value less than 0.1

\*\* $p$  value less than 0.05

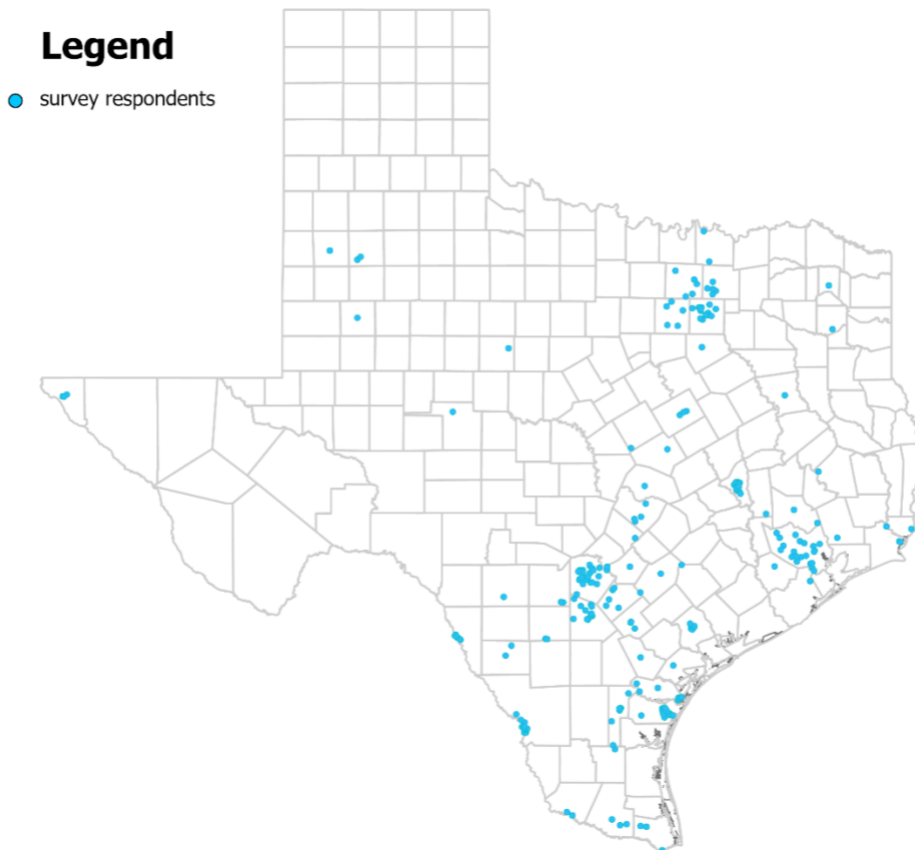
The results of the chi-squared analysis showed a strong correlation between time spent outside and awareness of environmental laws and policies that regulate the oil and gas industries ( $p = 0.019$ ). Trends between location groups and opinions on whether the regulations are effective ( $p = 0.091$ ), and time spent outside and support for regulations ( $p = 0.947$ ) can also be observed, although these were not statistically significant. While the chi-squared tests cannot determine the nature of these relationships, Table 16 provides some context into how the responses were distributed across variables.

Referring to the third research question, the results of the following tests indicate that, of the selected demographic and lifestyle characteristics, time spent outside is the only statistically significant factor influencing perceptions of the oil and gas industry. And this refers only to awareness of fracking regulations. While there was a trend towards time spent outside and support for regulations, we cannot conclude statistical significance. For RQ3, the qualitative results from Table 15 provide the most in-depth insight into resident perceptions of the oil and gas industry. According to respondent explanations, it appears that an appreciation for the economic benefits of oil and gas and/or employment in the industry may lead to more positive perceptions of oil and gas development. Conversely, concern for the environmental impacts of oil and gas, coupled with distrust for the industry's motives may lead to more negative perceptions of oil and gas development.

#### **Section 4.4.: Spatial analysis of quality of life outcomes**

The final portion of the survey analysis sought to provide more precise data on quality of life outcomes across location groups, as well as incorporating a spatial component to the survey analysis. While the three location groups used in the non-spatial analysis were useful for dividing

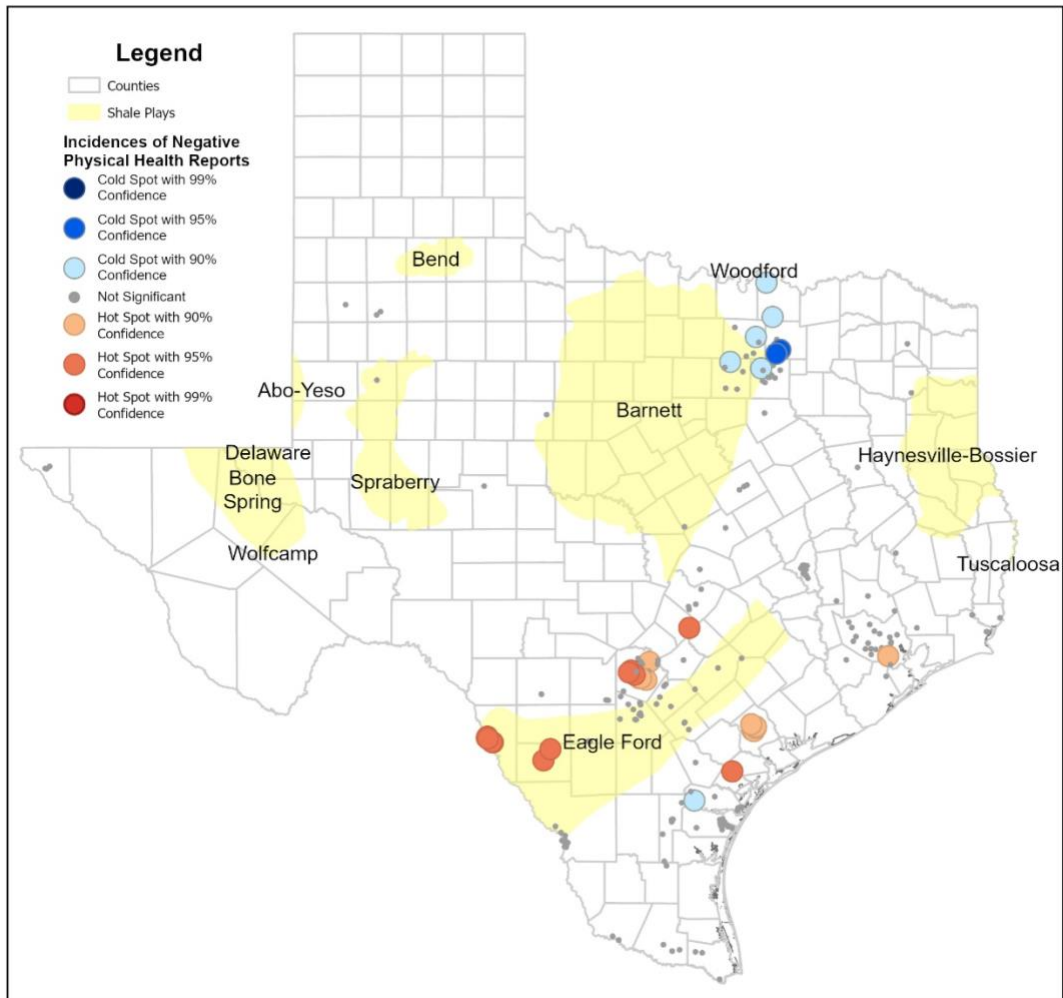
respondents into broad groups that could be used for comparisons, the vast presence of oil and gas development in Texas and the local nature of oil and gas activities means that looking at the data on a smaller scale may produce results that were not visible using the regional groups. Thus, I used the Getis-Ord  $G_i^*$  statistic to perform a hotspot analysis of self-reported health outcomes using the KNN algorithm to conceptualize respondents' relationship to each other. For consistency, I used a similar set of variables as Section 4.1 to assess quality of life (self-reported physical and mental health data). However, instead of using the community health index for social health, I used Question 11 from the survey, which asks respondents to rate their satisfaction with their environmental conditions (RQ2). In this way, the spatial analysis helps to visualize quality of life outcomes in communities near oil and gas development, as well as satisfaction with one's environmental conditions in these communities. In Figure 5, The blue dots mark respondent locations using their responses to the question asking for the two closest intersecting streets to the respondent's home.



**Figure 5.** Select survey response locations.

Maps for the hotspot analyses are included below. In each map, I include boundaries for the shale plays to illustrate where the points fall in relation to the EFS region. Finally, due to the ordering of response options for these questions, higher values indicated worse self-reported health outcomes. Thus, hotspots indicate more negative results, while cold spots indicate more positive results.

## Hotspot Analysis for Physical Health

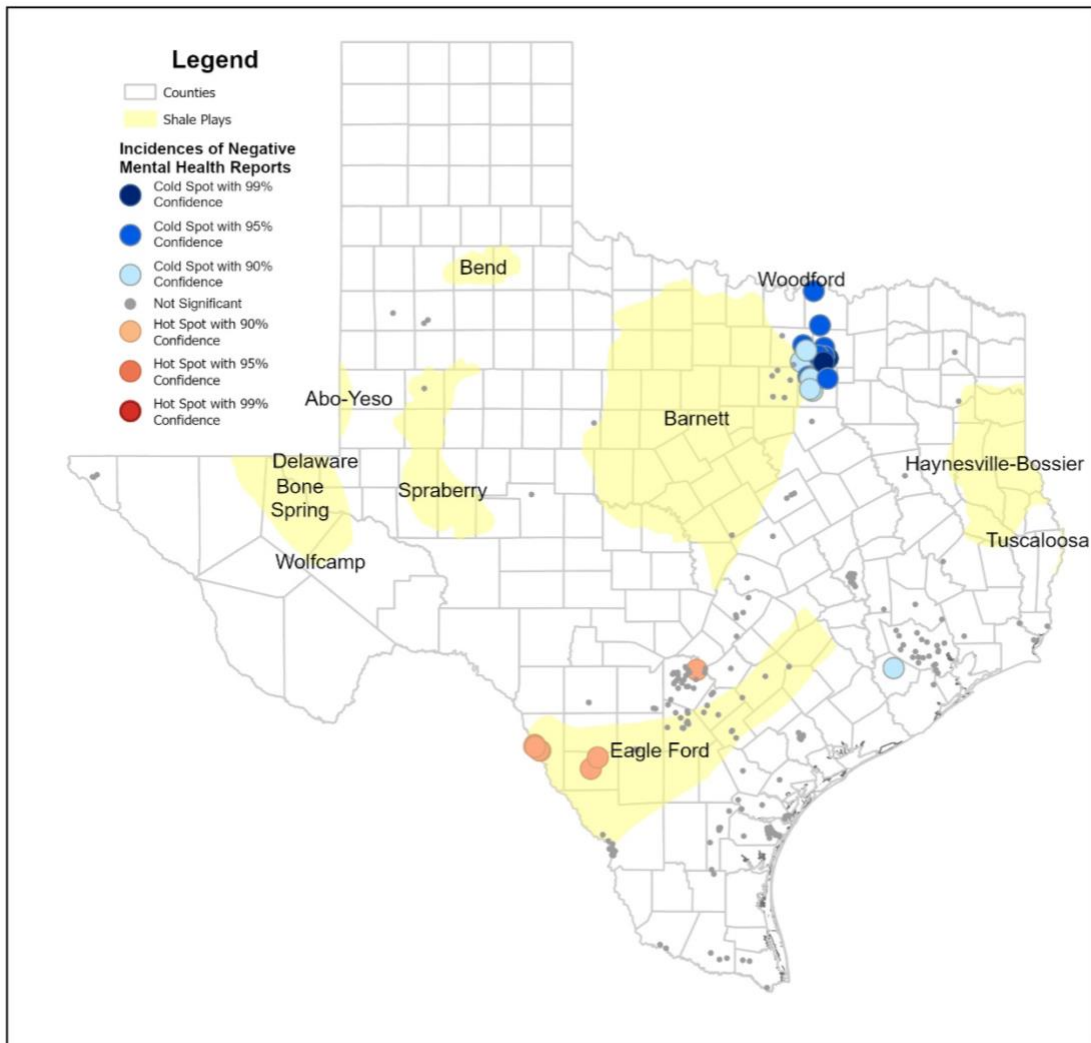


**Figure 6.** Hotspot Analysis for physical health (Q1).

In Figure 6, hotspot analysis using data derived from the question regarding respondents' physical health over the last year shows clustering of worse self-reported physical health in several areas inside and adjacent to the EFS. Conversely, the test produced clusters of few incidences of worse physical health in locations in North Texas, specifically in the Dallas/Fort Worth metropolitan area. There is also one cold spot located in an EFS-adjacent community.



## Hotspot Analysis for Mental Health

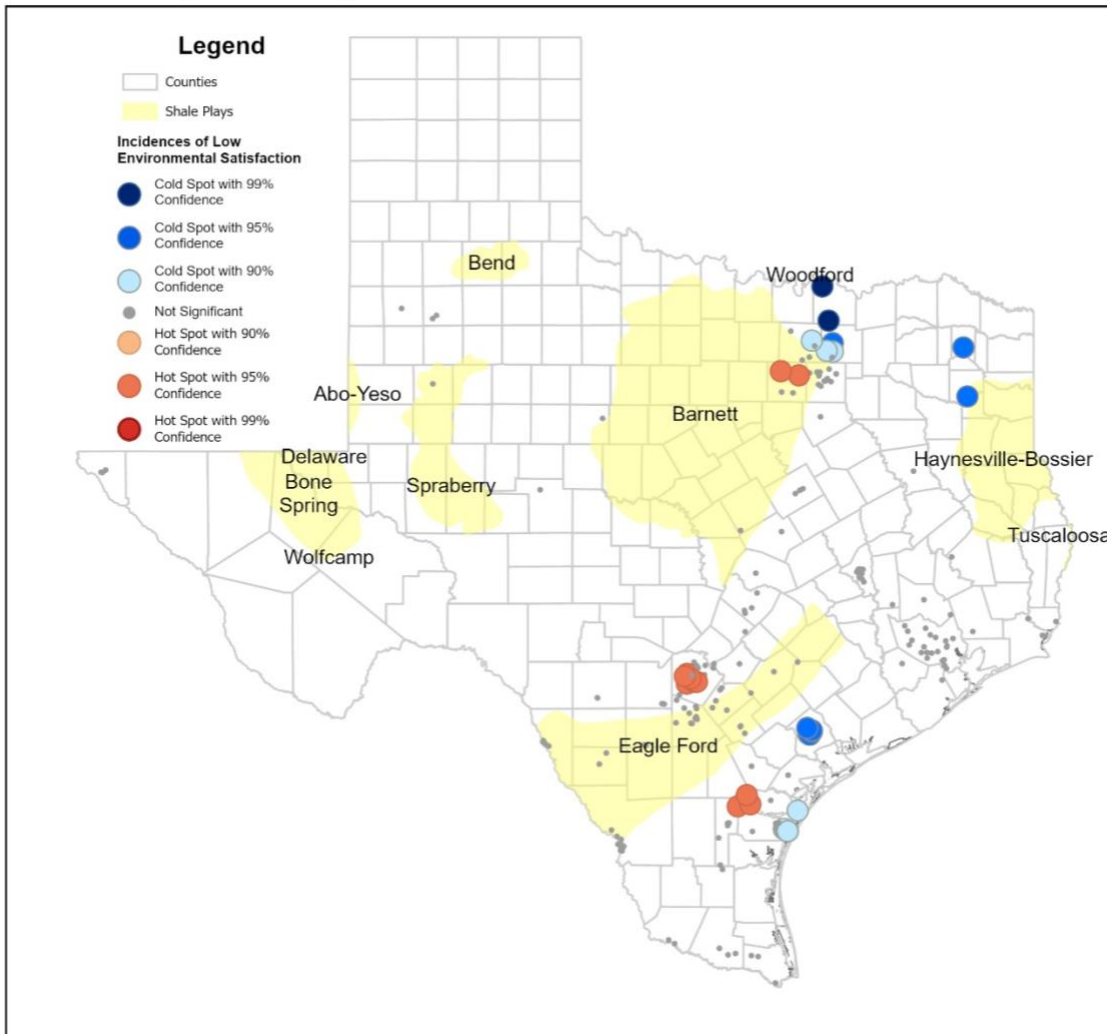


**Figure 7.** Hotspot analysis for mental health question (Q3).

As Figure 7 illustrates, there is clustering of worse self-reported mental health in several locations inside the EFS and one adjacent area. Meanwhile, there is clustering of cold spots (or better mental health reports) in North Texas just outside the boundaries of the Barnett Shale. There is also a single cold spot in an EFS-adjacent area near the Houston metropolitan area. While the hot spots do not necessarily indicate poor mental health outcomes, they do represent clusters of lower-than-average scores for this question.

Finally, I performed a hotspot analysis using the question that asked respondents to rate their overall satisfaction with the environmental conditions in their neighborhood/community (Q11). This question was chosen to help connect the survey results back to the social determinants of health theory by evaluating local perceptions of environmental conditions. Results for this test are displayed in Figure 8.

### Hotspot Analysis for Environmental Satisfaction



**Figure 8.** Hotspot analysis for environmental satisfaction question (Q11).

The results of the environmental satisfaction hotspot analysis were the most mixed of the three variables. There are clusters of strong environmental dissatisfaction in two areas adjacent to the EFS, and there is also a cluster of environmental dissatisfaction inside the Barnett Shale. Areas with the most environmental satisfaction (cold spots) are concentrated just outside of the Barnett Shale in North Texas and in two EFS adjacent communities. While there are also two cold spots in East Texas, the low density of response rates in this area could be deceiving since the nearest neighbors are likely to be further apart from each other than the other clusters.

While the spatial component of the survey analysis provides a more in-depth view of quality of life within location groups, the results of the hotspot analyses should be interpreted with caution. While the k-nearest neighbor analysis provided the best algorithm for classifying each respondents' relationship to the other, it has limitations as well. First, k nearest neighbor analysis can be generous with what the algorithm considers a "neighbor." This means that there is no set distance for what the test considers a neighbor, which can lead to problems with the test comparing points that are far away from each other. While every effort was made to ensure that points were within a reasonable distance of each other (i.e., neighbors were within the same county or directly adjacent counties), some points may have factored in neighbors with significantly different environmental conditions. Thus, these results should be used to draw attention to potential problematic counties or neighborhoods rather than to draw definitive conclusions about quality of life in these areas. Combined with the other components of the survey analysis, the hotspot analyses provide more insight into the spatial distribution of potential health impacts across the Eagle Ford Shale.

## Chapter 5: Interview Results

### Section 5.1: Quality of Life and Health Impacts

*RQ1: How are the quality-of-life dimensions that are related to health (physical, mental/emotional, community) affected by oil and gas development?*

To address the first research question, interview participants provided contextual knowledge on the known health impacts of fracking in the region and the associated physical and mental health concerns. Participants consistently reiterated many of the common health symptoms and conditions reported in the literature and testified that they have interacted with residents having these experiences. Such health issues included: nose bleeds, respiratory illnesses such as asthma and chronic obstructive pulmonary disease (COPD), cancer, and higher rates of premature birth (particular among Hispanic women). Several participants cited gas flames as the most significant concern for public health. While these flames can be released in the form of flaring events, unburned gas is released when drillers break into the shale to extract oil. This process releases unregulated amounts of methane-containing natural gas into the atmosphere, which is then transported for miles by wind.

Other public health challenges for residents of the Eagle Ford Shale are orphaned wells (also known as zombie wells or inactive wells). Orphaned wells are defined by the U.S. Department of the Interior as legacy pollution sites that are no longer operational, but the unmaintained equipment contributes to air and groundwater contamination (DOI, n.d.). One participant cited the Permian Basin as a prime example of what happens to oil and gas sites once they have been fully extracted, and warned of the same issues occurring in the Eagle Ford Shale in the future:

As far as public health is concerned, the coming challenge is in the oil fields with the cleanup that's not going to happen. We know this because it happened in the old world. The Permian Basin is full of the last generation of oil wells which were never properly cleaned up because there's no financial incentive to do that. And now they're leaking into the aquifers onto the surface. It's a total disaster that nobody can even comprehend how to begin to fix. And the same thing is going to happen in the Eagle Ford Shale, and the same thing is going happen with the refineries on the coast. They're going to make their money and they're going to get out. (Journalist)

In addition to the physical health implications of fracking, residents face mental health impacts and emotional distress. Participants described stress, anxiety, and depression as significant problems for residents impacted by fracking regularly, often stemming from disappointment from feeling helpless when it comes to protecting their health and the health of their families. While residents routinely report incidents associated with fracking activity such as violations of air emissions, dust, noise, light pollution, and oil and waste spills on the road, their reports largely remain ignored, leading some residents to consider moving. Participants cited these frustrations with health concerns, reporting violations, and worries about relocating as major contributors to emotional struggles in Eagle Ford Shale communities. Additionally, participants also expressed concern for the health of livestock and the accompanying mental health challenges. As a prominent ranching region, water and soil contamination have implications for livestock and ranchers who are responsible for them, and equipment malfunctions at sites have had serious impacts to residents' livestock and property. For the ranchers, these health impacts lead to emotional distress and financial burden. In many cases,

residents are financially responsible for replacing livestock and repairing property damage caused by fracking-related incidents. Despite this abundance of mental health challenges that residents complain about in the context of fracking, their emotional struggles are often overlooked. As one participant described:

I think the emotional problems are some of the biggest problems that people face and nobody wants to pay attention to those. I mean, it's hard to quantify something like that. Generally, the pattern that I see is the husband/father feels helpless to protect his family. So, he gets this boiling rage that spills over onto everything. And then the kids are going to school and they're sick. They're going to school with industry supporters whose kids are bullies. It's a horrible dynamic, and I know because I've been in that situation with my son when we were impacted. (Activist)

Another participant complained that accidents associated with oil and gas are not treated the same as other catastrophes, such as natural disasters. Some residents have reported feelings of hopelessness over their lack of control of the negatives impacts of the industry. This participant, a former industry employee and Eagle Ford Shale resident, opened up about their mental health challenges with oil and gas development:

I grew up watching TV, and things would happen watching the news and the boat would capsize and the people are hanging on the boat, but here comes the coast guard and they drop down a line and they save them. Or a tornado comes, but people come and feed you and they rebuild, and this is America where people take care of each other. When it comes to oil and gas, nobody comes. When I realized that paradigm, I went into some depression. People here grow up believing one thing and then they find out it's something different, especially when it comes to oil and gas. (Activist)

## **Section 5.2: Interview Themes**

The aforementioned physical and mental health impacts are components of quality of life that are of concern for Eagle Ford Shale residents. To better understand quality of life impacts and form a contextual understanding of resident perceptions of their community and the oil and gas industry (RQs 2 and 3), participants also provided key accounts of the interpersonal dynamics that allow oil and gas development to take place on a poorly controlled level in the Eagle Ford Shale. Interviews also provided key information to the broader question of answering what quality of life impacts are faced by residents of the EFS and other oil and gas communities. This sociopolitical context alluded to potential community health impacts, the third component of quality of life. Throughout the open coding process, I generated three themes based on shared sentiments and experiences described by the participants. These themes are *industry influence*, *regulatory negligence and inadequacies*, and *relationships and culture*. The first two themes represent structural barriers that are closely tied to the sociopolitical climate in Texas, while the last theme describes how industry and government work together to influence resident opinions and community culture surrounding oil and gas development.

### **Section 5.2.1: Regulatory Negligence and Inadequacies**

Participants invariably described instances of regulatory failures, forming the basis for the first theme. While participants mentioned various unique concerns with regulating oil and gas, the fundamental structure of the regulatory system in Texas was unanimously identified as a core cause of public health barriers. In many cases, these failures involved either negligence from state agencies or inadequacies with monitoring sites and enforcing regulations when violations were present. More specifically, lack of organization and capacity within the Texas

Commission on Environmental Quality (TCEQ) and the Railroad Commission of Texas (RCT), the two agencies responsible for regulating various aspects of oil and gas development throughout the state, appear to be at the root of these regulatory issues. One of the most significant structural concerns for these state agencies is the fact that oil and gas companies self-report violations and site accidents. As one participant explained:

There has never been adequate regulation in the United States for oil and gas. It's always been a self-reporting system. So if they pollute, whether it's a spill or air pollution or whatever, they are supposed to report it to the regulatory agency, which is laughable. But that's why we don't know how much methane is in our atmosphere from oil and gas because they consistently underreport it. (Activist and former industry employee)

Another key structural issue brought up by multiple participants was lack of accountability with environmental compliance. When asked about the barriers preventing agencies from enforcing safety in oil and gas production, one participant described structural issues between the two agencies that make it difficult for residents to report their concerns. While the Railroad Commission of Texas is responsible for overseeing potential contamination in private groundwater wells, the Texas Commission on Environmental Quality oversees surface water contamination. And, while the TCEQ is responsible for reviewing air pollution complaints, the RCT is the only organization that can issue or retract venting and flaring permits to oil and gas companies. "It creates a structure where there's never anybody to go for your problem who can actually solve your problem," explained one nonprofit employee.

Beyond confusion about which agency is responsible for different aspects of oil and gas development, state agencies also struggle with lack of capacity to effectively monitor oil and gas



activity and take action on potential problems. According to a participant, air pollution concerns from flaring are only assessed through odor complaints, and there is often no formal equipment to measure these potential violations:

When the TCEQ comes out to investigate, they basically just send somebody out to smell with their own nose. They don't use devices all the time. If you are complaining about odors, it's just based on the human nose that you get from the investigator who happens to come out. So it seems sort of obvious that you wouldn't get consistent results with that kind of an activity and it's bewildering that it's allowed to take place that way in Texas.  
(Nonprofit employee)

Participants indicated that agencies simply do not have the personnel or equipment to monitor pollution effectively. “There are only five air quality monitors throughout the entire Eagle Ford Shale region... We just don't have the air monitoring network to even be able to tell who is more impacted,” the participant explained. Similar regulatory issues apply to potential groundwater contamination as well, but they are brought on by policy inadequacies rather than capacity issues. According to one participant, Texas lacks policies that other states with similar levels of fracking have in place (such as Wyoming and Colorado), including a requirement to capture baseline groundwater quality data before drilling a well at a location. Even when restrictions are put in place on paper, participants explained that they are rarely enforced. Another example of an unenforced fracking policy involves orphan wells. Two participants explained that fracking companies will often reach out to landowners about obtaining rights to frack on their property. While the process of transferring rights over to the companies is simple, only requiring the completion of a P-13 Form (a document used to signify a change in ownership

of an oil well), what happens to the land after it has been fracked is less clear. Technically, plugging the well is the responsibility of the RCT, but participants emphasized that the process of getting officials to come out and plug the well is difficult and lengthy. Whether this is due to capacity issues or lack of resources to plug these wells remains unclear, but it is likely a mix of both, according to interviewees.

Again, the policy and capacity issues that prevent public health from being prioritized are structural. When asked about barriers to better regulating oil and gas across the region, many participants indicated that these systemic issues are at the root of the problem:

We have what is called a *permission to pull* system, in which the government gives facilities permits to pollute and admit certain toxicants. And these are the toxicants that are regulated, but there's so much that is not regulated by the state and at that point you have to think about who is making these decisions to regulate certain chemicals and to not regulate certain chemicals. (Researcher and Activist)

The state regulatory agencies are underfunded. And that's intentional. Stuff that's written on paper doesn't work out in the field. (Activist and former industry employee)

It comes down to the fact that we do not organize our regulations around the precautionary principle. So the precautionary principle emphasizes the need to prove safety before proving harm. But we don't have that. We just let companies use some new proprietary chemicals and then prove harm. You see that a lot with, not only in environmental toxicology, but also with pharmaceuticals. And then you also have industry lobbying and influence at the regulatory scale. (Researcher)

It's a system that doesn't work for the public. It might work from a bureaucratic standpoint, but certainly to reach the public's aims of maintaining their own health, it is not a functional system and can be really frustrating. (Nonprofit employee)

There are some rules on the books, but they're not enforced. There's a lot of loopholes so we don't even really know what it would take at this point...what a system to adequately regulate oil and gas would look like, how many people would need to be employed, what kind of equipment they would need to have...I mean it would take an army because oil and gas is everywhere all over this county...to try to regulate it is a much bigger job than what the public believes and what lawmakers and NGO's are telling people. (Activist and former industry employee)

While motives for maintaining an inadequate system cannot be determined, some examples brought up by participants raise concerns for accountability of regulatory agencies. One participant described an instance where uncontrolled spraying of oil and gas (also known as "blowouts") was occurring at a plant next to a resident's home, which was causing rashes when the family members spent time in the backyard. While the TCEQ and the RCT deflected blame, the family obtained testing from three certified labs that detected the presence of hydrocarbons on their property. However, both agencies denied the validity of these tests, stating that the lab results could not be considered proof of harm because a regulatory official was not present at the time of testing. Examples such as this show a lack of accountability among regulatory agencies and a system that does not support the public.

In summary, the main problems with the regulatory system include: lack of capacity in equipment and personnel, a structure that is not set up to support public health, and insufficient ways for reporting problems that arise. All three of these components represent core issues stemming from years of not prioritizing human health and safety over production.

### **Section 5.2.2: Industry Influence**

The *industry influence* theme describes the structural makeup of oil and gas companies in the Eagle Ford Shale. It includes testimonies from participants on how the oil and gas industry interacts with residents to maintain control over public opinion and limit the power of regulatory agencies. Participants explained that oil and gas companies use their immense amount of wealth to create barriers for residents who express concerns about their health or other fracking-related complaints. These barriers exist in several forms, including: non-disclosure agreements signed by residents in exchange for money, the burden-of-proof being placed on landowners in legal cases and the existence of a number of loopholes to legal action, large-scale donations by oil and gas companies to public entities such as schools and government agencies, and delay tactics used by lawyers to postpone cases brought forth by residents against oil and gas companies.

Summarizing the fundamental issues with the industry, one participant said:

The oil companies have a lot of money, and with money you can create messaging. The people on the other side don't have any money. Corporations make billions of dollars, so what are they going to do? How can you possibly stand up against that? It's even more true when it goes to court because you know, oil companies pay good lawyers.

(Journalist)

Although legal action against industry actors would appear to be the most effective way of protecting residents whose health is being impacted by fracking, these barriers run so deep that some participants believe that working directly with residents in legal cases is rather unproductive. As one informant indicated:

The fastest way to get them out of harm's way is not to help them find a lawyer or to help them find a scientist because they're going to be years in litigation. When the industry finds out that residents have enough scientific data to win a case, they are going to go in and give them a lot of money and a nondisclosure agreement. And that's why there's not more information about the health impacts and the water impacts and the air impacts from fracking. That's why everything has been sealed. Nobody can find out that information because it's sealed behind nondisclosure agreements. (Activist and former industry employee)

Often, impacted families cannot afford to hire a lawyer to represent them in cases against industry actors. In these cases, larger environmental organizations have been known to take on cases for families or groups of families being impacted. However, even when brought to court, these cases proved ultimately unproductive for public health exposure because of the tendency for oil and gas lawsuits to result in settlements that include nondisclosure agreements, as previously noted. As one interviewee stated:

What would happen is the family...they need to get out because their water is contaminated and they're breathing this horrible air. They're sick all the time. They need to get to safety. And so they would sign a nondisclosure agreement and all that evidence would go away. (Activist and former industry employee)

Even for those unwilling to accept nondisclosure agreements, the outcomes for exposing health harms remain bleak. Another participant mentioned instances where lawyers hired to represent oil and gas companies in legal cases used tactics to suppress evidence of human health harms and delay court appearances when faced with time-sensitive matters such as resistance to new infrastructure or projects breaking ground in a particular place:

They (oil companies) will throw up every procedural barrier that is available to them in the laws, including getting you to sign every kind of thing you could possibly sign. If you ever want to challenge an oil company in court, even if your claim is totally justified, they will make it so difficult and expensive for you to go through the process because their lawyers will just be like, “oh, can we request a delay? Can we request to move the courts? Oh, the plaintiff didn't do this. Oh, they need to file this or that. Oh, we're going to file a motion of something you've never heard of.” So it's never even getting to the nuts and bolts of the claim of the litigation. It's this procedural stuff around the edge. (Journalist)

Structural tactics also exist that make it difficult for residents to prove that any harm was done to them. For example, if a landowner wants to claim that an oil well on their land has affected their air or water quality negatively, they must have had baseline air and water quality testing done before drilling began on their land. However, the financial burden of this testing is placed entirely on the landowner (which can cost thousands of dollars), and few landowners get testing done because that option is not made known to them. Unfortunately, without testing prior to drilling, there is not a reliable way for landowners to claim that their poor air or water quality is because of fracking activity. As one participant noted:

I've seen examples of oil and gas companies arguing in groundwater contamination cases in court that landowners couldn't claim that the company was responsible for contaminating the groundwater because the gas might have been there before the contamination allegedly occurred. And so the burden of proof was placed on the landowner with those arguments. (Researcher)

Other comments regarding industry malpractice shared this theme of money as a suppressant of legal action and a facilitator of power imbalances between residents and corporations. Some examples of testimonies from participants are:

They use their money to suppress the truth. They use their money to suppress science. They use their money to corrupt our government. They sued me twice with slap suits trying to shut me up. So, you know, they misuse their money in the legal system. Their money and power... it permeates everything. (Activist)

Something has to be done about the power that industry actors have...something structurally. We have the question of working within the system versus completely transforming the system. It's really hard to work within such a flawed system, especially with bigger forces such as capitalism, which is interrelated with other forms of oppression that hold each other up and are the backbone of the United States government. (Researcher and Activist)

There are also instances of industry actors using money to control the public outside of court cases. For example, homeowners are often tempted to transfer rights to produce oil on their

property over to oil companies in exchange for money. However, once the oil has been extracted and the well becomes orphaned, the burden of clean-up falls to the state agencies, where action is often slow or nonexistent. This leaves residents vulnerable to groundwater contamination and air pollution from unmaintained and deteriorating equipment on their property. Moreover, participants also indicated that the industry uses its wealth to drive public opinion and influence community sentiment in subtler ways, such as by funding public services like parks and schools. As one participant explained:

Right in the actual oil fields it's more personal. Oil companies donate playgrounds to schools and then paint the playgrounds in the color of the oil company. Or, they dedicate a baseball field and they get their names put all over everything, the libraries and the school cafeterias. They'll hold meetings and put on fairs to seem like a positive presence in the community. And a lot of people are irritated by that because they say, "well they caused like 10 million dollars' worth of environmental damage here and try to fix it with a \$6,000 playground." (Journalist)

In summary, the oil and gas industry uses its immense wealth to keep residents powerless when it comes to combating public health issues. Whether intentionally deceptive or not, this imbalance of power lays the groundwork for environmental injustices by suppressing scientific evidence and creating a system where resident experiences are not an effective means to inducing change for impacted communities.



### Section 5.2.3: Politics and culture

The third and final theme, *politics and culture*, describes how the oil and gas industry and government work together to produce barriers for residents (intentionally or unintentionally) and how culture surrounding oil and gas development plays a part in subjective quality of life. One participant described this relationship as “the revolving door between government and industry” and described this dynamic as “the backbone of the regulatory system.”

On the political end, participants cited legislative failures as a key issue in addressing corruption in the oil and gas industry. As previously discussed, it appears that industry actors use wealth to maintain power over the public. A similar pattern is seen in the ways that oil and gas companies interact with state legislators and regulatory agencies. For instance, one participant explained that many times, state legislators’ campaigns are financed by the oil and gas industry in exchange for approval on projects or penalty reductions for regulatory violations, with pipeline companies and wastewater disposal companies as particular perpetrators of this problem. Unlike many states, Texas has no legislation preventing commissioners from having personal financial interest in the companies that donate to their campaigns, and there is also no limit to the amount that corporations can donate. As one participant stated, “The fundamental structure of campaign finance in Texas is what keeps us from having common sense rules and laws in place that prioritize the public over business.”

It was in those town halls that I realized the railroad commission, our state agency with publicly elected officials, was not actually on the side of the public. They played the role of spokesperson for the industry, and they were not interested in hearing what could go wrong. They wanted to make it seem like the community's concerns were based on what

they called *misinformation*. And so it was disheartening to see that a public agency would treat the public that way. (Nonprofit employee)

These financial contributions from the oil and gas industry undoubtedly carry weight for Texas state legislators. In 2023, House Bill 2127 was passed, which bans local municipalities from creating regulations that extend beyond what the state already has in place.

On the cultural side, participants explained that many residents struggle reconciling their concerns for their health and the environment with their gratitude for the job opportunities and economic stability that oil and gas have brought to their communities. Here, community context was helpful for understanding the potential reasons for conflicting opinions among residents. First, the economic impact of oil and gas development on communities in the Eagle Ford Shale was continuously emphasized by participants as something that residents appreciate and very much need. Prior to the fracking boom in 2010, the Eagle Ford Shale region was viewed as a collection of dying communities across South Texas. Although generational wealth existed in the form of ranch properties, lucrative job and income opportunities were scarce throughout the region. For many residents, fracking brought job opportunities and financial stability, which they remain grateful for. At the same time, participants emphasized that residents are aware of the health implications associated with living near oil and gas development. However, many residents do not feel comfortable speaking out due to the fears of job loss (if they work in the industry) or going against cultural norms. Many residents simply do not realize their rights when it comes to voicing their complaints and fear the power of major industry actors. For those who choose to speak out, a plethora of procedural barriers arise. The quotes in Table 17 below provide context to how participants described the sociopolitical conditions that allow these

barriers to perpetuate. While it appears that sentiment surrounding the oil and gas industry varies, most residents are aware of the benefits and drawbacks, and this awareness can be a dividing force between community members.

Table 18. Theme 3 exemplar quotes.
Both are true in that like people are against it (fracking) and people are for it. People say, “Hey, I want them to be good neighbors. I don't want them to necessarily leave, but to be good neighbors. (Researcher and Activist)
Mostly what people are thankful for with the oil companies is the jobs. You can work on an oil rig making 30 or 40 bucks an hour easily, or you can go to Subway and make 9 or 10 bucks an hour. Working at a refinery, you can also make \$100,000 a year without a high school diploma. People are thankful for that. (Journalist)
It’s Texas...it's embedded in the culture and if you threaten the Texas culture, that's not cool. So it's something that you're coming up against. (Researcher and Activist)
They see it as a balance. You want a higher quality of life, you're gonna have to sacrifice some things, like all these different kinds of pollution. But they pay you enough to buy an Advil when you get a headache.” (Journalist)
What most people are aware of is the potential of them losing their job if they speak out about their concerns...they just feel like they don't have the freedom to speak honestly about what is going on. (Journalist)
In the Eagle Ford Shale, it's hard for people to speak out about fracking. I have worked with a lot of people down there who are concerned and they make complaints. But speaking out publicly is very hard because there's a lot of people who are low income and then fracking comes in and they lease their property or the neighbors lease their mineral rights and all of a sudden they're getting a great big check. And you go to church with this neighbor and you sit there in church with this neighbor who is profiting from something that is making you sick all the time. These people don't say anything because it's their church and they don't want to cause a problem in the church or with their neighbor. (Activist and former industry employee)

Again, money plays a dominant role in community sentiment and building the culture surrounding oil and gas development. The role of money as a facilitator of a power imbalance between industry actors and residents was apparent throughout the interviews. Two participants noted:

It certainly makes and it's quite complicated because there's a lot of intimidation and it's not easy for people to speak out against the industry in those communities because

the industry brings in so much money. Like way more money than people ever heard of before to lease their land. So, you had cattle ranching land where you were making money running cattle and selling them. Now you get oil, and just to let people on your land, you're getting 10,000 dollars a month. The 10,000 dollars a month buys a lot of loyalty. And in general, most of the big families will be big supporters or working closely with the companies. And they will be very harsh on anybody who says this industry has any negative impact on the community because they're making some money out there. (Journalist)

I know some of these folks know it's dangerous. But that's also the thing about this area is like, when people are getting royalties, they don't want to talk about the bad or the negative that comes with dealing with things like noise pollution, light pollution, air pollution, etc. They'll talk about it in their homes, but that's really about as far as they get. They don't want their faces to be known as someone who spoke out against the industry, and they don't want their names out there talking dirty about the industry when sometimes the industry is paying their car bills or their mortgages. (Nonprofit employee)

#### **Section 5.2.4: Environmental Injustices and Power Dynamics**

Throughout the thematic coding process, issues of environmental justice stemming from power imbalances appeared consistently as a cross-cutting theme. These injustices ranged from public health disparities across groups to imbalances of power that prevent residents from speaking out against the oil and gas industry. Each of the impacts I present in the prior three themes constitute environmental injustice because participants noted that they affect vulnerable groups in the EFS region disproportionately. So, while all of the aforementioned impacts have implications for environmental justice, below I present more specific examples of injustices described by participants and how imbalances of power between residents, industry leaders, and governing agencies allow these injustices to perpetuate.

In regards to disparities across social groups, the interviews largely provided information that reiterated findings from prior studies. For example, multiple participants expressed concern for Black and Hispanic groups, who are routinely exposed to more pollution than white residents. Particularly in adjacent communities such as parts of Houston and Corpus Christi, minority groups and low-income neighborhoods are more likely to be located in areas of the city zoned for industrial use. For example, Corpus Christi, described as the “industrial hub of the EFS” by one participant and the “terminus of all EFS activity” by another, sees the implementation of many liquefied natural gas plants, plastic plants, and other refineries, and is burdened by petrochemicals used in the transportation, storage, and exportation process of oil and gas production. These Gulf Coast industrial hubs also have larger populations of Black residents than other areas in EFS and adjacent communities. Echoing prior literature examining benefit sharing in oil and gas development (Clough & Bell, 2016; Fry, 2015), Corpus Christi sees unequal benefits of its contribution to EFS oil and gas production since the majority of products

manufactured at port facilities are shipped overseas, according to two participants. Thus, Corpus Christi and other port cities along the Texas Gulf Bend incur the environment burdens of fracked gas infrastructure without the financial benefits of a lucrative local gas market (such as lower utility bills).

When it comes to public health hazards with oil and gas development, the risks do not end after production is complete. As previously mentioned, inefficiencies with cleaning up fracked sites leave residents located near these orphan wells vulnerable to the effects of deteriorating infrastructure and the associated toxins. These effects present themselves as issues of environmental justice because affected residents experience problems with petrochemicals leaking into groundwater, which is especially hazardous for those who use well water.

Participants explained:

Exxon runs one of the largest plastic plants in the world outside Corpus Christi...when that facility is 80 to a hundred years old, they're just going to leave it there. And this has happened all over West Virginia, Ohio, and Indiana, where the last industrial boom was. They call them brownfields. It's fields where grass doesn't grow. The same thing's going to happen here. They're going make their money and they're going to get out. (Journalist)

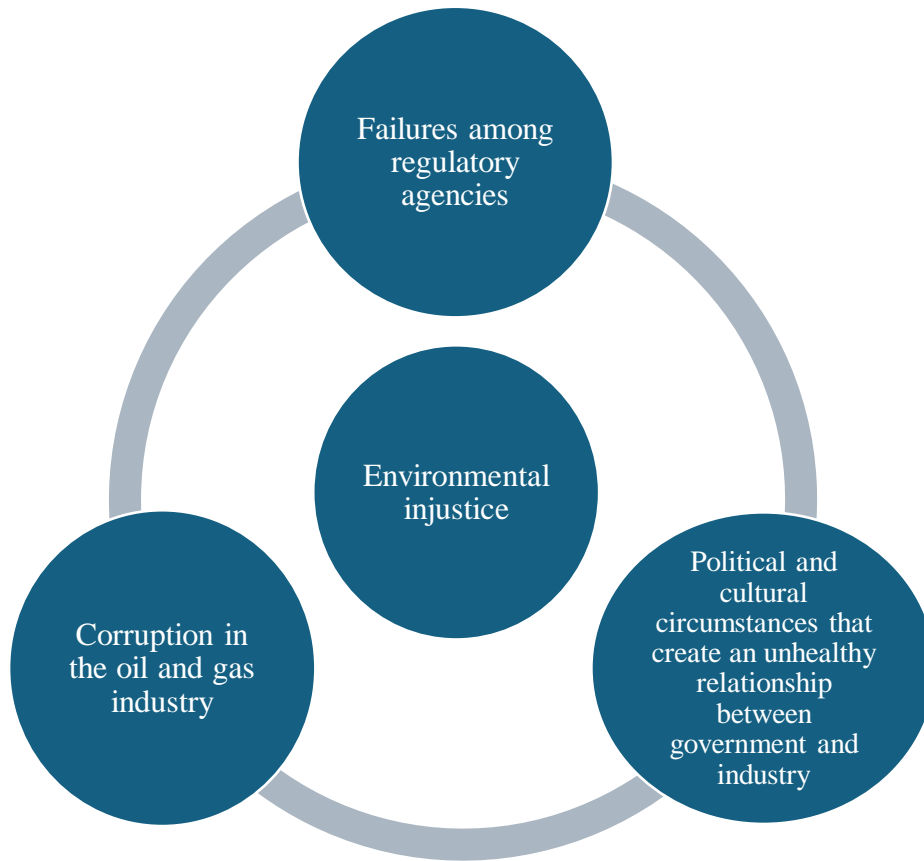
Drawing back to the procedural justice concerns with oil and gas legal cases, participants explained that many residents are keenly aware of the power imbalance between the industry and the community. One informant described a case where a doctor was asked to testify in court for a resident who sued an oil company on account of health issues they were experiencing, and the doctor refused to testify for fear that the oil company would bring in corporate doctors to deny his claims. In addition to fears of being outmatched by the resources held by the oil and gas

industry, many residents fear speaking out because they rely on the royalties from oil companies who lease their land for fracking. This is especially true for small ranching operations, who often rely on these royalties to maintain their land. Even though these royalties are certainly not enough money to justify the health risk or provide financial stability to residents, oil companies know they can offer low compensation because many small ranchers in the Eagle Ford Shale struggle financially to maintain their properties and are not in a position to turn down extra income. Additionally, residents are simply not aware of their rights when oil companies try to take advantage of residents by drilling on their property and then denying wrongdoing when harms occur. And, as participants noted, residents cannot rely on state agencies to stand up for them when injustices are taking place:

We have been underrepresented by many of our representatives. And that's where the problem comes in: poor regulation, because there's no enforcement in place or good law that will protect our communities. Our communities have been suffering many environmental injustices. Not only water pollution, but also air contamination, to name a few. And this is due to the poor policy enforcement from the Texas Railroad Commission and from other environmental agencies. (Nonprofit coordinator, former industry employee)

Bringing these concepts together, the three themes that emerged from the interviews provide insight into how environmental injustices are curated in Eagle Ford Shale communities. Theme 3 (politics and culture) brings Themes 1 and 2 together to reflect how the individual instances of regulatory inadequacies and industry corruption are exacerbated by the relationship

between these two groups. Figure 9 below illustrates this dynamic and the sociopolitical circumstances that create and sustain environmental injustices throughout the Eagle Ford Shale.



**Figure 9.** Sociopolitical circumstances that produce environmental injustices in the EFS.

### **Section 5.3: Challenges and Solutions to Quality of Life Issues**

In regards to quality of life improvements for residents of the Eagle Ford Shale, there was unanimous agreement among participants that moving away from fossil fuels is the only effective way to remove environmental injustices associated with oil and gas. However, for advocates of alternative energy sources, the path to proving that these injustices have and will



always accompany extractive industries such as oil and gas is unclear. As noted in Theme 2, the nature of the legal system when it comes to cases against the industry makes it nearly impossible to accumulate a body of evidence against fracking. Particularly in regards to physical and mental health issues, participants expressed that the complexity of human health is a major barrier to linking oil and gas development to human health harms. With a seemingly unlimited number of factors that affect one's physical and mental health, it is difficult to present indisputable evidence of human health harm associated with fracking to courts. However, participants shared their thoughts on the state of public health research as it relates to oil and gas, as well as their opinions on reaching a solution to the issues residents of oil and gas communities face (example quotes displayed in Table 19). Some participants believed one of the most effective ways to help residents is to engage them in research and encourage them to speak out so that the harms of oil and gas are exposed more broadly rather than remaining sealed behind nondisclosure agreements. Other participants thought that a transfer of power from state to federal government would be useful in removing some of the sociopolitical circumstances that prevent fracking from being more heavily regulated (e.g., withdrawing the state's authority to delegate the Clean Air Act and the Clean Water Act). However, nothing would prove more effective than moving away from the global dependence on fossil fuels and its associated market.

Table 19. Exemplar quotes from participants regarding challenges and solutions to human health harms.

Well, for, from my perspective, I really see research and how research is done as, something to hopefully, you know, change how people's lives are impacted. So for instance, establishing policies and systems that are based on the precautionary principle. Doing science in a bottom-up way, meaning that researchers are connected with communities and serve as bridges and resources for groups that are burdened. I mean, thinking big scale, like. Something has to be done about the power that industry actors have.

I tell them (residents) you've got to talk to the media. Every time the media knocks on your door. You need to give an interview and talk about what's happening to you and then it will embarrass the operator. And they will buy your place so that you can move on. And that's how I've been able to help people the fastest.

I think what needs to happen is Congress needs to have all of those non-disclosure agreements unsealed. And invite the families in to tell their story to Congress and Congress can do that. You know, they have the power to unseal those. Those documents because This is a public health, I mean. Fracking is a public health. Crisis for the people who are directly impacted. It is also a climate emergency and we're about to go on the cliff. So, you know, that. That's something that Congress could do that would help people a lot. But there is. I mean, when you talk about people, let's get some regulations to improve people's life who live next to oil and gas. Yeah, that would be good. But It's only going to, they might be poisoned less.

Science tells us that we have to stop using oil and gas and they say right now, stop right now. We know what we need to do and we have the ability to do it. We have the money that we can transfer from the many billions that are given to oil and gas to subsidize our tax money that they turn around and use to propagandize us. Or, to fight against us in many different ways. That money could be diverted to renewable energy. If Joe Biden would declare a national climate emergency, then he would have expanded executive powers. And there are many things he could do to actually save our future. But because oil and gas is really powerful, he's not doing that.

I think that the policy focus at this point needs to be mandating thorough cleanup when industry is done.

The most effective pathway to a solution right now is to become less dependent on fossil fuels. They have us over a barrel because they know we need them...which is why I'm happy to see more wind farms being built and more solar farms. There's a new solar farm being built in Dimmit County. Alternative energy resources are now being discovered and appreciated by entities like towns and private companies to help provide other sources of energy and to get us away from oil and gas.

## Chapter 6: Discussion

This research is the first to explore the quality of life impacts of oil and gas holistically in the Eagle Ford Shale region of Texas. Both the survey and interview findings provide insight into how oil and gas development affect quality of life in affected communities. For the first research question, *how are the quality of life dimensions that are related to health (physical, mental/emotional, community) affected by oil and gas development?* the survey results did not support the hypothesis that residents in Eagle Ford Shale and Eagle Ford Shale-adjacent counties have more negative responses to the physical, mental, and community health survey questions compared to residents outside of the Eagle Ford Shale. While there were instances of correlations between quality of life components and socioeconomic groups (race, ethnicity, and income), these disparities were not significant across location groups. However, given the prevalence of Hispanic/Latino, Black, and Indigenous groups across the Eagle Ford Shale, it is worth noting that a larger percentage of the population could be vulnerable to these negative quality of life outcomes, though a larger sample size is necessary to make these assertions. Other results from the survey data, such as associations between race and satisfaction with one's environmental conditions, should be considered alongside the participants' assertions that non-white individuals experience more environmental burdens from fracking infrastructure than white individuals. While *environmental conditions* cannot be specifically linked to fracking in the context of the survey, the participants expressed that individuals in the Eagle Ford Shale see fracking as part of their environment. Thus, these results warrant further consideration in future case studies.

Scholars should also be mindful to avoid discounting residents' lived experiences on account of the survey results. As evidenced in the interview findings, there are patterns of negative health symptoms and community frustrations over fracking infrastructure and the

interpersonal dynamics between residents, industrial leaders, and the state government. And, as noted by multiple participants and in the open-ended survey questions, oil and gas development stretches across the entire state of Texas (notably, the Permian Basin in West Texas and Barnett Shale in north central Texas). Thus, the disparities between location groups may not have been stark enough to produce statistical significance despite there being sample-wide patterns of environmental complaints. And, given the additional information respondents provided regarding the interpersonal dynamics behind the oil and gas industry in the Eagle Ford Shale, it is clear that even those who see the benefits of oil and gas recognize its implications for public health. Thus, the existence of nuance is critical to recognize when evaluating the impacts of oil and gas development on human health, and relying on p-values has increasingly been recognized as an incomplete way of interpreting data (Gartlehner et al, 2023).

The hotspot analyses using the self-reported health data provided additional insight into the spatial distribution of quality of life outcomes across Texas. While the location groups used for the ANOVA, t-tests, and chi-squared tests did not show significant disparities across location groups, the hotspot analyses showed clusters of negative quality of life indicators in several areas within the EFS and in adjacent communities. Conversely, the majority of positive quality of life outcomes were concentrated in areas outside of the EFS, notably, in parts of the Dallas-Forth Worth metro area located outside of the Barnett Shale. While a larger sample size would greatly benefit this type of analysis, these results suggest that quality of life impacts may be observed most prominently at the neighborhood scale rather than at larger scales such as the county or regional level. However, these types of analyses may be especially useful to planners seeking to understand specific neighborhoods or communities where resources should be directed when county-level data does not provide the most precise information about public health needs.

Connecting these findings back to my theoretical framework, the results of this study shed light on several components of social determinants of health theory (Wick, 2020). First, economic stability clearly plays a significant role in an individual's perception of the oil and gas industry, as evidenced by the fact that survey respondents praised the economic benefits of oil and gas in their area. Next, one's neighborhood and built environment, meaning things like the amenities they have access to and the conditions they are routinely surrounded by, also impact a person's perception of their health and well-being. Survey respondents showed clear concern for the environmental and human health effects of oil and gas development and expressed a clear distrust in industry leaders. These findings regarding perceptions of the oil and gas industry are in line with prior research conducted in Texas where residents expressed distrust in the oil and gas industry for its social and environmental impacts but appreciated its economic and service-related benefits (Theodori, 2010; Uzunian, 2015). However, individuals may not be aware of how their built environment contributes to their quality of life, as indicated by the lack of descriptions in responses to the question regarding how respondents' feel the positive and negative environmental conditions they described affect their health and well-being. Finally, the social and community context concept proved especially relevant during the interviews, where the findings indicated that situating the quality of life indicators within the social and political circumstances in the EFS is critical to understanding the factors that influence community sentiment surrounding oil and gas development. These findings echo prior literature that argues for more case-study approaches in public health research in order to understand the context and mechanisms behind health outcomes (Paparini, 2020).

## Section 6.1: Limitations and Future Research

While there are several limitations to this study, the most prominent limitation throughout data collection was the reachability of EFS residents, which could have contributed to the incompatibilities in responses between the survey and interview participants. While I initially planned to target only the top-producing EFS counties, this proved unachievable due to availability of survey respondents in these areas. Thus, responses were solicited from more populous and often urban/suburban areas throughout EFS where oil and gas activity is more heavily regulated. This meant that the survey may not have targeted the most impacted communities, such as residents living in rural areas. Additionally, because the survey was online, residents without internet connectivity were excluded from the sample. In regards to how the theoretical framework was applied in the survey, it is possible that the other components of quality of life outside of health could be outweighing the negative environmental impacts faced by these communities. Going back to the social determinants of health (Figure 2) and the interview themes, economic stability clearly plays a part in resident perceptions of oil and gas development in their area. Thus, it is possible that the survey was unable to perfectly isolate the health dimensions of quality of life from its other components. Other possibilities exist due to limitations with the methodology, particularly with the survey. To better isolate health-related quality of life from the other dimensions of quality of life, future surveys could ask more pointed questions about resident experiences with their health and whether or not they are located near fracking infrastructure. For instance, such surveys could ask respondents if they feel that fracking infrastructure negatively affects their health. These types of questions were intentionally avoided in this study as to not prompt respondents to choose a side they would not normally have bias towards. However, given that respondents seemed to have trouble describing their

environmental conditions and connecting positives and negatives of their environmental conditions to their well-being, it may be useful to ask more targeted questions to prompt less variability in the interpretation of the environmental questions. Additionally, given the participants' comments about the prevalence of fracking across the entire state of Texas and the appearance of industry-specific complaints from the non-EFS group, it may be useful to ask questions about respondents' proximity to fracking infrastructure rather than assuming proximity based on county or region.

Another limitation of the non-spatial components of the survey analysis is the subjectivity in location groups. As previously mentioned, the EFS region does not include strict county boundaries. Rather, the region is composed of communities located directly on the shale and communities located outside of the shale that remain involved in EFS activities. Within these two sets of groups, there are varying degrees of oil and gas activities. While efforts were made to target the counties most heavily involved in oil and gas operations, within-county variances also exist and may impact survey results depending on respondents' specific locations within their county. The spatial analysis using ArcGIS helped mitigate these limitations and provided further clarification on some of the results from the ANOVA and chi-squared tests. However, as previously discussed, the results of the spatial analysis should be interpreted carefully given the range of distances between nearest neighbors and the localization of neighborhood environmental conditions. Finally, a larger sample size would greatly benefit a study of this nature since some analyses could not be conducted due to an insufficient sample size (e.g., perceptions of industry by job type). Likewise, more responses could also provide a more definitive understanding of weak correlations in the data where the  $p$ -value was trending towards significance but could not be considered statistically significant (e.g.,  $p$ -values in the factorial

ANOVAs that were less than 0.1). Future studies should prioritize obtaining both a larger sample size and soliciting survey responses from communities that are most directly impacted by oil and gas development (i.e., rural communities where fracking is least regulated).

Ultimately, however, I recognize the limitations of the quantitative analyses, particularly in regards to assessing subjective quality of life. At the same time, qualitative methods (such as the interviews and the open-ended survey responses) often do not serve as reputable evidence in legal cases. Not only is this unfortunate for residents of the EFS and other oil and gas communities who wish to take legal action against industry leaders, but this reality also represents a larger challenge in social science research. Scientists who work in politicized corners of science, such as energy research, often experience struggles with reporting their findings in a way that comes across as “objective science” (Edwards, 2018). Particularly with oil and gas topics, engaging with stakeholders requires framing the research question in such a way that the problem in question is sometimes masked by the need to balance out one’s positive and negative assessments. Thus, while a mixed-methods approach may provide the most holistic assessment for a topic such as quality of life, there are limitations with both quantitative and qualitative approaches, as well as determining continuities in the results for each approach.

## **Section 6.2: Implications**

This research helps to fill a gap in scholarship on the effects of environmental hazards on quality of life and holistic well-being. As previously mentioned, prior studies on public health and fracking have largely focused on physical health impacts but neglect the emotional and community impacts of living near industrial clusters such as Eagle Ford Shale (Hirsch et al., 2017). Because environmental conditions have influence on both physical and mental health,



more studies focusing on quality of life are needed to fully understand the extent of negative outcomes associated with oil and gas development on human health. In addition, scholars have written on the challenges associated with layered vulnerability (Taylor, 2014), which involve multiple injustices occurring simultaneously to create a compounding effect. One case study described this phenomenon as accumulated injuries of environmental injustice involving exposure to toxic pollution, unequal and insufficient compensation for environmental harms, and frustrations over political powerlessness (Mah and Wang, 2019). This project adds to the understanding of layered vulnerabilities by highlighting the challenges faced by communities who experience compounding effects of injustices associated with oil and gas development. The results of this study advance scholarship by emphasizing the need for large-scale mixed-methods approaches to public health research in oil and gas communities.

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## Appendix

### Resident Survey

#### Section 1: Health and Wellbeing

In this section, you will be asked questions about your general health and well-being.

---

Q1 In general, would you say your physical health is:

- Excellent (1)
  - Very good (2)
  - Good (3)
  - Fair (4)
  - Poor (5)
- 

Q2 In general, would you say your mental health is:

- Excellent (1)
  - Very good (2)
  - Good (3)
  - Fair (4)
  - Poor (5)
-

Q3 Compared to one year ago, how would you rate your health in general now?

- Much better now than one year ago (1)
  - Somewhat better now than one year ago (2)
  - About the same (3)
  - Somewhat worse now than one year ago (4)
  - Much worse now than one year ago (5)
- 

Q4 During the past 4 weeks, to what extent has your physical health interfered with your normal social activities with family, friends, neighbors, or groups?

- Not at all (1)
  - Slightly (2)
  - Moderately (3)
  - Quite a bit (4)
  - Extremely (5)
- 

Q5 During the past 4 weeks, to what extent have your emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

- Not at all (1)
- Slightly (2)
- Moderately (3)
- Quite a bit (4)
- Extremely (5)

## Section 2: Occupation & Leisure

In this section, you will be asked questions about your occupation and how you spend your free time.

---

Q6 Do you currently have a job?

- Yes (1)
  - No (2)
- 

*Display This Question:*

*If Do you currently have a job? = Yes*

Q7 Is your job primarily outdoors, indoors, or a mix of both?

- Mostly outdoors (1)
  - Mostly indoors (2)
  - A mix of both (3)
-

Q8 How much of your leisure time is spent outdoors?

- None at all (1)
  - A little (2)
  - A moderate amount (3)
  - A lot (4)
  - A great deal (5)
- 

Q9 Approximately how much time do you spend outdoors per day? (Including work hours)

- 30 minutes or less (1)
  - 1-2 hours (2)
  - 2-3 hours (3)
  - More than 3 hours (4)
- 

End of Block: Occupational Information and Leisure Time

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Start of Block: Community and Neighborhood

### **Section 3: Community and Neighborhood**

In this section, you will be asked several questions about the environment where you live. The first set of questions asks for your opinion on the social environment of your neighborhood. You can consider "neighborhood" to be the streets that encompass a 10-minute walk from your house.

Q10 For the questions below, please select the extent to which you agree with the statements.



	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
I feel like I belong around here. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy living around here. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of the area around here as a real home, not just a place. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Given the opportunity I would like to move away from here. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I regularly stop and talk with people around here. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel different from people around here. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Litter is a problem around here. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graffiti/vandalism is a problem around here. (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are not enough green areas or trees around here. (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The properties around here are too close together. (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The area around here is nicely kept by its residents. (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I think of this area as a desirable place to live. (15)

There are other places which are more desirable places in which to live. (16)

I think this is a good place to bring up children. (17)

---

#### Section 4: Environmental Conditions

In the next set of questions, you will be asked about environmental conditions around where you live. "Environmental conditions" may refer to things like: the air you breathe, the quality of food and water you have access to, your proximity to industry, the wildlife and vegetation around you, temperatures, noises and smells around you, etc. Please be detailed in your responses.

---

Q11 Overall, how satisfied are you with the environmental conditions around where you live?

- Not at all satisfied (1)
  - Somewhat satisfied (2)
  - Very satisfied (3)
- 

Q12 Describe any **negative** environmental conditions you face in the place where you live.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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Q13 Describe any **positive** environmental conditions you face in the place where you live.

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Q14 How do you feel those environmental conditions (positive and negative) affect your general health and well-being?

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Page Break

## Section 5: Policy & Regulations

In this section, you will be asked questions related to your feelings about policies and regulations in the fracking industry.

---

Q15 Are you aware of any environmental laws or policies that regulate the fracking industry in the area where you live?

- Yes (1)
  - No (2)
  - Unsure (3)
- 

Q16 If yes, how do you feel about those regulations?

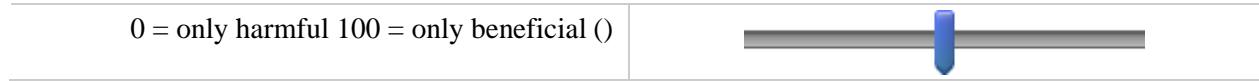
- I feel that the regulations are effective (1)
  - I do not feel that the regulations are effective (2)
  - I am not sure (3)
- 

Q17 How supportive are you of environmental laws or policies that limit the amount of fracking in the area where you live?

- Very unsupportive (1)
  - Somewhat unsupportive (2)
  - Neither supportive nor unsupportive (3)
  - Somewhat supportive (4)
  - Very supportive (5)
-

Q18 On a scale from 0 (only harmful) to 100 (only beneficial), how do you view the oil and gas industries?

0 10 20 30 40 50 60 70 80 90 100



Q19 Please expand on your response to the previous question. Why did you select that number?

---

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End of Block: Environment and Neighborhood

Start of Block: Demographic and Household Information

Page Break

## Section 6: Demographic/Housing Information

In this final section, you will be asked some basic demographic and household information.

---



Q20 In what year were you born?

---

Q21 How do you describe yourself?

Male (1)

Female (2)

Non-binary / third gender (3)

Prefer to self-describe (4) \_\_\_\_\_

Prefer not to say (5)

---

Q22 Choose one or more races that you consider yourself to be

- White or Caucasian (1)
  - Black or African American (2)
  - American Indian/Native American or Alaska Native (3)
  - Asian (4)
  - Native Hawaiian or Other Pacific Islander (5)
  - Other (6)
  - Prefer not to say (7)
- 

Q23 Are you of Spanish, Hispanic, or Latino origin?

- Yes (1)
  - No (2)
-

Q24 What is the highest level of education you have completed?

- Some high school or less (1)
  - High school diploma or GED (2)
  - Some college, but no degree (3)
  - Associates or technical degree (4)
  - Bachelor's degree (5)
  - Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS etc.) (6)
  - Prefer not to say (7)
- 

Q25 What was your total household income before taxes during the past 12 months?

- \$30,000 or less (1)
  - \$30,001-\$66,999 (2)
  - \$67,000-\$99,999 (3)
  - \$100,000 or more (4)
- 

Q26 Do you rent or own your home?

- Rent (1)
  - Own (2)
- 

*Display This Question:*

*If Do you currently have a job? = Yes*



Q27 Of the choices listed below, which best represents the kind of business, industry, or organization you work in?

- Agriculture, Forestry, Fishing, and Hunting (1)
- Mining, Quarrying, and Oil and Gas Extraction (2)
- Utilities (3)
- Construction (4)
- Manufacturing (5)
- Wholesale Trade (6)
- Retail Trade (7)
- Transportation and Warehousing (8)
- Information Technology (9)
- Finance and Insurance (10)
- Real Estate and Rental and Leasing (11)
- Professional, Scientific, and Technical Services (12)
- Management of Companies and Enterprises (13)
- Administrative and Support Services (14)
- Waste Management and Remediation Services (15)
- Educational Services (16)
- Health Care (17)
- Social Assistance (18)
- Arts, Entertainment, and Recreation (19)
- Accommodation and Food Services (20)

Public Administration (21)

Other Services (except Public Administration) (22)

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Q28 Do you have health insurance?

Yes (1)

No (2)

Unsure (3)

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*Display This Question:*

*If Do you have health insurance? = Yes*

Q29 How would you rate the quality of your health care?

Very poor (1)

Poor (2)

Fair (3)

Good (4)

Very good (5)

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Q30 What county do you live in?

- 1. Karnes County (4)
  - 2. La Salle County (5)
  - 3. Gonzales County (6)
  - 4. McMullen County (7)
  - 5. Dimmit County (8)
  - 6. Maverick County (9)
  - 7. Webb County (10)
  - 8. Brazos County (11)
  - 9. Atascosa County (12)
  - 10. Wilson County (13)
  - 11. Bexar County (14)
  - 12. Jim Wells County (15)
  - 13. Uvalde County (16)
  - 14. Victoria County (17)
  - 15. San Patricio County (18)
  - 16. Nueces County (19)
- 

Q31 Please provide the name of the two closest intersecting streets near where you live.

- Street 1 (1) \_\_\_\_\_
- Street 2 (2) \_\_\_\_\_

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Q32 How long have you lived in your county?

- Less than 5 years (1)
- 5-10 years (2)
- 10-20 years (3)
- More than 20 years (4)

**End of Block: Demographic and Household Information**

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