The Marcellus Shale Impacts Study Wave 2: Chronicling Social and Economic Change in Northern and Southwestern Pennsylvania

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Executive Summary

Commercial production of natural gas from the Marcellus Shale formation began in 2005 and quickly gained momentum. According to 2013 data from the Pennsylvania Department of Environmental Protection (DEP), the number of wells drilled in Pennsylvania increased dramatically between 2007, when 115 wells were drilled, and 2011, when 1,963 wells were drilled. The number of wells drilled dipped in 2012 to 1,348, with diminished activity in response to lower market prices. DEP SPUD data show that, in 2013, there were 1,218 unconventional gas wells drilled in Pennsylvania, and, in 2014, the number increased slightly to 1,374.

In 2012, this research team began the first wave of longitudinal research to examine social and economic impacts of Marcellus Shale activity in four case study counties – Bradford and Lycoming Counties in northern Pennsylvania, and Washington and Greene Counties in southwestern Pennsylvania. Wave 1 found that the impacts of Marcellus Shale activity are likely very uneven across places, people, and time; documenting these differences became the focus for Wave 2. Descriptive analyses conducted in Wave 1 identified potential effects of development but lacked the ability to test those relationships statistically. Wave 2 sought to re-examine the impacts on crime, housing, the economy, agriculture, health and health care access, and traffic incidents in relation to Marcellus Shale development. Another finding of Wave 1 was that the impacts of Marcellus Shale development likely vary substantially across people and households, across geographic locations, and over time. Consequently, Wave 2 further describes and assesses these differences in the experiences of individuals and communities by analyzing data collected through a survey. Finally, because the initial Wave 1 results indicated that those who may be most affected are low-income families, the final goal of Wave 2 was to assess changes (if any) in the social support and housing access for low-income families in the study counties. This report describes the efforts of the research team to address these issues.

Summary of Findings:

Crime: Driving under the influence and disorderly conduct arrest rates are associated with well density, controlling for other factors. Rates of driving under the influence are higher in counties with high levels of well development compared to counties that do not have well development; however, the counties with high levels of development did not experience an increase in DUIs from before to during Marcellus well development that was greater than other counties. Counties with higher Marcellus well density had higher rates of disorderly conduct arrests than counties with little or no well activity. Counties with higher well density experienced a larger increase in disorderly conduct arrest rates over time than did counties with lower or no well density. The other three crime categories examined – minor crimes, public drunkenness, and drug abuse violations – are not significantly related to Marcellus Shale well development across counties or over time.

Economics: Although economic impact studies generally find modest positive economic changes associated with development, what those impacts are, where they are, and their magnitude varies widely. Employment and compensation are generally found to have less impact than income generated from leases and royalties. Economic impacts will likely be short-run due to the temporal dynamics of the industry.

Housing: Analyses revealed no statistically significant associations between well development and changes in county housing stock. Rental availability decreased across Pennsylvania between 2000 and 2009/2013, but it declined the most in counties with the most wells. Counties with the highest well counts experienced the largest average increase in median rent over the study period. Counties with the most wells experienced a slight increase in median household income among homeowners between 2000 and 2009/2013, suggesting that homeowners may have experienced income benefits from drilling, on average. Moreover, whereas median household income among renters declined in all three categories of well development, the decline was the smallest in counties with the most wells.

Agriculture: The number of farms in Bradford County increased substantially between 2002 and 2012, while the number of farmers in the other counties and Pennsylvania in general declined. Average acreage in the four study counties increased, with the exception of Lycoming County. Lycoming and Bradford counties experienced the most dramatic drop in milk cow inventory especially when compared to their neighboring counties and statewide. Moreover, the decline in milk cows increases steadily from no drilling to high drilling counties.

Health: There is substantial heterogeneity in population health, health care access, health care utilization, and changes in those indicators since well development began across the four study counties (2008 to 2013). Compared to counties with wells, counties with no wells experienced significantly larger *increases* in the percentage of adults without health insurance and significantly larger *declines* in the percentage of poor children without health insurance. Counties with the most wells experienced an average increase in the percentage of adults reporting fair/poor health, while counties with no wells experienced an average decline in the percentage of adults reporting fair/poor health and had better overall self-rated physical and mental health than counties with wells. Among the four study counties, Greene County performed the worst on most health outcomes.

Traffic: The findings suggest that the most rural counties in the Northern Tier experiencing the highest levels of development – particularly Bradford, Tioga, Susquehanna, Clinton, and Lycoming – had increased absolute numbers and rates of total crashes and heavy truck crashes particularly in 2010 and 2011, when the activity was at its height. For the 2012-2013 time period, the number of total crashes and heavy truck crashes declined. Comparisons of all counties in Pennsylvania by the level of well development indicate that counties with the highest number of wells experienced higher numbers and rates of total crashes and heavy truck crashes during the period of the most significant well development (2008-2011).

Low-income households: Nearly all respondents described the effects of the shale gas industry on the cost and availability of housing and in particular how rising housing costs had contributed to their own residential instability and/or that of others whom they knew. These challenges were coupled with the difficulties in finding employment offering wages that might cover rising housing costs. Respondents described how higher-paid employment opportunities in the industry were not widely available. Respondents also described a mix of community changes above and beyond changes in the housing market, such as perceived increases in crime. Some female respondents described increases in prostitution and either directly or indirectly attributed community change to the gas industry. Low income residents tended to strongly believe that public policy makers had largely ignored or had remained unaware of the negative consequences of shale gas development, especially as it has affected the most vulnerable segments of Pennsylvania communities.

Survey Results: The survey results reveal substantial differences in the reported experiences by geographic location, proximity to development, and socio-demographic characteristics. Greene County respondents consistently have the most negative perceptions of the industry's impact. Bradford County respondents were not quite as negative as Greene County, except in relation to concerns about problems regarding drugs and alcohol and growing income inequality because of Marcellus Shale development. Greene County also had the poorest reported quality of life and health and stress indicators of the study counties, although this is consistent with other research on the topic. Washington County and Lycoming County generally had more positive reports of the impacts of development than either Bradford or Greene counties. Higher well density is associated with more positive views on the economic impacts, but also more negative views on community and environmental impacts. These results suggest that high well density brings opportunities to benefit economically but also a greater likelihood of bearing the costs of development and exposure to a broader set of environmental, social, and political concerns that development brings. The ability to financially benefit is an important influence on perceived impacts of Marcellus Shale development. Both leasing status and employment in the industry by someone in the household were associated with more positive economic, community, environmental, and higher quality of life and health. Renters consistently reported more negative views related to the economic impacts of development. They see fewer economic benefits and more economic costs (particularly related to housing costs). Renters were less supportive of development than were homeowners. Women consistently report more negative views of Marcellus Shale development across indicators related to economic, community, environmental, and health effects. In this analysis, age was not a significant influence on perceived impacts of Marcellus Shale development. In contrast, income was a significant influence on several perceived impacts. Generally speaking, those with higher incomes report more positive impacts of development.

One important point that these results raise is that there is no one, singular answer to the question "what is the impact of natural gas development?" The impacts vary by social group, by geographic location, by point in time, and by the type of impact that is of interest. It is therefore critical to understand the effects of development to further describe these differences across people, place,

and time, and the processes by which these factors influence one's experience of natural gas development. State policy needs to recognize these localized (in both time and space) impacts of development and develop policies that are flexible, responsive to local needs, and adaptable as industry and local communities respond to industrial and technological changes. Another implication of Wave 2 is that standard methods of public data collection do not match the need to document impacts at relatively fine geographic and temporal scales, preferably sub-county and annual collection procedures. Comprehensive monitoring at the municipal level is needed, allowing targeting of attention, resources or programs to areas or population groups especially affected, particularly in relation to funds (such as the impact fees) that are intended to compensate for impacts. Finally, policy approaches are needed that effectively recognize disparities in experiences. Certain segments of the population are more vulnerable to rapid economic and industrial change. Policies need to consider mechanisms to compensate those groups negatively affected, and offer security for those most vulnerable to disruption because of the changes.

Table of Contents

Introduction 7
Goals and Objectives 9
Results 25
Topical Research Reports 25
Crime 25
Economics 25
Housing 26
Agriculture 28
Health 29
Traffic 30
Low-income households 32
Survey Results 32
Relationship to Marcellus Shale Development 35
Perceived Impacts on the Local Economy & Family Economic Situation 37
Financial Benefits and Costs 44
Community Impacts 53
Perceived Community Impacts of Marcellus Shale Development 53
Overall Community Impacts 74
Overall Perceptions of Marcellus Shale Impacts to Communities 78
Overall Support and Opposition to Marcellus Shale Development 83
Perceived Environmental Impacts 87
Index of Perceived Environmental impacts 96
Health and Well-Being 101
Written Comments Regarding Marcellus Shale Development 112
Summary of Perceived Impacts of Marcellus Shale Development by Geographic Characteristics, Well Proximity, and Socio-demographic Characteristics 118
Differences by County 118
Differences by Well Density 121
Differences by the Ability to Benefit Financially 122
Differences by Renter Status, Gender, Age, and Income 123
Conclusion 125
Policy Considerations 126
References: 129
Appendix A: Statistical Tables 136

Introduction

Commercial production of natural gas from the Marcellus Shale formation began in 2005 and quickly gained momentum as the potential value of the resource became clear. The number of wells drilled in Pennsylvania increased dramatically between 2007, when 115 wells were drilled, and 2011, when 1,963 wells were drilled (DEP, 2013). The number of wells drilled dipped in 2012 to 1,348, with diminished activity particularly in the Northern Tier counties in response to a lower market price for natural gas. Pennsylvania DEP SPUD data show that in 2013 there were 1,218 unconventional gas wells drilled in Pennsylvania, while in 2014 that number increased slightly to 1,374. In 2015, as of August 31st, 567 additional unconventional gas wells were drilled, suggesting further drop-offs in drilling activity. In 2012 Pennsylvania also enacted a series of reforms to the Commonwealth's Oil and Gas Act (known as Act 13). Act 13, among other regulatory changes, imposed an impact fee on natural gas wells for funds to be distributed to several state agencies and to county and municipal governments, to account for the impacts from Marcellus Shale activity to local communities and the commonwealth. From the beginning of unconventional gas development using horizontal drilling and hydraulic fracturing to release and extract natural gas from the Marcellus Shale play many questions have been raised about how gas development activity would socially and economically impact Pennsylvania communities and people.

In 2012 and 2013, this research team began the first wave of longitudinal research to examine social and economic impacts of Marcellus Shale activity in four case study counties. These counties included Bradford and Lycoming counties in north central Pennsylvania, and Washington and Greene counties in southwestern Pennsylvania, as both regions experienced among the most pronounced gas development within the state. The first wave of research (Wave 1) had four main goals: (1) identify and document indicators of economic, social, institutional, and infrastructural change related to Marcellus Shale development; (2) analyze data collected during the project to understand and interpret trends in

relation to drilling activity and in comparison to historical and current regional, state, and national trends; (3) describe the experiences of critical populations and institutions relative to activity levels; and (4) examine and evaluate strategies communities have used to effectively manage change. The output from Wave 1 was a series of nine topical reports (population change; health and health care services; effects on educational institutions; youth perspectives; housing impacts; criminal activity and the criminal justice system; local government experiences; economic benefits; and agriculture) and a final project report that explored interrelationships among the topics and described potential policy recommendations based on the findings.

Wave 1 found that the impacts of Marcellus Shale activity are likely very uneven across places, people, and time. The analyses, which primarily used secondary data sources aggregated at the county level, revealed relatively few patterns that can be directly attributed to Marcellus Shale development. However, focus group results and conversations with advisory committee members revealed very different impressions about localized impacts within the counties themselves. It is likely that the aggregate, county-level data and calculated statistics mask the experiences of specific groups of people, in specific places within the counties, at specific periods within the natural gas development process. These localized impacts can have substantial consequences for policies that are to be administered at the county level. For example, some would argue that the local distribution of Act 13 funds should reflect impacts on the populations directly affected by natural gas development. Unless there is systematic knowledge of where those impacts are occurring, and for whom, the distribution may not reflect the intended goal of compensating for impacts.

The findings from Wave 1, and the experience gained by the research team in the process of conducting the project, indicated several research needs for Wave 2. First, the descriptive analyses conducted as part of Wave 1 were useful for identifying main indicators; however, the lack of

multivariate statistical analyses and the limited set of cases examined made identifying causality a problem. Consequently, a primary objective of Wave 2 was to re-examine specific topics from Wave 1 – crime, housing, economic – using multivariate statistical approaches. In addition, Wave 1 was unable to address some issues fully, either because of the lack of available data (e.g., the most recent Census of Agriculture did not become available until the early spring of 2014), or lack of resources. A second goal of Wave 2 was to describe changes in agriculture, health and health care access, and traffic incidents in relation to Marcellus Shale development. Another finding of Wave 1 was that the impacts of Marcellus Shale development likely vary substantially across people and households, across geographic locations, and over time. Consequently, the third goal of Wave 2 was to further describe and assess these differences in the experiences of individuals and communities by analyzing data collected through a survey. Finally, because the initial Wave 1 results indicated that those who may be most affected are low-income families, the final goal of Wave 2 was to assess changes (if any) in the social support and housing access for low-income families in the study counties. This report describes the efforts of the research team to address these issues, questions, and concerns.

Goals and Objectives

Four principal goals were identified for Wave 2 as follows. The first was to explore the relationships between Marcellus Shale development and a limited set of the most salient social and economic indicators. The indicators examined included: (1) criminal activity; (2) housing; and (3) economic impacts. Multivariate analyses were completed to identify associations between Marcellus Shale activity and economic and social outcomes exclusive of other potential influences and moderating or mediating influences. This was accomplished in part by examining the relationship between the incidence of indicators related to crime, housing, and economic impacts and indicators of well

development at multiple points in time (both before and during well development). The outcomes of this goal are three topical reports, one each on economic impacts, housing, and crime.

The second goal was to describe changes in the study counties regarding the agricultural sector, health and health care access, and traffic incidents that may be associated or coincident with Marcellus Shale development. This analysis describes the changes in the study counties in the following topics: the numbers, types, and characteristics of farms; traffic accidents and fatalities; and individual health and access to and use of health care services. Similar to Wave 1, this analysis examined the indicators before and during Marcellus Shale activity for the study counties, and compared the trends in the study counties to those in neighboring counties. Specifically, changes in the number of farms and type of farming activities occurring in the study counties between 2007 and 2012 were identified and described. Further, the number and severity of traffic accidents, and related fatalities, in the study counties between pre-Marcellus (2000-2007) and during Marcellus (2008-2012) time periods were identified and described. Last, changes in population health outcomes, such as the prevalence of health care resources, use of health care services, insurance coverage rates, and rates of various chronic diseases in the study counties between pre-Marcellus (2000-2007) and during Marcellus (2008-2013) time periods were identified and described. The outcomes of this goal are three topical reports, one each on health, agriculture, and traffic.

The third goal was to identify the characteristics of people and places (including proximity to development activity) associated with the levels and types of impacts experienced within the study counties. The population characteristics associated with the level and distribution of the economic benefits from shale gas development, such as education level, occupation, mineral right ownership, and proximity to development activity were identified and described, as well as the relative amounts of income gains and employment changes these segments of the population experienced. Further, the

effects of Marcellus Shale development on key indicators of residents' assessment of the quality of life in their communities were described, as well as how proximity to such activity may affect those residents' assessments. Last, the degree to which the study counties differed in the perceived distribution of benefits and risks across population segments was described. This final report summarizes the results of these analyses.

The fourth and final goal was to document changes (if any) in the availability and affordability of housing and sources of social support for low-income families in the study counties. This goal was addressed through interviews conducted within the four study counties with social service providers and with low-income residents. These data were used to describe, from the perspective of respondents, the barriers to housing access and affordability for these population segments and the formal and informal means by which these population segments have attempted to address their housing needs. The outcome of this goal was a topical report specifically describing this research on the impacts on low-income families.

Methodology

Methodologies unique to each goal of this project are reviewed below. The methodologies are described by goal of the project. Additional information about specific methodologies used for Goals 1, 2, and 4 are available in each the respective topical reports.

Goal 1

Crime Topical Report Methodology

The crime topical report focused on the changes in crime at the county level in relation to Marcellus Shale activity. The report provides the results of statistical models that test whether the number of wells is associated with changes in crime at the county level for all Pennsylvania counties. The

specific crime data used are arrests for all minor crimes and arrests for four specific crimes found consequential in previous research (driving under the influence (DUI), public drunkenness, drug abuse violations, disorderly conduct). These arrest data were obtained from the Federal Bureau of Investigation's (FBI) Uniform Crime Reporting (UCR) system (Department of Justice, 2000-2012). Annual data were collected for the years 2005-2012. To account for population size differences across the state, rates were calculated as arrests per 100,000 residents in that year. This report provides the results of statistical models that test the relationship between the levels of natural gas development (as measured by number of wells per square miles) as a significant predictor of arrest rates across Pennsylvania counties, while controlling for social, economic, and demographic factors that are known to influence crime rates. These factors were measured using data from the 5-year estimates (2005/09 and 2009/13) from the Census Bureau's American Community Survey (ACS). Two multivariate models are presented in the report. The first model tests whether counties with Marcellus Shale development (as measured by annual well density) were significantly different in the rate of arrests from counties with no development while controlling for differences across counties and for time. The second model tests whether Marcellus Shale development (as measured by cumulative well density) was a significant predictor of the percentage change in arrest rates from the beginning of well development (2007) to the height of development (2012).

Economics Topical Report Methodology

A multitude of peer-reviewed studies recently have been published on the economic impacts of Marcellus Shale development, often with divergent assumptions, models, and findings. The Economics Topical Report summarized these studies, emphasizing the differences in approaches, to aid policy makers and others in interpreting the findings. The summary is organized specifically by major

assumptions, data sources, and methodologies used to highlight differences between the studies and the implications of those methodological approaches.

Housing Topical Report Methodology

The Housing Topical Report used multivariate models to examine changes in housing characteristics for Pennsylvania counties in relation to well development. The analysis used county-level housing and population data from the 2000 Decennial Census and the 5-year estimates (2005/2009 and 2009/2013) from the American Community Survey. The housing indicators examined include overall housing supply, age of housing, occupancy, affordability, household income inequality, and percentage change in each of these outcomes.

Goal 2

Traffic Topical Report Methodology

The Traffic Topical Report describes changes in annual traffic indicators (total crashes, heavy truck crashes, and crashes resulting in one or more fatalities) between 2000 and 2014. Data on total crashes and heavy truck crashes were made available by the Pennsylvania Department of Transportation; data on crashes with fatalities were obtained from the National Highway Traffic Safety Administration (NHTSA). The trends over time are described for the four study counties, for the counties bordering the study counties, and for all counties in the state by level of Marcellus Shale development.

Agriculture Topical Report Methodology

The Agriculture Topical Report describes changes in the agricultural sector in relation to Marcellus Shale development. The main data for the agriculture report were the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) Census of Agriculture for 2002, 2007, and 2012. These data allowed for a comparison of changes in a number of variables, including the

number of farm operations, the average size of these operations, and the agricultural profile of the four study counties, as well as comparisons to neighboring counties, before and during Marcellus Shale development.

Health Topical Report Methodology

This report examined several county-level indicators of population health outcomes, health care access, health care utilization, and changes in those indicators since substantial well development began. Specific indicators include health insurance rates, hospital bed and health care provider supply, outpatient utilization, emergency department utilization, all-cause and cause-specific inpatient hospitalization and length of stay, self-rated health, smoking and alcohol consumption, and sexually transmitted disease rates. Descriptive trends focused on the four study counties and their neighboring counties. For all counties in Pennsylvania, statistical tests were used to identify health outcomes which were significantly different between counties with no wells, counties with some wells (bottom 75 percent of development), and counties in the top quartile of well development.

Goal 3

Wave 2 incorporated a survey of individuals living in households in the four study counties to examine the impacts of development more closely than is possible through the secondary data analyses. The purpose of this survey is to understand how the experiences, costs, and benefits of Marcellus Shale development vary across different levels of proximity to unconventional natural gas wells and key economic and demographic indicators.

The survey consisted of five sections. The first section, titled “Marcellus Shale and Your Community,” asked respondents their views about Marcellus Shale development, including how they believe it has affected or is affecting their local economy and what it is like to live in their community,

their local environment, and their household. Respondents were also asked about actions they have taken in response to Marcellus Shale development (i.e. civic, personal), risks they perceive to be associated with development, and the overall extent to which they oppose or support development. The second section, titled "Views of Your Community," asked respondents what their community means to them and the quality of its features. The third section, titled "Your Home and Land," included questions on home ownership status, land use, sources of drinking water, and their perceived proximity to Marcellus Shale natural gas infrastructure. The fourth section, "Marcellus Shale and Your Household," asked about benefits and expenses that individuals might have accrued from Marcellus Shale development. This included questions about land and natural gas rights ownership, leasing status, if anyone in the household is receiving leasing and royalty payments, and, if so, how they have spent this income. The fifth and final section, "About You," collected demographic information about respondents and asked them to self-rate their current health and level of stress. At the end of the survey, respondents were asked to indicate if they would like to receive a summary of the study results and their willingness to participate in future research. They also were provided space to include any comments about Marcellus Shale development.

Survey Administration

The survey was administered from December 2014 to March 2015 by Penn State's Survey Research Center. Individuals in sampled households had the choice to respond by mail or a web option. Selected households received a total of five mailings: a pre-survey notification, a first survey mailing, a first reminder, a second reminder with copy of the survey, and a final reminder. All mailings included a unique login code if the respondent chose to use the web option. All correspondence requested that an adult who is involved in household decision-making complete the survey.

Survey Sample Selection Procedures

A goal of this survey process was to ensure adequate coverage of the population living near wells that was likely to have the most direct experience with Marcellus Shale development. A simple random sample of households may not have identified a large enough sample of these households. Consequently, the approach used here was a stratified random sample. In this technique, random samples of households are selected from within three strata defined by the density of unconventional natural gas. To create the strata, unconventional natural gas well data from the Pennsylvania Department of Environmental Protection's Office of Oil and Gas Management (2015) and the software ArcGIS were used to geocode (identify the specific geographic location) of wells within U.S. Census-defined boundaries called "block groups."[1] Then, the well density (number of wells per square mile) for each block group was calculated. Three strata, consistent across the counties, were identified: zero wells per square mile, between zero and one well per square mile, and one or more wells per square mile. Figure 1 displays the four study counties divided into block groups and color coded by strata.

[1] The U.S. Census Bureau defines *census blocks* as the smallest geographic unit for which demographic data are collected and published. Typically block boundaries are defined by existing features (i.e., roads, streams, municipal boundaries). *Block groups* are geographic clusters of contiguous census blocks generally containing between 600 and 3,000 people (U.S. Census Bureau, n.d.). They do not necessarily conform to municipal boundaries.

Figure 1. Well Density per Square Mile of Census Block Groups within Study Counties

A total of 1,000 households were sampled from each county. To ensure a sufficient sample of individuals living in households in close proximity to development, the study oversampled the highest strata (one or more wells per square mile). Five hundred households were randomly selected from this highest strata and 250 from the other two strata (zero wells per square mile and between zero and one wells per square mile). Table 1 displays the number of households sampled by county and strata. In total, this survey procedure used a sample of 4,000 households, 2,000 from the highest strata (one or more wells per square mile) and 1,000 each from the other two strata. The sample was purchased from Survey Sampling, Inc., a commercial firm that aggregates household addresses through multiple sources

(such as post office listings, telephone directories, magazine subscriptions, etc.). The sample was created by randomly selecting household addresses within each of the strata identified.

Table 1. Sample of Households by County and Strata

County	0 wells/sq. mi	Between 0 and 1 wells/sq. mile	1+ wells/sq. mile	Total
Bradford	250	250	500	1,000
Lycoming	250	250	500	1,000
Washington	250	250	500	1,000
Greene	250	250	500	1,000
Total	1,000	1,000	2,000	4,000

Survey Response Rate

A total of 1,291[2] responses were received. Of the original 4,000 households selected, the survey was undeliverable to 479 households due to invalid addresses, no mail receptacle, vacancy, or inability to forward. The effective response rate was 36.7 percent (1,291/3,521). The response rates vary by strata and county as indicated in Table 2. The highest number of total responses was from Lycoming County (393), followed by Bradford (381), Washington (280), and Greene (240). As expected due to oversampling, the majority of respondents live in census block groups in the strata with the highest density of wells (687 from block groups with one or more wells per square mile. A total of 328 households within block groups with 0-1 wells per square mile completed surveys; 274 from block groups with zero wells per square mile completed surveys. The majority of surveys completed came in paper form (1,170), while 119 individuals responded through the web form.

[2] A total of 1,291 responses were received, but two paper surveys had their identifier codes removed so that county and strata cannot be identified. These surveys were not included in the data reported here.

Table 2. Number of Survey Responses by County and Strata Sampled

	0 wells/sq. mile	Between 0 and 1 wells/sq. mile	1+ wells/sq. mile	Total
Bradford	83	99	199	381
Lycoming	81	102	204	387
Washington	59	65	156	280
Greene	51	62	128	241
Total	274	328	687	**1289**

Sample Weighting Procedures

A weighting procedure was needed to generalize the findings to the four study counties. The weights are based on U.S. Census data to adjust (weight) the sample to match the population of the study counties. The weights used in the analyses adjust for three issues with the sampling that result in disproportionate representation of individuals within the acquired sample: (1) the stratified sampling procedure that results in disproportionate representation of households in the top well density stratum; (2) household as the unit of selection that results in the disproportionate representation of individuals from one-person households; and (3) a disproportionate percentage of males who completed the survey. A weight was added to each individual response that represents the number of people in the population for which they are "speaking" based on their household location (in relation to their county and strata), their household size, and gender. The weights included here were calculated by Penn State's Survey Research Center as part of its survey administration procedures.

Variables and Measurement

The survey was intended to understand how experiences, costs, and benefits might vary across different levels of proximity to unconventional natural gas wells and by other geographic and socioeconomic characteristics. To make this possible, all sample household addresses were geocoded using ArcGIS. These addresses were then added to the geocoded unconventional natural gas wells, based on Pennsylvania Department of Environmental Protection (2015) data, to determine their

proximity to unconventional natural gas wells. Three proximity variables were calculated: the number of unconventional natural gas wells within 1 mile of each household, within 2 miles of each household, and within 5 miles of each household. These variables are used below to describe differences in experiences.

Sample Description

The final sample included 1,289 respondents across the four study counties.[3] Table 3 shows the means, frequencies and standard errors for the main respondent characteristics of interest. The table displays the percentage of the sample that did not answer each question, as well as the weighted and unweighted descriptive statistics. The weighted results are used in this text description.

About 30 percent of the aggregated, weighted sample resided in Lycoming County; Bradford and Washington counties each contributed about 25 percent of the population, while 16 percent was from Greene County. Overall, the sample was overwhelmingly white (97.8 percent), male (53.2 percent), and married (67.4 percent). Respondents were about 58 years old, on average, and resided in their current county for an average of 43.2 years. About 40 percent of the sample had a high school diploma, 27 percent attended some college, and about 30 percent had a college degree or advanced degree. In terms of employment, the largest proportion of the sample was employed (56.5 percent). Most of the remaining respondents were not in the labor force (42.0 percent), with a majority of those not in the labor force indicating they were retired.

[3] In the statistical analyses below, the sample is trimmed to the 880 cases for which complete data were available on all items.

Table 3. Descriptive Statistics for Demographic Variables (Weighted and Unweighted Sample) and Population Figures for Four Study Counties from US Census Bureau's American Community Survey (n=1,289)

	Percentage Missing	Unweighted Sample	Weighted Sample	Population*
County	0.0%			
Bradford County		29.6%	24.9%	14.7%
Lycoming County		30.0%	29.4%	27.4%
Washington County		21.7%	25.0%	48.9%
Greene County		18.7%	16.3%	9.0%
Age	6.1%	58.6 (0.4)	57.7 (0.5)	
18-64 Years of Age		63.4%	66.3%	78.1%
65 and Older		36.6%	33.7%	21.9%
Gender	5.7%			
Male		66.4%	53.2%	49.2%
Female		33.6%	46.8%	50.8%
Race	6.8%			
White		98.1%	97.8%	94.1%
All others (Black, Hispanic, Other, Multi-Racial)		2.1%	2.2%	5.9%
Marital Status	2.3%			
Married		67.3%	67.4%	51.8%
Divorced/Separated		10.2%	9.2%	12.4%
Widowed		10.6%	11.3%	7.9%
Cohabitating/Single		12.0%	12.2%	27.9%
Employment Status	4.5%			
Employed (full-time, part-time, self-employed)		55.6%	56.5%	55.8%
Unemployed		1.5%	1.5%	4.7%
Not in the labor force (disabled, student, retired, homemaker)		42.9%	42.0%	39.5%
Education	2.0%			
Less Than High School Diploma		4.3%	3.7%	11.3%
High School Diploma		39.0%	39.5%	42.7%
Some College		28.4%	26.9%	24.4%
Bachelor's Degree		16.5%	16.7%	14.2%
Master's, Professional, or More		12.0%	13.2%	7.3%
Household Income	11.5%			
Less than $10,000		2.9%	2.9%	6.7%
$10,000 - $24,999		13.8%	14.6%	17.8%
$25,000 - $49,999		25.6%	24.6%	25.8%
$50,000 – $74,999		21.2%	21.6%	20.2%

	Percentage Missing	Unweighted Sample	Weighted Sample	Population*
$75,000 - $99,999		14.9%	15.4%	12.6%
$100,000 - $149,999		13.9%	13.6%	11.2%
$150,000 - $199,999		4.3%	4.1%	3.1%
$200,000 or More		3.5%	3.3%	2.7%
Length of Residence in County (Years)	5.7%	43.4 (0.6)	43.2 (0.7)	
Number of Children in Household	11.3%	0.5 (0.03)	0.5 (0.03)	
Number of Adults in Household	4.8%	1.9 (0.03)	2.0 (0.03)	
Homeownership Status	2.5%			
Owner		90.3%	89.0%	74.0%
Renter		6.8%	7.9%	26.0%
Living with Friend or Relative at No Cost		1.4%	1.8%	NA
Other		1.5%	1.3%	NA

Note: Statistics provided are percentages in that category or the mean and standard error (in parentheses). *Population figures were gathered from the U.S. Census Bureau's American Community Survey 5-year estimates for 2009-2013. Figures depict the totals for the combined four study counties.

Comparing the unweighted and weighted samples to the population figures for the four study counties indicated some substantial differences, some of which are corrected when using the weighted sample. In comparison with the figures for the four-county population, the weighted sample has a relatively more equal representation of the four counties, with percentages of the sample ranging from 16.3 percent for Greene County to 29.4 percent for Lycoming County. In comparison, Greene County has only 9.0 percent of the population in the four counties, whereas Washington County has nearly half, (48.9 percent) of the total population. The weighted sample is slightly older, with 33.7 percent of the sample over age 65, compared to 21.9 percent of the four-county population in this age category. Because the unweighted sample over-represented men, the sample was adjusted so that the proportion in the weighted sample (46.8 percent female) was closer to that of the population (50.8 percent female). Racial composition of the weighted sample is relatively similar to that of the population. The weighted sample has a higher proportion of respondents who are married and a smaller proportion that are single or cohabitating than the population for the four counties. Employment status of the weighted sample is relatively similar to that of the population. The weighted sample is slightly more educated than the

population as a whole, with a lower proportion of respondents with less than a high school diploma and a higher proportion with a graduate degree. The weighted sample has a slightly higher overall household income than the population as a whole; although most of the figures are within a few percentage points, the weighted sample has a consistent underrepresentation of the lower income categories (up to $50,000) and an overrepresentation of the higher income categories. The weighted sample has a higher proportion of homeowners than is found in the population of the four counties. Differences between the weighted sample and population related to gender, age, education, and income are typical for surveys; men, people who are older, more highly educated, and have higher incomes tend to complete surveys at a higher rate. These differences are only a problem for generalizing the results of the survey to the population to the extent that these variables are related to the outcomes of interest. Specific instances where these are a concern are noted in the results section.

Goal 4

Impacts on Low Income Families Topical Report Methodology

The fourth and final goal was to document changes (if any) in the availability and affordability of housing and sources of social support for low-income families in the study counties. This goal was addressed through interviews conducted within the four study counties with social service providers and with low-income residents.

In the spring and summer of 2014, meetings and conversations were held in all four study counties with service providers and administrators in the areas of public housing and social services to discuss and develop a recruitment strategy and interview protocol to complete interviews with low-income county residents. An interview protocol was subsequently developed that included questions about the respondent's socio-demographic characteristics, and the respondent's household. This was

followed by a series of open-ended questions regarding the respondent's experiences living within areas experiencing marked shale gas development. The final set of questions focused on residential change extending over the 5-year period prior to the interview.

Criteria for inclusion in the study were limited to adult (age 18 or older) low-income respondents who maintained a current residence in one of the four study counties at the time of the interview, and who had lived in Pennsylvania for the majority of the 5-year period preceding the interview. "Low income" was defined as having a household income at or below 125 percent of the federally defined poverty line at the time of the interview, and/or participation in an income-qualified social assistance program (e.g. section 8 housing assistance, food stamps) within the 5 years preceding the interview.

Two principal methods of recruitment of low-income respondents were used. First, beginning in September 2014, recruitment posters and postcards were distributed describing the study and how to contact the researchers via phone or email to inquire about participating in the study. Postcards and posters were distributed to social service and housing agencies, public libraries, thrift stores, trailer parks and other public locations. The research team also worked directly with staff at social service agencies, housing assistance agencies and food banks and pantries to contact clients and encourage them to take part in the study. Participants were also recruited directly, with staff assistance, at food pantries during scheduled food distributions. Using these recruitment methods, interviews were conducted with 39 low-income respondents, including 10 interviews in Bradford County, 11 in Lycoming County, and nine interviews in both Greene and Washington counties.

Results

Topical Research Reports

Crime

The crime topical report analyzed changes in arrest rates for five crimes across Pennsylvania counties: overall minor crimes, driving under the influence, public drunkenness, drug abuse violations, and disorderly conduct. The findings suggest that of the five crimes, driving under the influence and disorderly conduct arrest rates are associated with well density, controlling for other factors. Rates of driving under the influence are higher in counties with high levels of well development compared to counties that did not have well development; however, the counties with high levels of development did not experience an increase in DUIs from before to during Marcellus well development that was greater than other counties. Counties with higher Marcellus well density had higher rates of disorderly conduct arrest than counties with little or no well activity. Counties with higher well density experienced a larger increase in disorderly conduct arrest rates over time than did counties with lower or no well density. The other three crime categories – minor crimes, public drunkenness, and drug abuse violations – are not significantly related to Marcellus Shale well development across counties or over time.

Economics

The economics report analyzed recently published peer-reviewed studies of economic impacts from Marcellus Shale development. Generally, these studies find modest positive economic changes associated with development. However, what those impacts are, where they are, and their magnitude vary widely, although areas with the most wells often experience the most positive benefit. Employment and compensation are generally found to be less significant than income generated from leases and royalties. These findings indicate that the distribution of the economic benefits are not necessarily

community-wide, but rather accrue to a smaller subset of the population (or even non-residents), and are determined by factors such as mineral rights ownership, age, gender, and employment status. Studies did not account for costs to social and environmental systems and the review indicated the need to investigate industry impacts at scales beyond the county level given the spatial and temporal patterns of the industry.

The implications of this review were two-fold. First, economic impacts will likely be short-run due to the temporal dynamics of the industry. Drilling a well produces more jobs than later stages of development, meaning employment and compensation impacts will likely occur early in development. Royalties and leasing payments benefits are also temporal. These payments, and subsequent benefits, will be subject to changes in commodity prices, flow rates from wells, and investment strategies of mineral rights owners. Distributed public funds collected through impact fee payments or a proposed severance tax, could provide short-term economic benefits to communities but will also rely on the pace of well development and production. Second, there is fairly strong consensus in the academic literature that impacts to employment and compensation are modest, indicating that employment should be considered neither a long-term economic benefit of development, nor the most significant local economic benefit of development.

Housing

The housing report found substantial differences in housing outcomes and changes in housing outcomes across the four study counties, between the four study counties and their neighbors, and across levels of well development (i.e., counties with no wells, counties with some well development, and counties with substantial well development). However, very few housing outcomes or changes in housing outcomes since 2000 were statistically related to well counts (i.e., not statistically significant).

Analyses revealed no significant associations between well development and changes in county housing stock. Rental availability decreased across Pennsylvania between 2000 and 2009/2013, but it declined the most in counties with the most wells. This suggests that there has been increased rental demand and/or reduced supply of rental units in the counties with the most wells. However, some high drilling counties experienced more severe declines in rental availability than others. For instance, whereas Bradford County experienced a small decline in rental availability, Washington County experienced a decline in rental availability of more than 50 percent between 2000 and 2009/2013.

In terms of housing affordability, counties with the highest well counts experienced the largest average increase in median rent over the study period, but these counties also had the lowest percentage of renters spending 30 percent or more of their income on rent in 2009/2013 and experienced the smallest increases in the percentages of renters spending 30 percent or more of their incomes on rent between 2000 and 2009/2013. These findings suggest that although the median cost of rent increased in high drilling counties, income also increased enough to offset the rental costs and/or renters in high drilling counties shared rental units (e.g., doubled- or tripled-up) in an effort to reduce individual expenses.

Finally, there is substantial variability in household income inequality across the state; the gap in median household income between homeowners and renters increased in Pennsylvania between 2000 and 2009/2013. Counties with the most wells experienced a slight increase in median household income among homeowners between 2000 and 2009/2013, suggesting that homeowners may have experienced income benefits from drilling, on average. Moreover, whereas median household income among renters declined in all three categories of well development over the study period, the decline was the smallest in counties with the most wells. However, well development does not appear to be associated with increases in income inequality; there was no significant difference in the homeowner/renter income gap

between counties with the most wells versus counties without wells, and number of wells was not associated with changes in the renter/owner income gap between 2000 and 2009/2013.

Agriculture

The main data for the agriculture report were USDA's National Agricultural Statistics Service (NASS) Censuses of Agriculture for 2002, 2007, and 2012. These data enabled a comparison of changes in a number of variables, including the number of farm operations, the average size of these operations, and the agricultural profile of the four study counties, as well as comparisons to neighboring counties, before and during the Marcellus gas boom. The analysis revealed changes in agriculture. The number of farms in Bradford County increased substantially between 2002 and 2012, while the number of farmers in the other study counties, and Pennsylvania in general, declined. Average acreage in the four study counties increased, with the exception of Lycoming County. However, those increases were smaller than their adjacent counties and Pennsylvania generally. There were no clear patterns across the four study counties on those variables and the data do not allow for an analysis that would link variations in changes to Marcellus Shale activities.

One consistent pattern across the study counties was a decline in the dairy cow inventory. Lycoming and Bradford counties experienced the most dramatic drop in milk cow inventory especially when compared to their neighboring counties and statewide. Moreover, the decline in milk cows increased steadily from no drilling to high drilling counties. This suggests a possible link between Marcellus Shale gas drilling activities and a decline in dairy cows, which would further suggest a decline in dairy activity. However, the data do not allow for an analysis to determine cause. Data from surveys and other secondary data will be needed to determine the dynamic influences and relationships

between drilling activities and changes in farming operations, quality of life, and decisions related to land-use and availability.

Health

There is substantial heterogeneity in population health, health care access, health care utilization, and changes in those indicators since well development began across the four study counties and between the study counties and their immediate neighbors, many of which also experienced significant well development over the same period. There were statistically significant differences between counties with no wells, counties with some wells, and counties with the most wells on nine specific health-related outcomes: (1) counties with no wells experienced significantly larger *increases* than counties with wells in the percentage of adults without health insurance; (2) counties with no wells experienced significantly larger *declines* than counties with wells in the percentage of poor children without health insurance; (3) counties with some wells experienced significantly *larger* reductions in respiratory hospitalizations and digestive hospitalizations compared to counties with no wells; (4) counties with no wells experienced significantly *larger* reductions in length of stay for respiratory hospitalizations compared to counties with wells; (5) counties with no wells experienced significantly *smaller* increases than counties with wells in length of stay for hospitalizations caused by injuries, poisonings, and toxic effects of drugs; (6) counties with the most wells experienced an increase in the percentage of adults reporting fair/poor health while counties with no wells experienced a decline, and the difference is statistically significant; (7) counties with no wells experienced a *larger* decline in adult smoking rates than counties with some wells; (8) counties with some wells experienced a *larger* increase in chlamydia rates than counties with no wells and counties with the most wells; (9) counties with the most wells experienced *smaller* increases in the gonorrhea rates than counties with no wells.

These aggregate differences mask significant spatial variation in health indicators and changes in those indicators since well development began. Poor outcomes within specific counties with significant natural gas development (especially Bradford, Greene, Fayette, Susquehanna, and Westmoreland counties) point to the need for future monitoring and interventions to improve health.

Traffic

In Bradford County, the number of total crashes increased from 585 in 2009 to 848 in 2011 before declining again the next 2 years. The average number of reportable crashes in Bradford County was 709 in 2008-11, in comparison to 636 in 2000-2007. Similarly, Lycoming County experienced an increase from 1,165 crashes in 2009 to 1,330 in 2011 before a decline in 2012-2014. Several counties in the northern tier region also had substantial increases in the number and rates of total crashes, including Tioga, Sullivan, Clinton, and Potter counties in 2009 and 2010. Greene County experienced an increase from 356 crashes in 2009 to 420 in 2012 before declining in subsequent years. Washington County held relatively steady during this time period, and annual averages of 1,994 crashes for 2000-2007 and 2,007 crashes for 2008-2014. The southwestern region had little observable change in crash rates. The analysis of total crashes for all counties in the state suggests higher numbers of crashes in counties with wells. Counties with the highest number of wells experienced a 2.9 percent decrease on average, from pre-drilling (2000-2007) to the height of drilling (2008-2011), whereas counties with some wells (1-225) experienced a 10.1 percent decrease in the number of crashes. Counties with no wells experienced a 7.6 percent decrease, on average, in the number of crashes.

Bradford and Lycoming counties experienced dramatic increases in the number and rate of heavy truck crashes from 2009 to 2011. There was a 344 percent increase in the number of heavy truck crashes in Bradford County and a 132 percent increase in Lycoming County. Other northern tier counties

also experienced substantial increases: Tioga County experienced a 292 percent increase, Susquehanna County a 61 percent increase, and Clinton County a 157 percent increase in the number of heavy truck crashes from 2009 to 2011. Greene County experienced a 74 percent increase, and Washington County a 24 percent increase in the number of heavy truck crashes between 2009 and 2011. The rates for other southwestern region counties show only slight increases. On average, Bradford County experienced 63.50 heavy truck crashes annually in the 2008-2011 time period; in comparison, the annual average in the 2000-2007 period was 27.63. The analysis of the heavy truck crash data in relation to the number of wells drilled across all Pennsylvania counties indicates that while the overall trends of the three types of counties are similar, the years 2009-2011 show a larger increase for counties with high drilling activity compared to the other counties. On average, counties with the most wells had a statistically significant larger increase between 2000-2007 and 2008-2014 in the number of heavy truck crashes (17.5 percent) than counties with some wells (6.5 percent decrease) and counties with no wells (16.3 percent decrease).

The numbers of crashes with one or more fatalities in all study counties is quite small, so small changes can lead to very dynamic patterns that are hard to interpret. Bradford County had, on average, 9.50 crashes with one or more fatalities in the pre-drilling (2000-2007) period but 11.75 in 2008-2011. In contrast, Lycoming County had 17.50 in 2000-2007 and 16.50 in 2008-2011. Adjacent northern tier counties did not have consistent patterns. Greene County had its highest annual average number of crashes with fatalities in 2012-2014 (10.33), in comparison to the other time periods (8.50 in 2000-2007 and 7.00 in 2008-2011). Washington County held relatively steady across the time periods. Other southwestern counties were generally declining over the study period, with the exception of Fayette. Although the changes are not statistically significant, the counties with the most wells had slight percentage increase (0.42 percent) between pre-drilling (2000-2007) and active drilling (2008-2014)

time periods whereas counties with 1-225 wells had a 13.02 percent decrease and counties with 0 wells had a 16.50 percent decrease.

Overall, the findings suggest that the most rural counties in the northern tier experiencing the highest levels of development – particularly Bradford, Tioga, Susquehanna, Clinton, and Lycoming – had increased absolute numbers and rates of total crashes, heavy truck crashes, and crashes with one or more fatalities. The years of greatest impact appear to be 2009-2011, when the activity was at its height. For the 2012-2014 time period, and potentially in recent years, the number of crashes declined. This is likely due to two factors: decreased natural gas extraction due to low natural gas prices, and adaptations by operators and well servicing companies (such as using more piping for transporting water, recycling wastewater, and using rail to transport supplies). Both factors have likely led to a decline in the total number of trucks and oil and gas workers on the roads.

Low-income households

The report describing the perspectives of low-income adults examined perceptions of the expanding natural gas industry, and how these community changes may or may not have affected their economic and living circumstances. Particular attention was paid to perceptions of housing cost, adequacy, and availability. The data came from key informant interviews conducted in the fall of 2014 with 39 low-income adult respondents across the four-county case study area, as well as a smaller number of interviews with service providers associated with county social services, public housing agencies, and food banks.

The average age of low income respondents was 44, although the youngest was 20 years old and the oldest was 70. The sample was mostly homogenous (reflecting the lack of racial diversity across the study counties). Three African American respondents were interviewed, one Latino and the rest

white. Out of the 39 respondents, 21 were employed, although mostly in part-time jobs and other work that provided minimum wage or slightly above minimum wage salaries. Two respondents currently were working and earning salaries above the 125 percent poverty threshold, but had in the 5 years preceding the interview received income-qualified social services, and one had experienced homelessness. Several respondents were retired and others were unable to work due to disabilities. Still others were unemployed but actively looking for work. Given the average age of the respondents, many had adult children for whom they were no longer financially responsible. On average, respondents had between one and two dependent children. Nine respondents had one dependent child, five had two dependent children, and five had 3 dependent children. About one-third of the respondents were married.

Several main findings emerged from these interviews. First, nearly all respondents described the effects of the shale gas industry on the cost and availability of housing and the difficulties in finding employment offering wages that might cover rising housing costs. Respondents spoke about housing costs as being a significant factor in housing insecurity and general economic insecurity. Second, while some respondents were residentially stable over the 5-year period preceding the interview, many had experienced significant residential instability and/or homelessness. Six respondents were homeless at the time of the interview. In total, 16 described current and/or former homelessness in the 5 years preceding the interview. Nearly all respondents described how rising housing costs had contributed to their own residential instability and/or that of others whom they knew. Third, respondents described how higher-paid employment opportunities in the industry were not widely available.

Those respondents who were able to find work within the industry described difficult and often unsustainable and unsafe working conditions and/or job insecurity connected to fluctuations in the pace of gas development and, consequently, labor demand. Sixteen of the 39 respondents mentioned what

they saw as the unstable and unpredictable nature of gas industry employment. Of those 16 participants, 11 were from Bradford and Lycoming counties, perhaps reflecting the varying levels of activity over time in the northern part of the state versus the southwest. In total, four participants out of the 39 had personal experience working for the gas industry, and 13 knew of relatives or close friends that had employment through gas industry related work. None of the four participants previously employed through the gas industry retained that job at the time of the interview, and, of the participants who mentioned relatives or close friends that had worked with the gas industry, only five were currently working in the gas industry. Of the total 17 participants with direct experience of gas industry employment or having close friends or relatives working for the gas industry, 10 noted the general instability of gas industry employment.

Respondents described a mix of community changes above and beyond changes in the housing market, much of which respondents either directly or indirectly attributed to the gas industry. Several women in Lycoming and Bradford counties described prostitution and harassment. This included one woman in her late 20s in Bradford County, and three Lycoming County participants, one in her early 20s, one in her late 30s and one in her early 40s. Almost all references to harassment and prostitution were limited to residents in the northern tier. It is therefore unclear how extensive these perceptions are for residents in Greene and Washington counties.

Social service providers largely corroborated the experiences described by low-income county residents, in particular emphasizing the effect of tightened housing markets, rising costs, and the uneven access to economically sustainable employment opportunities. Low-income residents who were interviewed for this study tended to strongly believe that public policy makers had largely ignored or had remained unaware of the negative consequences of shale gas development, and especially as it has affected the most vulnerable segments of Pennsylvania communities.

Survey Results

Relationship to Marcellus Shale Development

This section provides an overview of the variables used in the analyses below related to likely predictors of the distribution of costs and benefits of Marcellus Shale development (Table 4). These variables identify potential differences that are, based on previous research, likely to influence how particular groups perceive the impacts of development. The primary variables used here include county, the density of wells within close proximity to the respondents' homes[4], whether respondents have a lease for a Marcellus Shale well on property they own, whether respondents' households are economically tied to the natural gas industry, respondents' home ownership status, gender, age, and household income. Table 4 provides descriptive statistics for these variables to contextualize the results that follow. As the county and demographic variables (gender, age, income, home ownership status) are summarized in the previous section, here the focus will be on the variables specifically related to the respondents' connections to Marcellus Shale development.

Table 4. Description of Sample in Relation to Marcellus Shale Development (n=1,289)

	Percentage Missing	Unweighted Sample	Weighted Sample
Well Density Proximity	0.0%		
Number of wells within 1 Mile		2.7 (0.1)	2.3 (0.1)
Number of wells within 2 Miles		12.1 (0.3)	10.6 (0.3)
Number of wells within 5 Miles		76.2 (1.4)	69.5 (1.5)
Employment in Natural Gas Industry	1.5%		
Yourself		5.8%	4.7%
Spouse		1.4%	1.8%
Other Household Member		3.6%	3.5%

[4] The number of wells within 1, 2, and 5 miles of respondents' homes were calculated using the home address of each respondent and the latitude/longitude of wells drilled (using Department of Environmental Protection data) between 2005 and the beginning of the survey period (December 2015). Each respondent's home address and all wells were mapped; then a radius of 1, 2, and 5 miles were calculated around each home, and the total number of wells within those circles were counted.

	Percentage Missing	Unweighted Sample	Weighted Sample
Not Employed in Natural Gas		89.2%	89.9%
Land ownership and Leasing Status	6.5%		
Anyone in Household Owns Land in the Marcellus Region		71.8%	66.7%
Of those who own land in the Marcellus Region…			
Property rights ownership	2.1%		
Own only the surface land		13.3%	14.9%
Own both surface land and gas rights		78.0%	75.3%
I do not know		8.6%	9.8%
Leasing Status	3.1%		
Land is not leased		30.1%	32.7%
Land is Leased but Lease is not held by household		6.3%	6.8%
Land is Leased & Household Holds Lease		59.0%	54.7%
I do not know		4.7%	5.8%
Of those who own land in the Marcellus Region, the land is leased, and the household holds the lease…			
Number of Acres Leased	5.7%	60.0 (5.9)	53.8 (4.9)
Leasing Payments	1.7%		
Received Leasing Payments		82.5%	81.4%
Expects to Receive Leasing Payments		8.0%	7.5%
Does Not Expect to Receive Leasing Payments		9.5%	11.1%
Royalty Payments	0.9%		
Received Royalty Payments		49.8%	46.9%
Expects to Receive Royalty Payments		31.2%	32.3%
Does Not Expect to Receive Royalty Payments		19.0%	20.8%

Note: Statistics provided are percentages in that category or the mean and standard error (in parentheses).

On average, respondents had 2.3 wells within 1 mile of their homes, 10.6 wells within 2 miles, and 69.5 wells within 5 miles of their homes. Note that these averages represent all respondents, even those sampled from census block groups with 0 wells per square mile.[5] In the weighted sample, about

[5] In the analyses that follow, the variables for the number of wells near respondents' homes are collapsed into categories for ease of displaying the information and because the distributions are highly skewed. For the two variables representing well density within 1 and 2 miles of the respondents' homes, categories reflect one category with 0 wells and then two categories that create a roughly equal distribution of the remaining respondents. For the variable representing well density within 5 miles, four categories are used. Each category represents approximately

10 percent of respondents (137) had household members (self, spouse, or other member) employed in the natural gas industry. About two-thirds of respondents (865) indicated that they own land in the Marcellus Shale region. Of these, three-quarters (661) own the gas rights on this land. Of the 661 who own the gas rights, just over half (54.7 percent) leased the land and the household holds the lease, about one-third (32.7 percent) have not leased the land, 6.8 percent leased the land but the lease is held outside the household, and 5.8 percent are uncertain if the land has been leased. The leaseholders leased, on average, 53.8 acres. Most (81.4 percent) received leasing payments, with another 7.5 percent expecting to receive payments; 11.1 percent do not expect to receive leasing payments. Just under half (46.9 percent) received royalty payments, with another one-third (32.3 percent) expecting to in the future. About one-fifth (20.8 percent) do not expect to receive royalty payments.

Perceived Impacts on the Local Economy & Family Economic Situation

This section describes the survey results related to perceived impacts on the local economy and respondents' families' financial well-being. Respondents were asked to rate a series of statements on a 5-point Likert scale, with the options: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The tables below present the mean scores of each of the six local economy questions by county, categories of well density, natural gas industry employment and leasing status, housing tenure (renter vs. non-renter), gender, age, and household income. All analyses use the weighted sample to account for the survey's complex sampling design.

Respondents reported mixed perspectives on the impact of Marcellus Shale activity on the local economy (see Table 5). About 61 percent of respondents either agreed or strongly agreed that there

one-quarter of the respondents; a "0 wells" category was not used in this case, because only 75 respondents had no wells within 5 miles of their homes.

were more economic opportunities that will keep youth in the area, compared to only about 19 percent who disagreed or strongly disagreed. A similar number of respondents agreed or strongly agreed that the cost of living in the area had gone up. The respondents were relatively evenly mixed about whether people had a lot more money due to Marcellus Shale activity; only about 33 percent agreed or strongly agreed there was more money, while about 33 percent were neutral about this, and 34 percent disagreed or strongly disagreed. When considering their own family's economic situation, fewer respondents said the activity had made them better off; about half (47 percent) disagreed or strongly disagreed, while about a quarter was neutral. Only about 26 percent of the respondents agreed or strongly agreed that their family's economic situation had improved. A majority of respondents also agreed or strongly agreed that property values had gone up. Similarly, a majority of respondents agreed or strongly agreed that rent had become too expensive for local residents.

Table 5. Distribution of Responses to Measures of Perceived Impacts on the Local Economy

Because of Marcellus Shale Development….	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
...there are more economic opportunities that will keep our youth in the area (n=1,285)	4.3%	14.7%	19.9%	41.3%	19.9%
...the cost of living here has gone up (n=1,281)	1.4%	13.2%	23.4%	39.7%	21.9%
...people in my community have a lot more money (n=1,283)	7.8%	26.8%	32.7%	25.8%	7.0%
...my family's economic situation has improved (n=1,284)	14.5%	32.6%	26.5%	18.6%	7.8%
...property values in this area have gone up (n=1,279)	5.1%	13.3%	24.2%	38.4%	19.0%
...rent has become too expensive for local residents (n=1,283)	1.6%	9.7 %	24.7%	30.6%	33.5%

Variation in Perceived Impacts on the Local Economy by Study County

Respondents' attitudes toward the local economy varied slightly across the counties. Table 6 provides the mean (average) rating for each item by county of respondent. Across all four counties, respondents generally agreed that there were more economic opportunities that would keep youth in the area, with means above 3.0 and relatively similar across counties (ranging from 3.5 in Greene to 3.8 in Washington). The four counties had differing responses to the statement about the cost of living; Bradford County respondents had a higher mean (4.0) than the other counties, followed by Lycoming and Greene with a mean of 3.7 and Washington County with a mean of 3.3. Responses for the assessment of changes to community wealth were neutral (ranging from 2.9 to 3.1) and similar across counties, suggesting no significant perceived impact on community members' financial situations. Respondents' family economic situation are reported to be, on average, slightly below neutral (means of 2.7 to 2.9), and not very different across counties. Perceptions of property value changes show some slight variation, with a mean for Lycoming and Greene county respondents higher (3.6 and 3.5, respectively) than Bradford and Washington county respondents (3.3 and 3.2, respectively). Finally, respondents from Bradford, Lycoming, and Greene counties generally agreed that rent had become more expensive for local residents (means of 4.3, 4.1, and 3.8, respectively), while those from Washington County generally were closer to neutral about the impact on renters. Such findings may reflect differences in the population size of the counties, and thus available housing stock.

Table 6. Mean Values for Perceived Impacts on the Local Economy, by County (n=880)

Because of Marcellus Shale Development…	Bradford	Lycoming	Washington	Greene
...there are more economic opportunities that will keep our youth in the area	3.6	3.7	3.8	3.5
...the cost of living here has gone up	4.0	3.7	3.3	3.7
...people in my community have a lot more money	3.1	2.9	3.1	3.0
...my family's economic situation has improved	2.9	2.7	2.7	2.8
...property values in this area have gone up	3.3	3.6	3.2	3.5
...rent has become too expensive for local residents	4.3	4.1	3.3	3.8

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Perceived Impacts on the Local Economy by Well Density

Tables 7-9 display the mean values for responses to the economic impact items by the number of wells within 1, 2, and 5 miles of the respondents' home addresses. Relatively few large differences are observed for the 1-mile measure. Those with 1-4 wells within 1-mile of their homes (as compared to the other categories) had a slightly higher mean for the item about increased cost of living and for higher rent costs. Respondents with any wells near their homes had slightly higher means than those without wells for the two items about community and family's economic situation. Similar patterns are found for the number of wells within 2 miles, with the largest differences between categories related to the community and family financial status items. This is not unexpected, because respondents with many wells close by would be more likely to be receiving lease and royalty income than would respondents living near few or no Marcellus Shale wells. Very few differences are found across the categories of number of wells within 5 miles of respondents' homes.

Table 7. Mean Values for Perceived Impacts on the Local Economy, by Number of Wells within 1 Mile of Respondents' Home Addresses (n=880)

Because of Marcellus Shale Development…	**0 wells/1m**	**1-4 wells/1m**	**5+ wells/1m**
...there are more economic opportunities that will keep our youth in the area	3.6	3.7	3.6
...the cost of living here has gone up	3.6	3.8	3.6
...people in my community have a lot more money	2.9	3.1	3.3
...my family's economic situation has improved.	2.6	3.0	3.0
...property values in this area have gone up.	3.5	3.6	3.6
...rent has become too expensive for local residents.	3.8	4.1	3.8

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 =Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Table 8. Mean Values for Perceived Impacts on the Local Economy, by Number of Wells Within 2 Miles of Respondents' Home Addresses (n=880)

Because of Marcellus Shale Development…	0 wells/ 2m	1-12 wells/2m	13+ wells/2m
...there are more economic opportunities that will keep our youth in the area	3.7	3.6	3.6
...the cost of living here has gone up	3.6	3.7	3.8
...people in my community have a lot more money	2.9	3.1	3.2
...my family's economic situation has improved	2.5	2.8	2.9
...property values in this area have gone up	3.5	3.6	3.6
...rent has become too expensive for local residents	3.8	3.9	3.9

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Table 9. Mean Values for Perceived Impacts on the Local Economy, by Number of Wells Within 5 Miles of Respondents' Home Addresses (n=880)

Because of Marcellus Shale Development…	0 -24 wells/5m	25-59 wells/5m	60-109 wells/5m	110+ wells/5m
...there are more economic opportunities that will keep our youth in the area	3.6	3.8	3.6	3.6
...the cost of living here has gone up	3.6	3.6	3.8	3.6
...people in my community have a lot more money	2.8	3.0	3.2	3.2
...my family's economic situation has improved	2.5	2.7	3.0	2.8
...property values in this area have gone up	3.5	3.5	3.7	3.4
...rent has become too expensive for local residents.	3.8	3.7	4.0	3.9

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Perceived Impacts on the Economy by Financial 'Stake' in the Play

Not unexpectedly, respondents with a household member with a direct financial stake in the play (i.e. working for the oil and gas industry, or who had leased mineral rights for drilling) were more likely to express positive economic attitudes towards Marcellus Shale drilling (Table 10). The largest difference between groups was related to family economic situation; those with a financial stake in the development similarly were more likely to identify that their family's economic situation had improved (3.4 for those with a household member employed by the industry, compared to 2.7 for those without

such a household member; and 3.3 for those who leased compared to 2.5 for those who had not leased). Those with an economic stake (employment or leasing) have higher means than other respondents related to perceived economic opportunities in the area, the perception that people in the community having more money, and that property values have increased. Notably all these responses were just slightly above neutral (3.0), which suggests that Marcellus Shale development overall has had a positive effect on those with such a stake.

Table 10. Mean Values for Perceived Impacts on the Local Economy, by Financial 'Stake' in the Play (n=880)

	Employed by industry		Leasing/holds lease	
Because of Marcellus Shale Development…	**Yes**	**No**	**Yes**	**No**
...there are more economic opportunities that will keep our youth in the area	4.0	3.6	3.8	3.5
...the cost of living here has gone up	3.6	3.7	3.6	3.7
...people in my community have a lot more money	3.3	3.0	3.3	2.9
...my family's economic situation has improved	3.4	2.7	3.3	2.5
...property values in this area have gone up	3.7	3.5	3.8	3.4
...rent has become too expensive for local residents	3.9	3.9	3.9	3.9

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Perceived Impacts on the Local Economy by Homeownership Status, Gender, and Age

As would be expected, those renting their homes and women tended to have more negative views on the impacts of Marcellus Shale development on the local economy, although the differences are not large (Table 11). Very few differences were found among respondents based on their age.

Table 11. Mean Values for Perceived Impacts on the Local Economy, by Homeownership Status, Gender, and Age (n=880)

Because of Marcellus Shale Development…	Renting home[6]		Gender		Age 65+	
	Yes	No	Female	Male	Yes	No
...there are more economic opportunities that will keep our youth in the area	3.4	3.7	3.5	3.8	3.6	3.7
...the cost of living here has gone up	3.7	3.7	3.8	3.6	3.6	3.7
...people in my community have a lot more money	2.9	3.1	2.9	3.1	3.2	3.0
...my family's economic situation has improved	2.4	2.8	2.6	2.9	2.8	2.8
...property values in this area have gone up	3.7	3.5	3.5	3.6	3.5	3.6
...rent has become too expensive for local residents	4.2	3.8	4.1	3.7	3.8	3.9

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Perceived Impacts on the Local Economy by Household Income

Higher income households viewed development more positively than did lower income households (Table 12). This holds true across all the items, indicating a strong pattern to the responses and the relationship between household income and perceived impacts of development. Lower income household respondents were more likely to disagree that economic opportunities in the community had increased, to agree that the cost of living had increased, to disagree that community members have more money, to disagree that their own financial status had improved, to disagree that property values had increased, and to agree that rent has become too expensive.

[6] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

Table 12. Mean Values for Perceived Impacts on the Local Economy, by Household Income (n=880)

Because of Marcellus Shale Development…	Household Income: Less than $25,000	$25,000 to $49,999	$50,000 to $99,999	$100,000 or more
...there are more economic opportunities that will keep our youth in the area	3.4	3.4	3.7	3.9
...the cost of living here has gone up	3.9	3.9	3.6	3.5
...people in my community have a lot more money	2.9	3.0	3.0	3.3
...my family's economic situation has improved	2.3	2.5	2.9	3.2
...property values in this area have gone up	3.2	3.6	3.5	3.7
...rent has become too expensive for local residents	4.0	4.0	3.8	3.7

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Financial Benefits and Costs

This section describes the survey results related to whether respondents or their families have experienced any financial benefits or costs associated with Marcellus Shale development. Respondents were asked if they or their family had received any financial benefits because of Marcellus Shale, which might include higher household income, additional hours worked, rental income, or leasing or royalty income. They then were asked if they or their family had to pay out-of-pocket for additional costs because of Marcellus shale, such as for lawyer fees, farm costs, water testing, or housing costs. For both questions, a “No” response was coded as a “0” and a “Yes” response was coded as a “1.” Respondents were also asked to describe qualitatively the specific costs and benefits they or their family experienced. The tables below present the mean scores by county, categories of well-density, natural gas industry employment and leasing status, housing tenure (renter vs. non-renter), gender, age, and household

income. Adjusted Wald tests[7] were used to identify whether there were significant differences in mean scores for composite indexes.

It is important to recognize that the cost question referred only to out-of-pocket costs. Respondents may have experienced other financial costs, such as changed property values, or other non-monetary costs, such as changes in use of property or quality of life, which were not addressed by this question yet which were addressed by other questions in the survey. In addition, benefits and costs were not directly compared because the survey questions did not ask respondents to report the total value of benefits and of costs that they experienced.

As shown in Table 13, a little less than half of the respondents (47.1 percent) reported that they had financially benefitted due to Marcellus Shale development (Table 13), while the remaining 52.9 percent said they had not benefitted. Only about one-fifth (20.6 percent) of respondents reported they had experienced out-of-pocket costs due to Marcellus.

Table 13. Experienced Financial Benefits and Costs

	Yes	No
Benefitted because of Marcellus (n=1,200)	47.1%	52.9%
Costs because of Marcellus (n=1,215)	20.6%	79.4%

Forty-seven percent of respondents said they have financially benefitted; however, only 26 percent of respondents said their family's financial situation improved due to the activity (see Table 6). This suggests that the benefits received by many of the respondents are either not large enough to

[7] The Adjusted Wald test compares the means and the distributions of the values of the dependent variables (e.g., perceived economic impacts) for each category of the independent variable (e.g., county, well proximity, income). A test statistic accompanies the Wald value to assess whether these differences were likely to occur by chance. Significance tests here indicate whether the differences are large enough, given the characteristics of the sample, that they are not likely to have occurred by chance (at the 95 percent confidence level, or probability [p] < .05).

make a difference to their family's financial situation, or that any costs they've experienced due to Marcellus may negate the positive benefits.

Respondents were most likely to report receiving lease dollars (61.3 percent of respondents reporting benefits), followed by royalties (41.9 percent) being second most common (Table 14). Employment impacts were relatively infrequently mentioned, with 4.2 percent of respondents reporting financial benefits saying they received a job directly involved in development, and another 6 percent saying they received a job indirectly related to development (such as in a hotel, food service, or other business affected by activity).

Table 14. Reported Financial Benefits

Theme	Number	Percent of Those Reporting Benefits
Lease	347	61.3%
Royalties	237	41.9%
Unspecified money	89	15.7%
Indirect job	34	6.0%
Mentioned family member's benefits	24	4.2%
Direct job	23	4.1%
Increased income from rental property	20	3.5%
Other	8	1.4%

The most common out-of-pocket cost identified by respondents reporting such financial costs was water testing, reported by about half of the respondents (47.9 percent) (See Table 15). Lawyer and legal fees were also very commonly mentioned (45.9 percent).

Table 15. Reported Financial Costs

Theme	Number	Percent of Those Reporting Costs
Water tests	120	47.9%
Lawyer/ legal fees	115	45.9%
Other	30	12.0%
Housing costs	21	8.4%
Vehicle repair	15	6.0%
Alternate water (bottled, filters, new well)	15	6.0%
Home/ property repairs	12	4.8%
Cost of living	8	3.2%
Farm cost	7	2.8%
Medical costs	3	1.2%

A little less than half of the respondents (47 percent) did not report either financial benefits or costs (Table 16). About one third of the respondents (32.3 percent) reported receiving benefits but not incurring costs, while about 14.8 percent reported both incurring financial costs and receiving benefits. Only 5.9 percent of respondents said they had incurred out-of-pocket costs, but had received no benefits.

Table 16. Reported Benefits and Costs (N=1,195)

		Reported Costs (percent of respondents)		
		Yes	No	Row Total
Reported Benefits	Yes	14.8%	32.3%	47.1%
	No	5.9%	47.0%	52.9%
(percent of respondents)	Column Total	20.6%*	79.3%	

* Row and column numbering does not add to 100 percent due to rounding error.

Variation in Experiencing Financial Benefits and Costs by Study County

Table 17 reports differences across counties in the financial experience of respondents. More than half of respondents in Bradford and Lycoming counties reported that they or their family had received financial benefits from Marcellus Shale development (61.9 percent and 53.3 percent, respectively), in contrast to less than half of respondents from Greene and Washington counties.

Notably, only about one in four Greene County respondents (25.3 percent) said they or their family had experienced financial benefits from the activity. These differences were statistically significant between Bradford and Washington counties, and Bradford and Greene counties.

In all but Greene County, a much smaller proportion of respondents reported they or their family experienced additional out-of-pocket costs due to Marcellus Shale development, ranging from 28.6 percent in Bradford County to 13.8 percent in Washington County. By contrast, almost half of respondents in Greene County (45.8 percent) reported higher out-of-pocket costs due to shale development activity, almost twice the number who had reported receiving benefits. Many of the differences between counties were statistically significant, including between Bradford and Washington counties, Bradford and Greene counties, Lycoming and Washington counties, and Lycoming and Greene counties.

Table 17. Experienced Financial Benefits and Costs, by County (n=880)

	Bradford	Lycoming	Washington	Greene
Benefits because of Marcellus*	61.9%	53.3%	45.0%	25.3%
Costs because of Marcellus**	28.6%	24.7%	13.8%	45.8%

* The percentage for Bradford County is statistically significantly higher ($p < .05$) than both Washington and Greene counties but not Lycoming County. ** The percentage for Washington County is statistically significantly lower ($p < .05$) than all other counties.

Variation in Experiencing Financial Benefits and Costs by Well Density

Tables 18-20 report responses by well density within 1, 2, and 5 miles of the respondents' residence. For well densities within 1 mile of the respondents' residence, there was not a clear pattern of benefits, although the differences were statistically significant. Nearly two-thirds of respondents with 1-4 wells within 1 mile of their homes indicated they had received financial benefits. Of those with 0 wells near them, 41.7 percent reported financial benefits. Only 31.4 percent of those with 5 or more wells near them reported financial benefits. In contrast, respondents in higher well density areas were

more likely to report experiencing higher out-of-pocket costs (66.7 percent of respondents) than were those with lower (29.3 percent) or no wells (17.3 percent) within that distance. These findings were statistically significant between no wells and 1-4 wells; and between no wells and 5 or more wells.

When the benefits and costs responses were compared within each well density, respondents in areas with 5 or more wells within 1-mile were more than twice as likely to report bearing costs (66.7 percent) than report financial benefits (31.4 percent). Respondents in areas with fewer wells, in contrast, were more likely to report receiving financial benefits than costs.

Table 18. Experienced Financial Benefits and Costs, by Number of Wells Within 1-Mile (n=880)

	0 wells/1m	1-4 wells/1m	5+ wells/1m
Benefits because of Marcellus*	41.7%	65.5%	31.4%
Costs because of Marcellus**	17.3%	29.3%	66.7%

* The percentage for homes with 0 wells receiving benefits is statistically significantly lower ($p < .05$) than homes with 1-4 wells, and higher than homes with 5 or more wells. ** The percentage for homes with 0 wells experiencing costs is statistically significantly lower ($p < .05$) than homes with 1-4 wells and homes with 5 or more wells.

When considering benefits and costs by well density within 2 miles, a clear and statistically significant pattern emerged, with the proportion of respondents reporting benefits or bearing costs increasing with the number of nearby wells (Table 19). For example, 32.0 percent of respondents with no wells reported receiving benefits compared to 65.3 percent of respondents in areas with 13 or more wells within 2 miles. These differences were statistically significant. Importantly, the responses from the highest well density areas differed from a 1 mile radius, with about twice as many respondents reporting benefits (65.3 percent) than costs (30.4 percent).

Table 19. Experienced Financial Benefits and Costs, by Number of Wells Within 2-Miles (n=880)

	0 wells/2m	1-12 wells/2m	13+ wells/2m
Benefits because of Marcellus*	32.0%	54.2%	65.3%
Costs because of Marcellus**	13.8%	22.4%	30.4%

* The percentage for homes with 0 wells receiving benefits is statistically significantly lower ($p < .05$) than homes with 1-12 wells and homes with 13 or more wells. ** The percentage for homes with 0 wells experiencing costs is statistically significantly lower ($p < .05$) than homes with 1-12 wells and homes with 13 or more wells.

When well density was considered at a 5-mile radius, the results were similar to the 2-mile radius, with the proportion of respondents reporting benefits and costs generally rising with the number of wells (Table 20). Respondents from the highest density area were somewhat less likely to report benefits (55.5 percent) than were respondents with middle levels of activity (57.4 percent and 63.1 percent, respectively), though these differences are not statistically significant.

Table 20. Experienced Financial Benefits and Costs, by Number of Wells Within 5 Miles (n=880)

	0 -24 wells/5m	25-59 wells/5m	60-109 wells/5m	110+ wells/5m
Benefits because of Marcellus*	31.8%	57.4%	63.1%	55.5%
Costs because of Marcellus**	14.8%	20.3%	26.7%	30.0%

* The percentage for homes with 0-24 wells receiving benefits is statistically significantly lower ($p < .05$) than homes in all other categories (25-59 wells, 60-109 wells, and 100 or more wells). ** The percentage for homes with 0-24 wells experiencing costs is statistically significantly lower ($p < .05$) than homes with 60-109 wells and 110 or more wells. The percentage for homes with 25-59 wells experiencing costs is statistically significantly lower ($p < .05$) than homes with 110 or more wells.

The proportion of respondents that reported benefits and costs changed dramatically by the radius used to calculate well density. Benefits rose with the density of wells within 2 and 5 miles, but were uneven for the measure of closest proximity, suggesting some level of concern about the level of benefits received by those with many wells close to their homes, especially in contrast to the costs they reported. For the measures at 2 and 5 miles, the pattern suggests greater benefits commensurate with well activity. As noted, 66.7 percent of respondents within the highest density category of the 1-mile

radius reported costs, compared to 30.4 percent and 30.0 percent of respondents in the highest density category of the 2-mile and 5-mile radiuses, respectively.

Variation in Experiencing Financial Benefits and Costs by Financial Stake in the Play

Not unexpectedly, whether respondents had a financial stake in Marcellus Shale activity was associated with whether they reported receiving benefits. About 70.7 percent of respondents with someone from their household employed by the oil and gas industry reported they or their family had received financial benefits, compared to 49.7 percent of respondents without such an employment connection (Table 21). About 92.4 percent of respondents who had leased or held a lease reported financial benefits, compared to only 26.8 percent of respondents who had not leased. Respondents who had leased were also more likely to report bearing out-of-pocket costs than were those who had not leased (32.3 percent compared to 16.8 percent). All three of these differences were statistically significant.

Table 21. Experienced Financial Benefits and Costs, by Financial 'Stake' in the Play (n=880)

	Employed by industry		Leasing/holds lease	
	Yes	No	Yes	No
Benefits because of Marcellus*	70.7%	49.7%	92.4%	26.8%
Costs because of Marcellus**	17.6%	23.5%	32.3%	16.8%

* The percentage for employed by the industry receiving benefits is statistically significantly higher ($p < .05$) than those not employed in the industry. The percentage for those with a lease receiving benefits is statistically significantly higher ($p < .05$) than those not holding a lease. ** The percentage for those with a lease reporting costs is statistically significantly higher ($p < .05$) than those not holding a lease. No statistically significant differences are found by employment in the industry.

Variation in Experiencing Financial Benefits and Costs by Homeownership Status, Gender, and Age

Whether respondents rented or owned their homes was associated with the likelihood that they or their family experienced benefits related to Marcellus Shale development (Table 22). Homeownership

is related both to a greater likelihood of receiving benefits and having costs. Only 12.0 percent of renters said they were receiving economic benefits, compared to about 55.1 percent of respondents who did not rent. The likelihood of experiencing costs followed the same pattern, with only 8.2 percent of renters reporting they or their family experienced costs, compared to 23.9 percent of non-renters. Both comparisons were statistically significant. Response differences between men and women were similarly statistically significant, with men more likely to report they or their family had received benefits than women; there were no significant differences for costs. There were not significant differences among age categories.

Table 22. Experienced Financial Benefits and Costs, by Homeownership Status, Gender, and Age (n=880)

	Renting home[8]		Gender		Age 65+	
	Yes	No	Female	Male	Yes	No
Benefits because of Marcellus*	12.0%	55.1%	47.4%	55.7%	51.2%	52.4%
Costs because of Marcellus**	8.2%	23.9%	21.1%	24.1%	20.8%	23.6%

* The percentage for those renting their homes receiving benefits is statistically significantly lower ($p < .05$) than those not renting. The percentage of women who reported receiving benefits is statistically significantly lower ($p < .05$) than men. No statistical significant differences are found for age. ** The percentage for those renting their homes reporting costs is statistically significantly lower ($p < .05$) than those not renting. No statistical significant differences are found for gender or age.

Variation in Experiencing Financial Benefits and Costs by Income

There were some statistically significant differences among responses when considering household income (Table 23), yet no clear patterns. Respondents from both the highest and lowest income households were more likely to report receiving financial benefits, and bearing costs, than were those from middle income households. Other than with the lowest income category, the percentage of

[8] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

households reporting benefits or costs increased with income. Not all of the comparisons were statistically significant so few conclusions can be drawn from the data.

Table 23. Experienced Financial Benefits and Costs, by Income (n=880)

	Less than $25,000	$25,000 to $49,999	$50,000 to $99,999	$100,000 or more
Benefits because of Marcellus*	61.9%	41.4%	57.3%	62.9%
Costs because of Marcellus**	28.6%	19.0%	22.5%	31.8%

* The percentage for those with household incomes less than $25,000 reporting receiving benefits is statistically significantly higher ($p < .05$) than those with incomes $50,000-$99,999. The percentage for those with household incomes $25,000-$49,999 reporting receiving benefits is statistically significantly lower ($p < .05$) than those with incomes $50,000-$99,999 and lower than those with incomes of $100,000 or more. ** The percentage for those with household incomes less than $25,000 reporting experiencing costs is statistically significantly higher ($p < .05$) than those with incomes $50,000-$99,999 and lower than those with incomes of $100,000 or more. The percentage for those with household incomes $25,000-$49,999 reporting experiencing costs is statistically significantly lower ($p < .05$) than those with incomes of $100,000 or more. The percentage for those with household incomes $50,000-$99,999 reporting experiencing costs is statistically significantly lower ($p < .05$) than those with incomes of $100,000 or more.

Community Impacts

Perceived Community Impacts of Marcellus Shale Development

This section describes the perceived impacts of Marcellus Shale development on respondents' communities. Multiple survey questions were used to assess these changes. First, the survey contained a series of items that reflect areas of community life that people expressed concern about in previous research and popular discourse. For example, topics included driving, roads and safety; crime and drugs; population change; inequality; institutional stress; and relationships and trust among community members. Respondents were asked to indicate their level of agreement with a series of statements using a 5-point Likert scale: strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4), strongly agree (5). All statements had the following language preceding it: "Because of Marcellus Shale

development…..” The exact wording of the items is provided in the tables below. Note that items were worded both positively and negatively, so as to avoid bias in how respondents completed the questionnaire (called response set bias). The analyses below present the mean scores of each question by county, categories of well density, natural gas industry employment and leasing status, housing tenure (renter vs. non-renter), gender, age, and household income. All analyses were weighted and account for the survey’s complex sampling design.

Table 24 provides the overall responses to each statement concerning perceived community impacts. Overall, the pattern of responses indicates generally positive assessment of Marcellus Shale development, with a few exceptions related to substance abuse and inequality.

The first three items relate to roads, traffic, and public safety concerns. Overall, there were concerns about the ability to travel through the area, although respondents generally indicated that roads were better after the gas companies fixed them and they were not nervous when driving through the area. About two-fifths (42.1 percent) agreed that it took longer to drive around their area, while about one-third (35.2 percent) disagreed with this statement. Nearly half (47.5 percent) agreed that roads were in better condition after the companies fixed them; about one-third (31.0 percent) disagreed with this statement.

Several of the items under the topic of community inter-relationships related to the concept “collective efficacy,” the inclination that individuals have to help others and work toward the safety and well-being of others in the community. The responses below indicate mixed results. Relatively few respondents indicated that, because of Marcellus Shale, trust had decreased (24.2 percent agreed) and that it was harder to get help from others (24.2 percent agreed). A slightly higher percentage (33.0 percent) indicated that people acted with less courtesy to each other because of Marcellus Shale

development. Interestingly, 42.4 percent of respondents indicated that people were more likely to call the police now because of Marcellus Shale development.

Three survey items pertained to public services, one about education, one related to crime, and one related to alcohol and drug abuse. Respondents were divided regarding the impacts on public services like education. Additionally, about two-fifths (41.9 percent) of respondents did not feel more vulnerable to crime and violence, but one-third (33.0 percent) did feel more vulnerable. A slightly higher percentage (44.2 percent) indicated that problems related to drugs and alcohol had increased because of Marcellus Shale development, while 30.6 percent disagreed.

Regarding inequality, about half of respondents (49.4 percent) agreed with the statement that community inequality had grown. Additionally, responses to the survey statement regarding whether physical health had worsened because of Marcellus Shale showed general disagreement (46.9 percent). Finally, respondents were asked about their overall level of optimism for their communities, and a plurality (45.1 percent) indicated they were more optimistic because of development.

Table 24. Distribution of Responses Regarding Community Impacts of Marcellus Shale Development

Because of Marcellus Shale development…	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Roads, Traffic, and Safety					
…it takes me a lot longer to drive around this area. (n=1,281)	7.1%	28.1%	22.7%	26.7%	15.4%
…the roads are in better shape after the natural gas companies fixed them. (n=1,281)	11.8%	19.2%	21.5%	32.7%	14.8%
…I get nervous when I drive in this area. (n=1,282)	17.7%	34.5%	23.3%	17.0%	7.5%
Community Inter-Relationships					
…I trust people in the community less. (n=1,276)	12.8%	32.2%	30.9%	18.5%	5.7%
…it is harder to get help from people who live here. (n=1,279)	12.6%	40.8%	31.3%	11.5%	3.9%
…people are more likely to call the police if someone is acting suspiciously. (n=1,282)	3.4%	18.7%	35.5%	37.3%	5.1%
…people act with less courtesy to each other in public spaces. (n=1,284)	8.5%	34.5%	.1%	23.6%	9.4%
Public Services					
…important public services like education are stretched thin. (n=1,277)	5.9%	30.2%	29.2%	23.8%	10.9%
…I feel more vulnerable to crime and violence. (n=1,281)	9.8%	32.0%	25.1%	24.3%	8.7%
…we have more problems related to alcohol and drugs. (n=1,281)	6.7%	23.9%	25.2%	27.8%	16.4%
Inequality					
…the gap between the 'haves' and the 'have-nots' has grown. (n=1,281)	4.0%	17.6%	29.0%	32.5%	16.9%
Health					
…the physical health of people in my community has gotten worse. (n=1,279)	13.2%	33.7%	34.1%	14.3%	4.8%
Overall					
…I am more optimistic about the future of my community. (n=1,283)	5.8%	16.6%	32.5%	35.8%	9.3%

Overall, the pattern of responses indicates that the issues of concern related to Marcellus Shale development were focused on increased inequality among community member and increased alcohol and drug use in the communities. Other issues – traffic, community inter-relationships, public services,

and health – were not of concern to the majority of respondents. Overall, respondents were relatively optimistic about the future of their communities because of Marcellus Shale development.

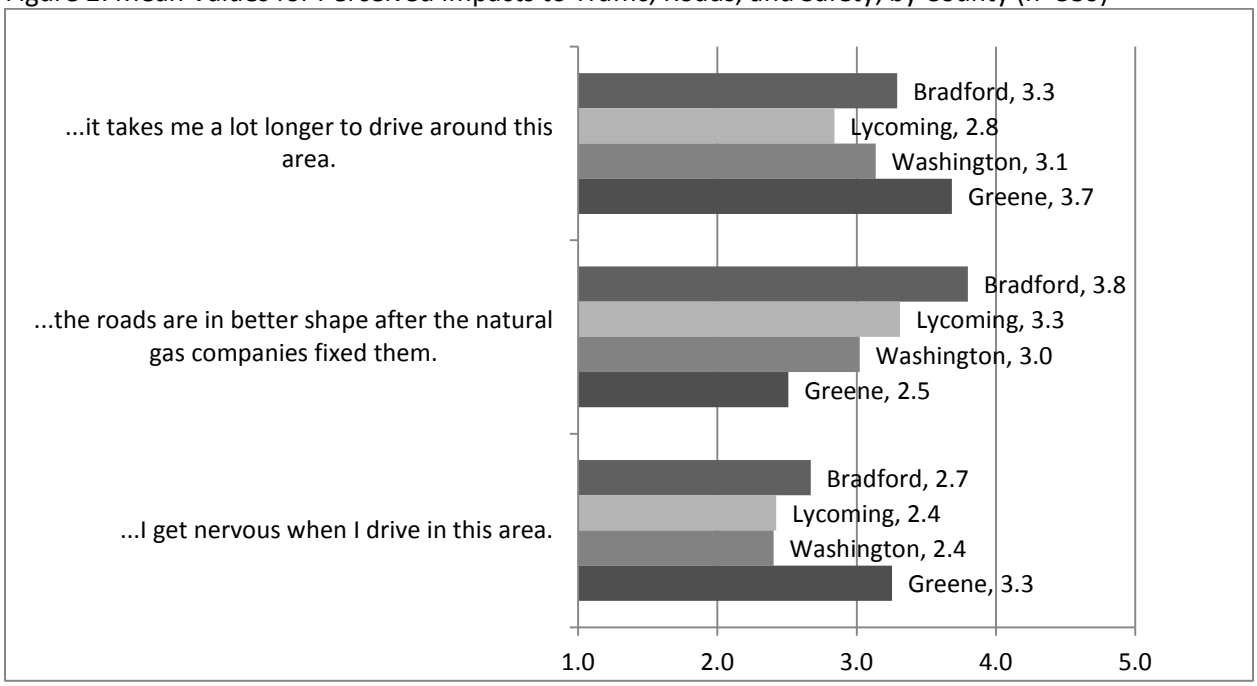
To further understand these responses, the following section examines the distribution of responses by county, proximity to wells, ability to economically benefit from development, demographics, and socioeconomic status.

Perceived Community Impacts by County

The following section shows the mean of the individual survey items by county. Means were calculated on a scale of 1 to 5, with scores closer to 1 indicating strong disagreement and scores closer to 5 indicating strong agreement. Scores near 3 indicate neutrality.

Figure 2 shows that Greene County respondents had the most negative responses regarding roads, traffic, and safety. Greene County respondents were most likely to agree that it takes longer to drive around the area, with a mean of 3.7. Bradford County had the next highest mean of 3.3, followed by Washington County (3.1) and Lycoming County (2.8). Greene County respondents had the lowest mean (2.5) in response to the statement that natural gas companies leave the roads better than prior to development (indicating disagreement). Washington County had the next lowest mean of 3.0 (indicating neutrality), followed by Lycoming County (3.3). Bradford County respondents were quite positive about the status of roads, with the mean of responses at 3.8 out of 5. Greene County respondents had the highest mean (3.3) of the four counties for feeling nervous when driving in the area, followed by Bradford County with a mean of 2.7, and Lycoming and Washington counties, each with means of 2.4.

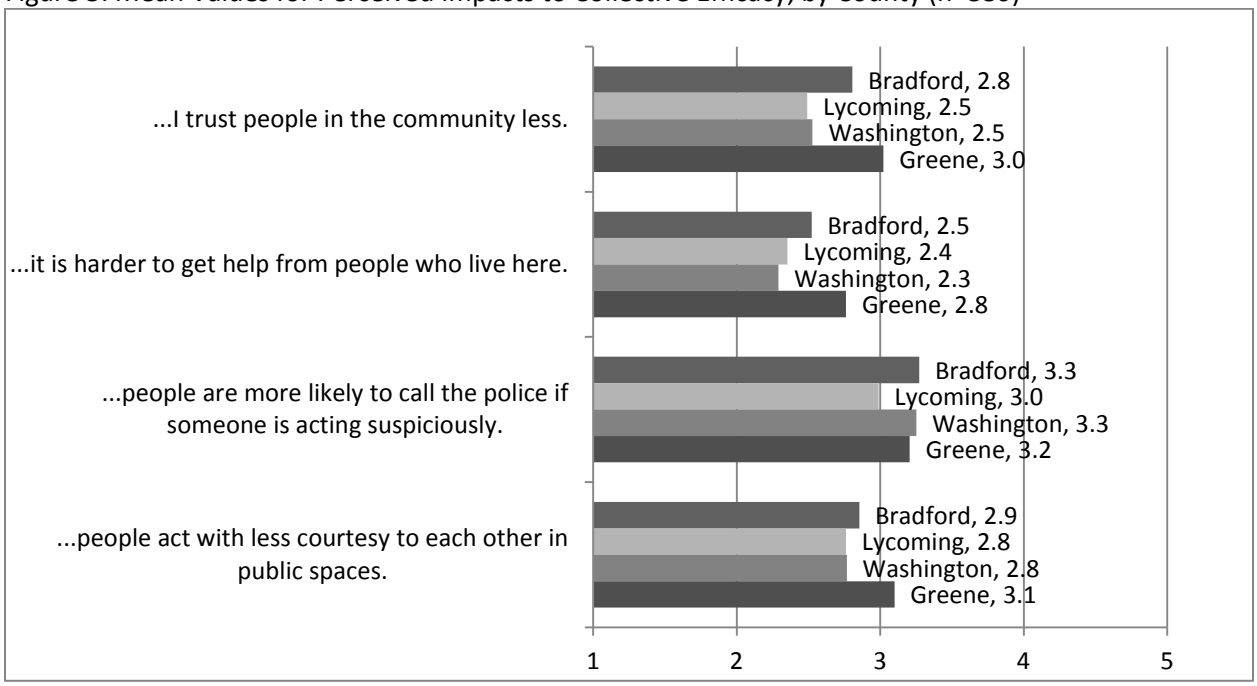
Figure 2. Mean Values for Perceived Impacts to Traffic, Roads, and Safety, by County (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 3 shows relatively little perceived negative impact of natural gas development on collective efficacy – the feeling that community members can act to create a safe environment. Respondents in Lycoming and Washington counties had the lowest mean (2.5), indicating disagreement with the statement that people trust each other less because of Marcellus Shale development; Bradford County residents had a mean of 2.8, and Greene County residents a mean of 3.0. A similar pattern was found for the statement "it is harder to get help from people who live here," with Washington County having the lowest mean (2.3), followed by Lycoming (2.4), Bradford (2.5) and Greene (2.8). Responses to the last two items (willingness to call police and acting with courtesy in public spaces) were near neutral (3.0) for all four counties.

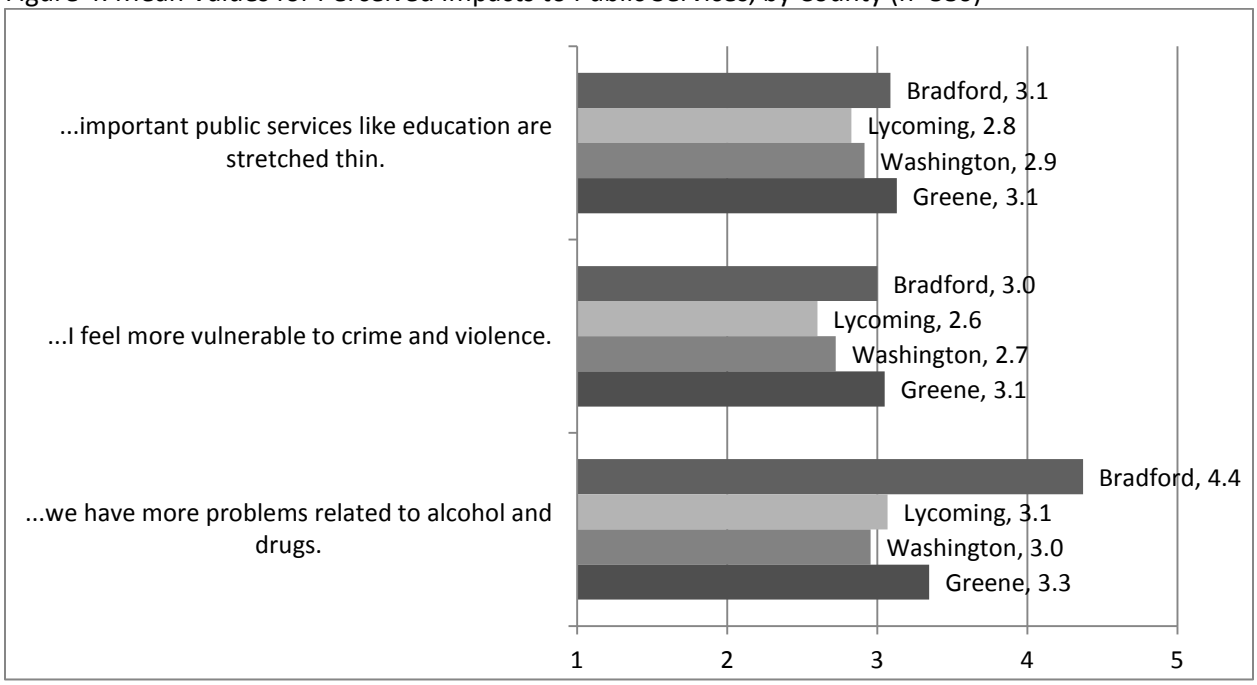
Figure 3. Mean Values for Perceived Impacts to Collective Efficacy, by County (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 4 shows the survey items related to public services. Most means hovered near 3.0, indicating that respondents felt that Marcellus Shale development has had little impact on education services, crime, and drugs/alcohol. There were exceptions, however. Lycoming and Washington county respondents had a slightly lower mean for the item "I feel more vulnerable to crime and violence," indicating slight disagreement in those counties, on average. Bradford County respondents had a very high mean (4.4) for "we have more problems related to alcohol and drugs," indicating substantial concern about the impacts of Marcellus Shale on substance abuse in their county.

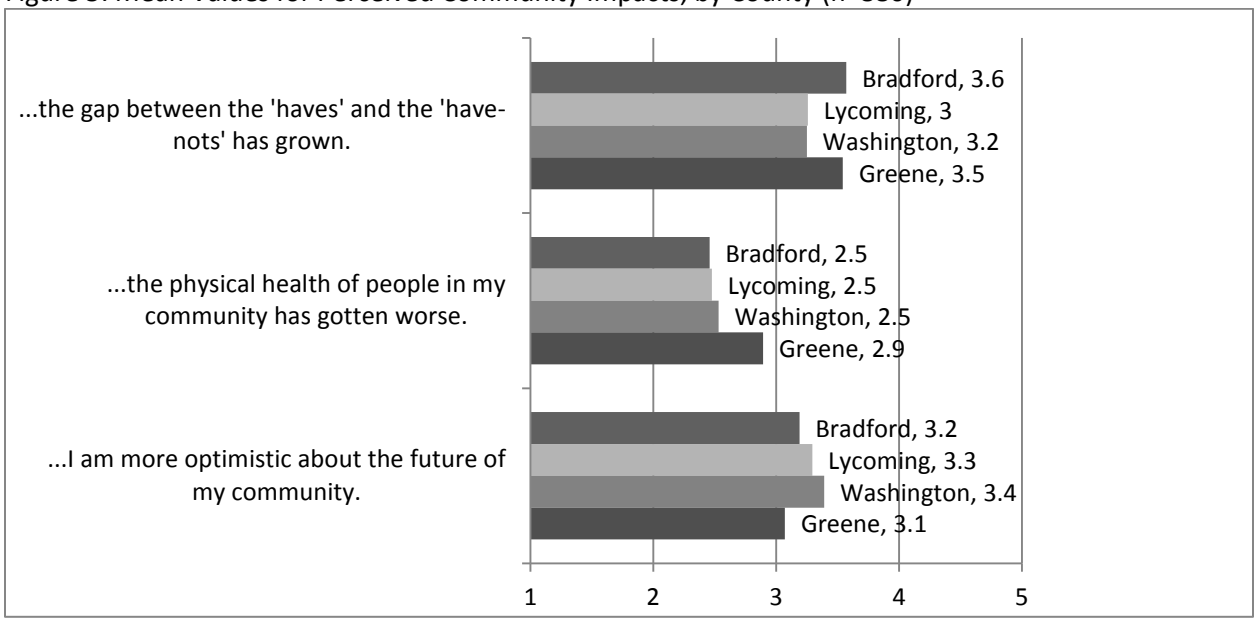
Figure 4. Mean Values for Perceived Impacts to Public Services, by County (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 5 shows the final three questions related to perceived impacts on community. The means for increased inequality ("gap between the haves and have-nots has grown") all exceeded 3.0, indicating concern across all counties, with the highest values for Bradford (3.6) and Greene (3.5), followed by Lycoming (3.3) and Washington (3.2). There was not concern about physical health effects in any of the counties, although Greene County had the highest mean (2.9). Responses to the summative statement, that Marcellus Shale development made them more optimistic about the future of their communities, suggested slightly positive attitudes, with all four county means slightly above 3.0; Washington County had the highest mean of 3.4, followed by Lycoming (3.3), Bradford (3.2), and Greene (3.1).

Figure 5. Mean Values for Perceived Community Impacts, by County (n=880)



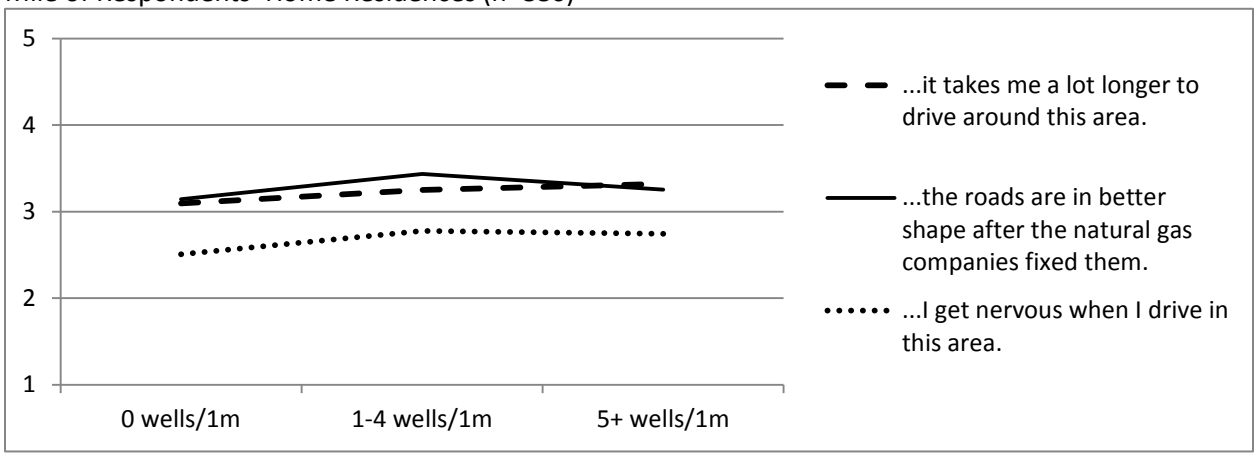
Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Perceived Community Impacts by Well Proximity

This section compares responses to the community impacts statements by proximity to wells. Figures 6 - 8 show the items related to traffic, roads, and safety by the number of wells within 1, 2, and 5 miles. Respondents with homes in areas with a high density of develoment indicated greater impacts on their driving time, as indicated by the means that increase across density categories. For the question related to the quality of the roads after being fixed by the natural gas companies, the highest means were generally in the middle categories regardless of the distance measured, indicating greater satisfaction with roads after construction was completed. For example, the highest means were for those who had 1-4 wells within 1 mile of their homes, 1-12 wells within 2 miles of their homes, and 60-109 wells within 5 miles of their homes. The means were slightly lower for those respondents in areas with the greatest density of wells, although they were above neutral (3.0). This could be related to dissatisfaction with the overall level of development and impacts on roads, particularly delays in fixing and rebuilding roads, given the large number of wells within close proximity to respondents' homes. In

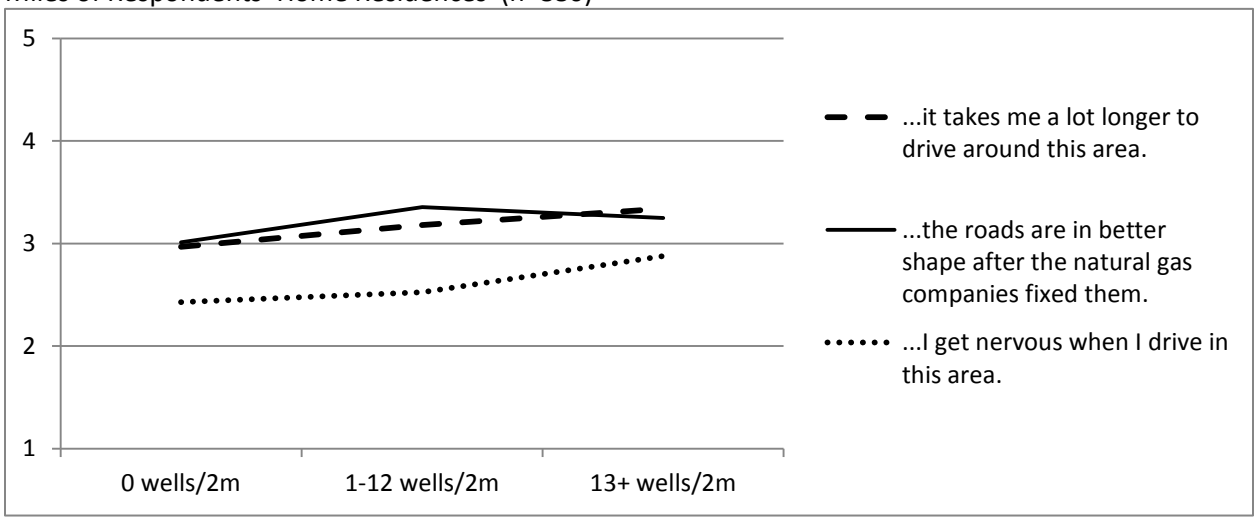
general, nervousness about driving was highest where the well density was the highest; the mean responses for those respondents who had 1-4 wells wthin 1 mile and those with 5 or more wells within 1 mile were 2.8 and 2.7, respectively.

Figure 6. Mean Values for Perceived Impacts to Traffic, Roads, and Safety, By Number of Wells within 1 Mile of Respondents' Home Residences (n=880)



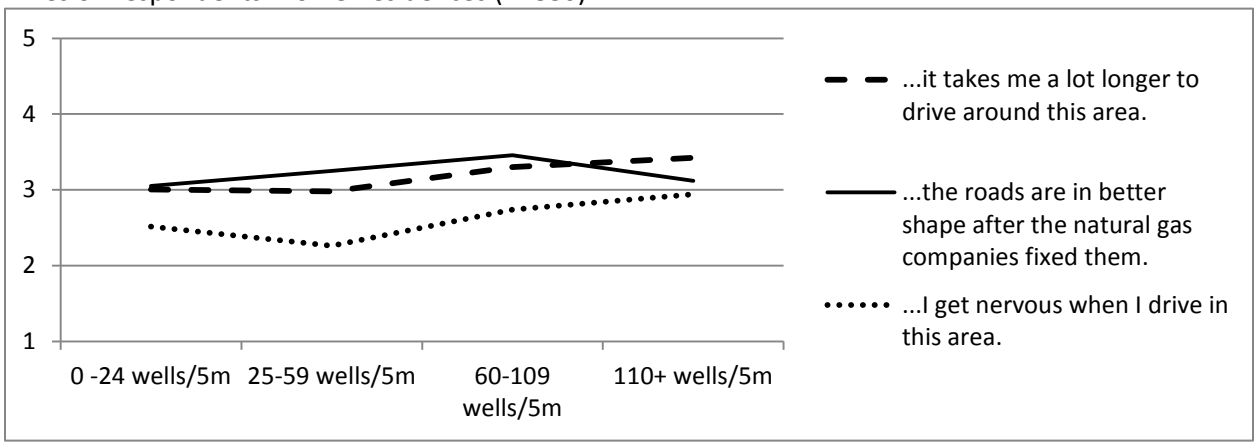
Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 7. Mean Values for Perceived Impacts to Traffic, Roads, and Safety, By Number of Wells within 2 Miles of Respondents' Home Residences (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 8. Mean Values for Perceived Impacts to Traffic, Roads, and Safety, By Number of Wells within 5 Miles of Respondents' Home Residences (n=880)

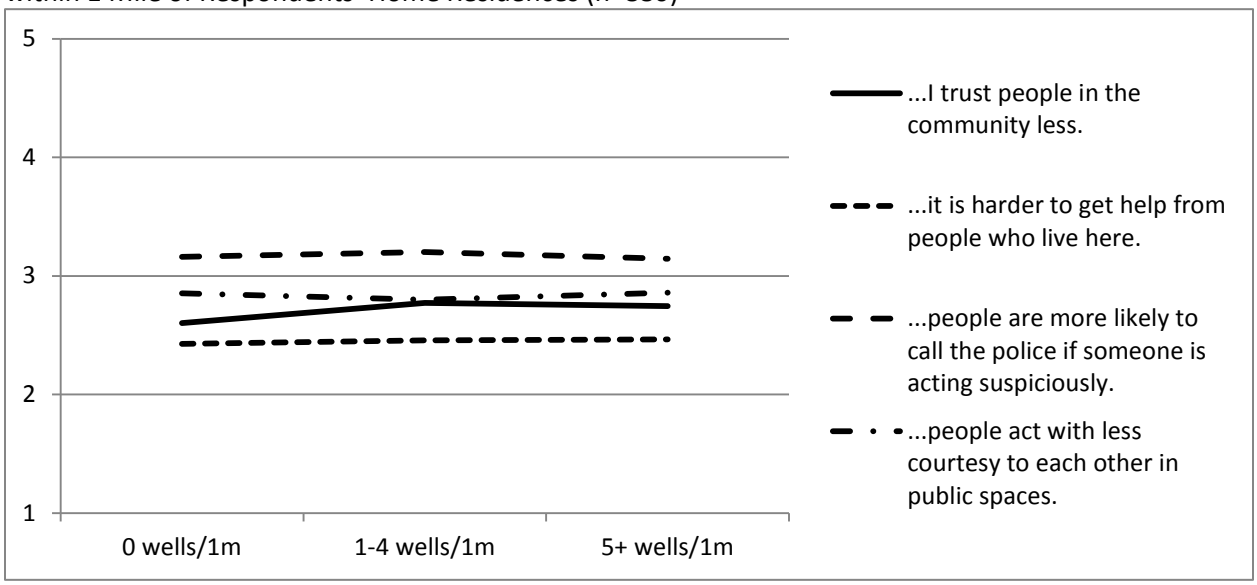


Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figures 9-11 provide the mean values for the community inter-relationship statements by well density measures. Diminished trust in other community members increased as well density increased, particularly for the density of wells within 2 and 5 miles. For example, the mean values increased from 2.5 for respondents with 0 wells within 2 miles, to 2.7 for those with 1-12 wells, and 2.8 for those with 13 or more wells within 2 miles. The values for the well density within 5 miles were 2.6, 2.4, 2.7, and 2.9 across the categories of well density, suggesting an increased likelihood of agreeing with this statement. Similarly, the perceived ability to get help from other community members diminished as well density within 2 miles (mean-values ranging from 2.3, to 2.4, and 2.6) and 5 miles (mean values of 2.4, 2.3, 2.5, and 2.6) increased. The likelihood of calling police if needed was relatively flat over well density distribution. The perception that people act with less courtesy in public places showed relatively little change across the categories of well density in 1 mile radius; there was a slight increase in mean values for those with higher levels of well density within 5 miles. However, it should be noted that these were small changes, and that with the exception of mean values for the item "people are more likely to call

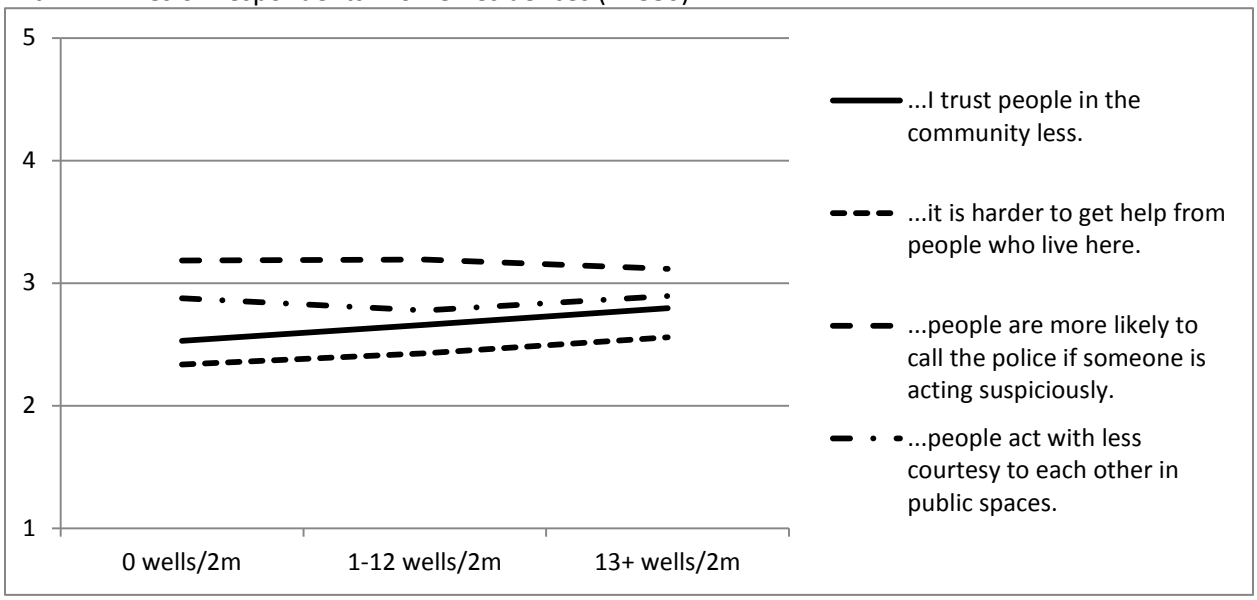
the police if someone is acting suspiciously," all the mean values remained under 3, indicating general disagreement with the statements.

Figure 9. Mean Values for Perceived Impacts to Community Inter-relationships, by Number of Wells within 1 Mile of Respondents' Home Residences (n=880)



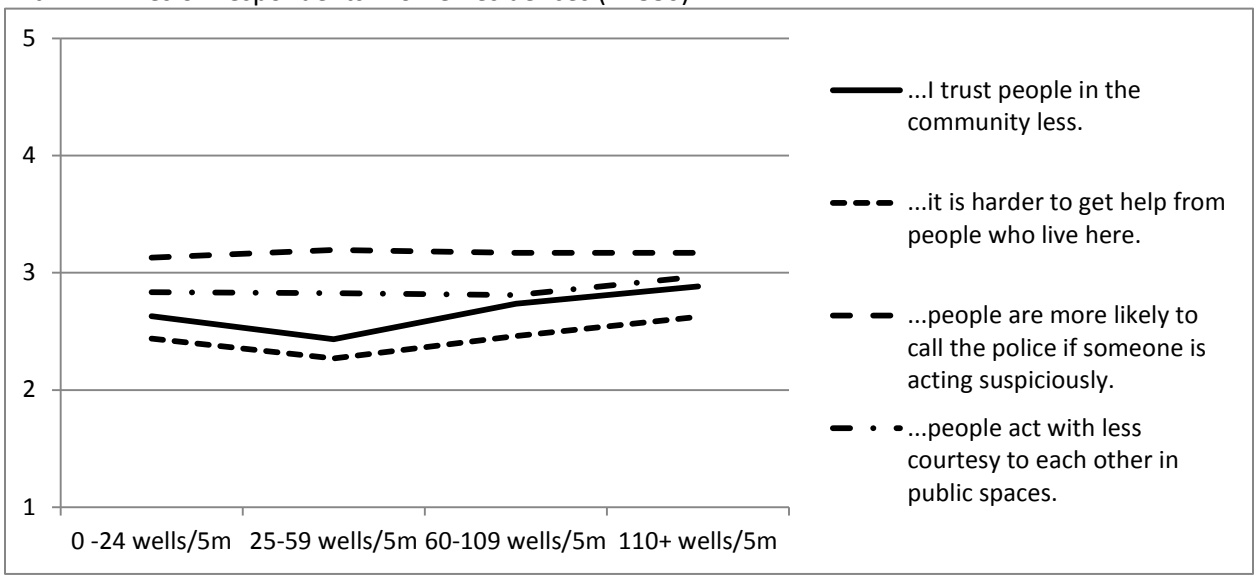
Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 10. Mean Values for Perceived Impacts to Community Inter-relationships, by Number of Wells within 2 Miles of Respondents' Home Residences (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

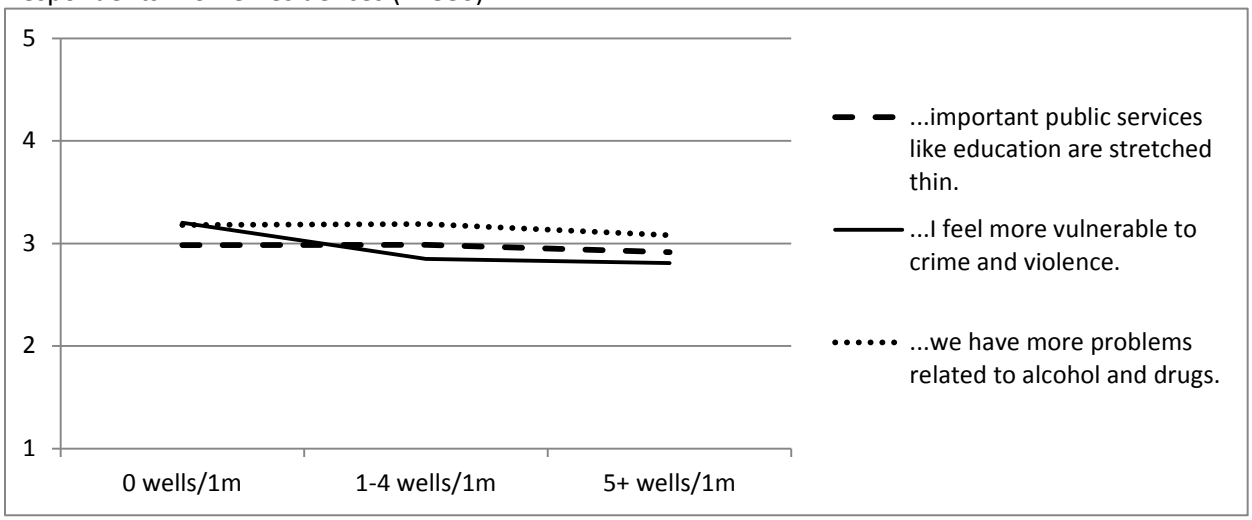
Figure 11. Mean Values for Perceived Impacts to Community Inter-relationships, by Number of Wells within 2 Miles of Respondents' Home Residences (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

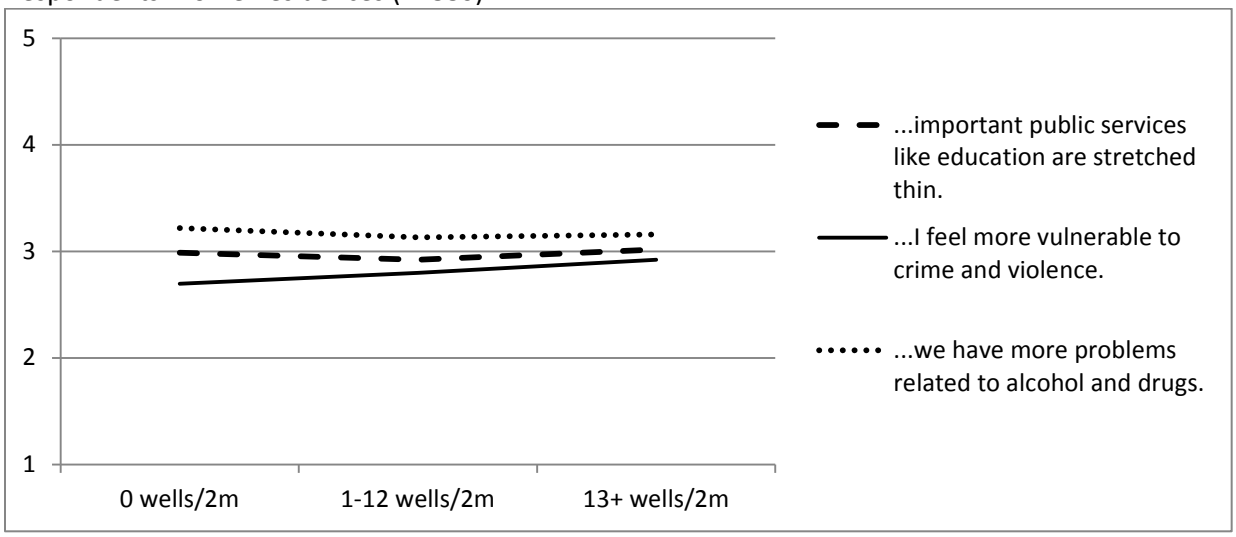
Figures 12-14 show the distribution of mean values for the survey items related to the effects of Marcellus Shale development on public services by well density. The perception that education was negatively affected by Marcellus Shale development was unchanged in relation to well density. Feelings of vulnerability to crime and violence showed an inconsistent relationship with well density. For the measure of wells within 1 mile, higher well density was associated with a decrease in the mean value, from 3.2 to 2.8, indicating more disagreement. For the number of wells within 2 miles, higher well density was associated with a slight increase in the mean value, from 2.7 to 2.9. For the number of wells within 5 miles, the highest value, 2.9, was for those respondents with 60-109 wells within 5 miles of their homes. The final item, related to perceived increases in alcohol and drugs, showed relatively little change in relation to well density for the 1- and 2-mile measures; for the 5-mile measure, the trend had a slight decrease in mean value across the well density categories, indicating that as well density increased, respondents showed slightly greater disagreement with the statement (with values from 3.3, to 3.0, to 3.2, to 3.1).

Figure 12. Mean Values for Perceived Impacts to Public Services, by Number of Wells within 1 Mile of Respondents' Home Residences (n=880)



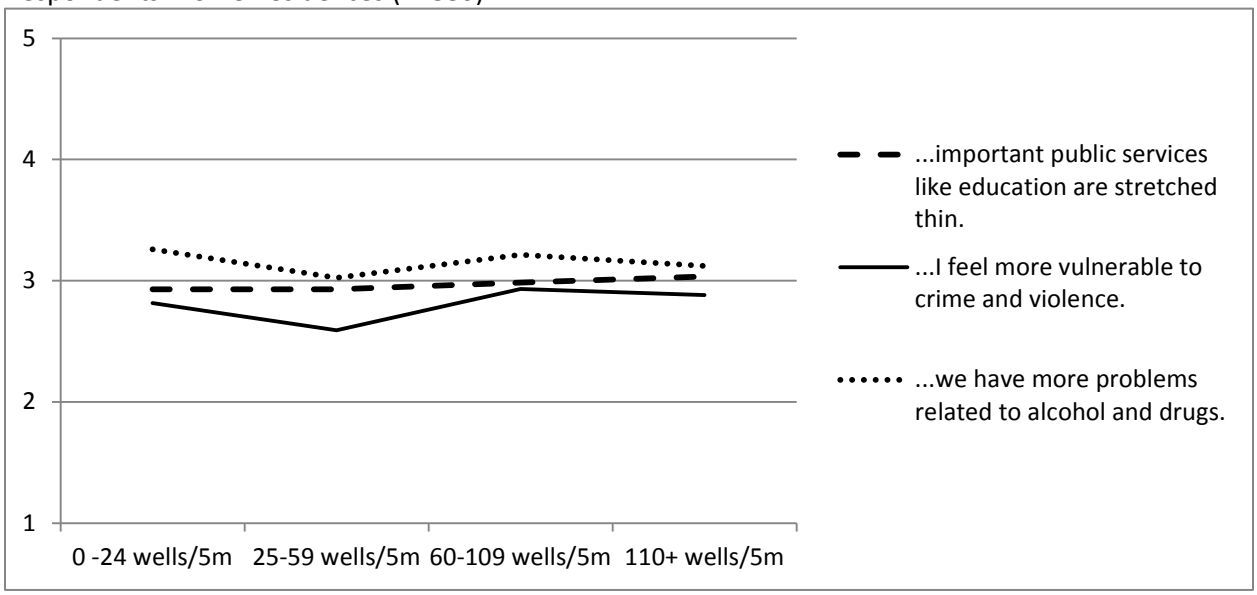
Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 13. Mean Values for Perceived Impacts to Public Services, by Number of Wells within 2 Miles of Respondents' Home Residences (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

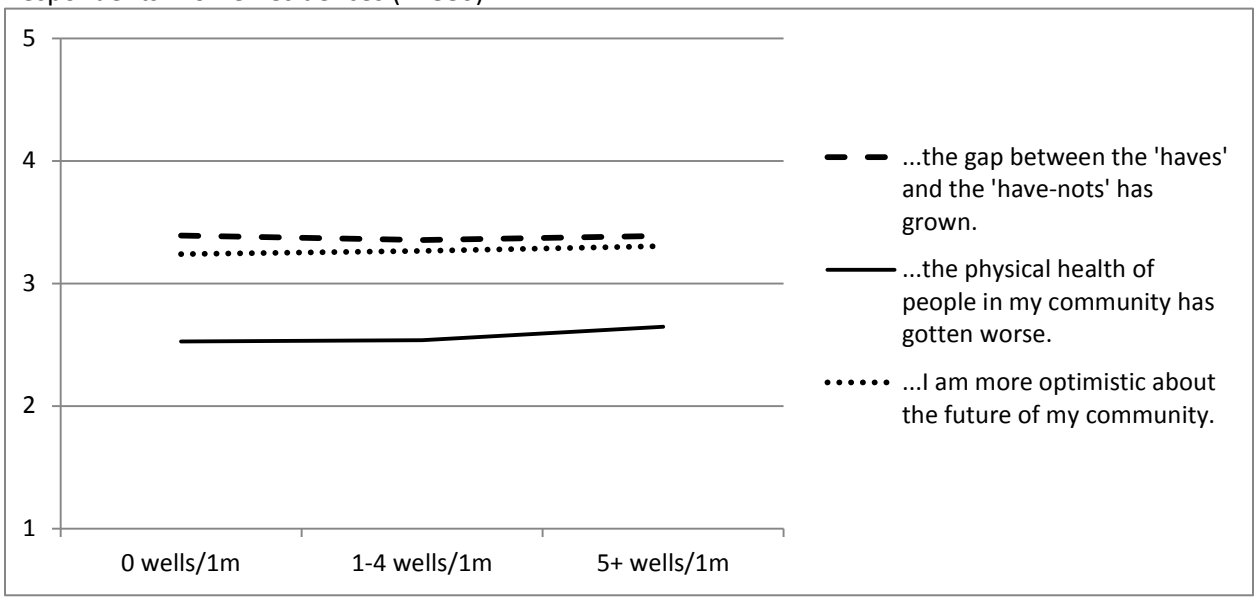
Figure 14. Mean Values for Perceived Impacts to Public Services, by Number of Wells within 5 Miles of Respondents' Home Residences (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

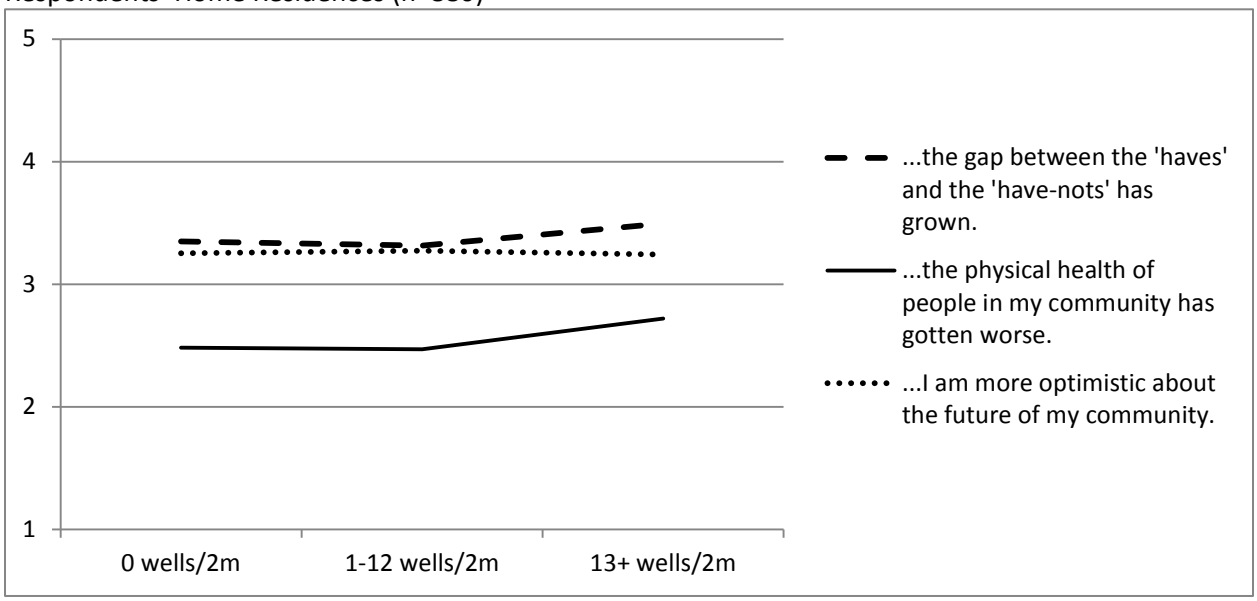
Figures 15-17 represent the distribution of mean values for the survey items related to inequality by well density. Respondents' views about inequality in relation to Marcellus Shale development were unrelated to well density within 1 mile. Concern about inequality was higher for respondents in high-density areas for the 2- and 5-mile measures. The highest mean values for the inequality statement was for respondents with the highest density of wells within 2 miles (3.5 versus 3.3 for the other categories) and for the respondents with the highest density of wells within 5 miles (3.5 in the highest two categories versus 3.3 in the lower two categories). A similar pattern was identified for the measure about physical health of people in the community. Although there was little difference in views at the 1 mile measure, higher density was associated with slightly more agreement that physical health was worse because of Marcellus Shale for respondents in the high-density categories of the 2- and 5-mile measures. Optimism about the community seemed unrelated to well density, with very similar values across all categories.

Figure 15. Mean Values for Perceived Impacts to Inequality, by Number of Wells within 1 Mile of Respondents' Home Residences (n=880)



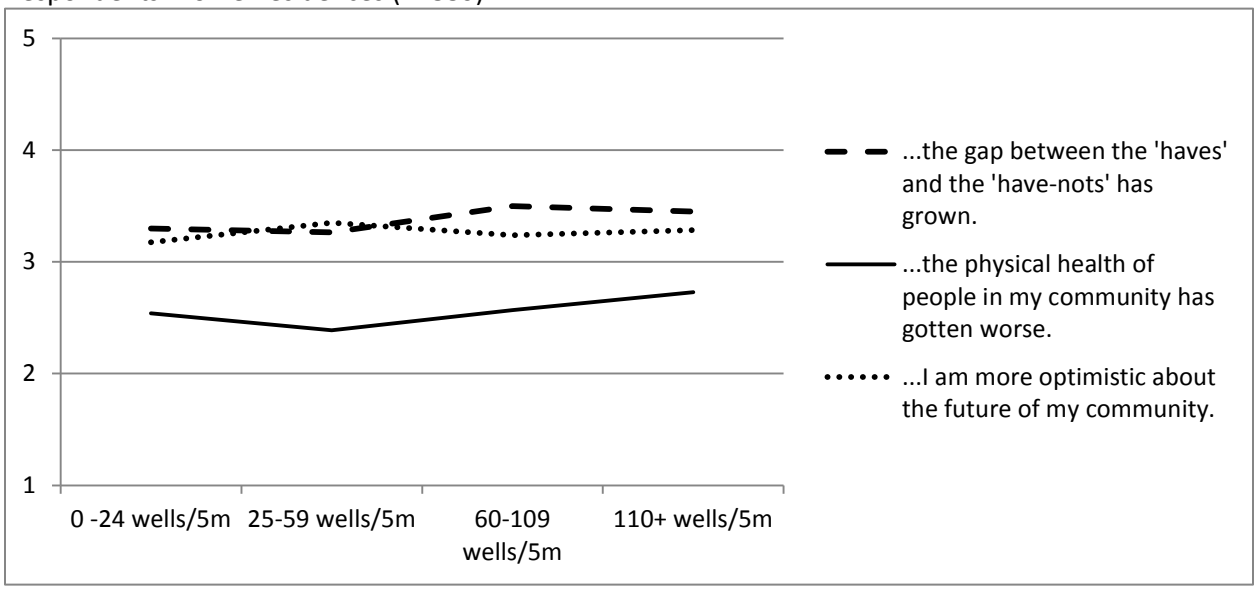
Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 =Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 16. Mean Values for Perceived Impacts to Inequality, by Number of Wells within 2 Miles of Respondents' Home Residences (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 17. Mean Values for Perceived Impacts to Inequality, by Number of Wells within 5 Miles of Respondents' Home Residences (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Perceived Community Impacts by Potential Impact Benefits (Employment with the Natural Gas Industry and Land Leasing Status)

Table 25 shows the distribution of mean values for those who can benefit economically through employment or leasing. In general, those who can benefit had more positive views of development. For example, those employed by the industry were more likely to agree that the roads were in better shape, to disagree that they trusted people less, to disagree that people acted with less courtesy, to disagree that they felt more vulnerable to crime and violence, to disagree that the community had more problems with alcohol and drugs, to disagree that inequality had increased, to disagree that the physical health of community members had become worse, and to agree that they were more optimistic about the future of the community. There were fewer large differences in means between those with and without a lease, although the general pattern of more positive views by leaseholders remains.

Table 25. Mean Values for Perceived Community Impacts, by Potential Economic Benefit (n=880)

Because of Marcellus Shale…	Employed by industry		Leasing/holds lease	
	Yes	No	Yes	No
Roads, Traffic, and Safety				
...it takes me a lot longer to drive around this area.	3.1	3.2	3.1	3.2
...the roads are in better shape after the natural gas companies fixed them.	3.7	3.2	3.6	3.0
...I get nervous when I drive in this area.	2.5	2.6	2.5	2.7
Community Inter-Relationships				
...I trust people in the community less.	2.4	2.7	2.6	2.7
...it is harder to get help from people who live here.	2.3	2.5	2.4	2.5
...people are more likely to call the police if someone is acting suspiciously.	3.1	3.2	3.1	3.2
...people act with less courtesy to each other in public spaces.	2.6	2.9	2.8	2.9
Public Services				
...important public services like education are stretched thin.	2.8	3.0	2.9	3.0
...I feel more vulnerable to crime and violence.	2.5	2.8	2.7	2.9
...we have more problems related to alcohol and drugs.	2.8	3.2	3.0	3.2
Inequality				
...the gap between the 'haves' and the 'have-nots' has grown.	3.1	3.4	3.3	3.4
Health				
...the physical health of people in my community has gotten worse.	2.2	2.6	2.4	2.7
Overall				
...I am more optimistic about the future of my community.	3.4	3.2	3.4	3.2

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Perceived Community Impacts by Rental Status, Gender, Age, and Household Income

Table 26 provides the mean value distribution across home rental status, gender, and age. Rental status was associated with only slight differences in relation to most of the community impact items. There were exceptions with four items where there was a 0.3 difference in means between renters and non-renters: people acted with less courtesy (renters mean of 3.1; non-renters of 2.8), impacts on education (renters mean of 3.2; non-renters mean of 2.9), inequality (renters mean of 3.7; non-renters mean of 3.4), and impacts on physical health (renters mean of 2.8; non-renters mean of 2.5).

Women tended to have more negative views about Marcellus Shale development. The following survey items have a difference in means of 0.3 or greater between men and women: women were more likely to agree that it took longer to drive in the area, to disagree that roads were in better shape, to agree that people acted with less courtesy, to agree that education was stretched thin, to agree that they felt more vulnerable to crime and violence, to agree that inequality has increased, and to agree that the physical health of community members has diminished. There were relatively few differences by status as a senior citizen (over age 65), with only one item showing a difference in means of 0.3 or more; respondents over age 65 were more likely to agree that they felt more vulnerable to crime and violence (3.0 for those 65 and over versus 2.7 for those under 65).

Table 26. Mean Values for Perceived Community Impacts, by Rental Status, Gender, and Age (n=880)

Because of Marcellus Shale….	Renting home[9]		Gender		Age 65+	
	Yes	No	Female	Male	Yes	No
Roads, Traffic, and Safety						
...it takes me a lot longer to drive around this area.	3.2	3.2	3.4	3.0	3.1	3.2
...the roads are in better shape after the natural gas companies fixed them.	3.1	3.2	3.1	3.4	3.4	3.2
...I get nervous when I drive in this area.	2.5	2.6	2.7	2.5	2.6	2.6
Community Inter-Relationships						
...I trust people in the community less.	2.8	2.7	2.8	2.6	2.6	2.7
...it is harder to get help from people who live here.	2.6	2.4	2.6	2.4	2.5	2.4
...people are more likely to call the police if someone is acting suspiciously.	3.2	3.2	3.2	3.1	3.2	3.1
...people act with less courtesy to each other in public spaces.	3.1	2.8	3.0	2.7	2.8	2.8
Public Services						
...important public services like education are stretched thin.	3.2	2.9	3.2	2.8	2.9	3.0
...I feel more vulnerable to crime and violence.	2.8	2.8	3.0	2.7	3.0	2.7
...we have more problems related to alcohol and drugs.	3.3	3.2	3.3	3.1	3.3	3.1
Inequality						
...the gap between the 'haves' and the 'have-nots' has grown.	3.7	3.4	3.6	3.3	3.5	3.3
Health						
...the physical health of people in my community has gotten worse.	2.8	2.5	2.8	2.4	2.6	2.5
Overall						
...I am more optimistic about the future of my community.	3.2	3.3	3.1	3.3	3.3	3.2

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Table 27 provides the means for the community impact items by household income categories.

In general, higher income household respondents had slightly more positive views of the community

[9] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

impacts of Marcellus Shale development, with a few exceptions. The means for the length of time to drive around the area were highest for those in the highest income category (mean of 3.4 for $100,000 or more) and the lowest income category (mean of 3.3 for less than $25,000), indicating higher agreement. There were no differences across income categories for the impacts on roads. Income was associated with concerns about driving in the area, as those with lower incomes expressed more agreement with this item than those in higher income categories.

A similar pattern was evident for the community inter-relationship items, with the highest means for those in the lowest income categories. Lower-income respondents were more likely to agree that they trusted people in the community less because of Marcellus Shale, that it was harder to get help from people because of Marcellus Shale, that people were more likely to call the police, and people acted with less courtesy to each other because of Marcellus Shale.

As shown in Table 27, those with lower household incomes had a more negative view on the impact of Marcellus Shale development on public services. Lower-income respondents were more likely to agree that educational institutions were negatively affected by development, that they felt more vulnerable to crime and violence, and that their community had more problems with alcohol and drugs. The same pattern held for two other community impact items. Lower income respondents were more likely to agree that inequality has increased and that physical health of community residents is worse. However, the final summative item, that Marcellus Shale development makes them more optimistic about the future of their communities, does not exhibit the same pattern. Those in the two highest income categories had the highest mean values (mean of 3.4 for $100,000 or more and a mean of 3.3 for $50,000-$99,999), followed by the lowest income category (mean of 3.2 for less than $25,000). The category of $25,000-$49,999 had the lowest mean of 3.0.

Table 27. Mean Values for Perceived Community Impacts, by Household income (n=880)

Because of Marcellus Shale….	Less than $25,000	$25,000 to $49,999	$50,000 to $99,999	$100,000 or more
Roads, Traffic, and Safety				
...it takes me a lot longer to drive around this area.	3.3	3.1	3.0	3.4
...the roads are in better shape after the natural gas companies fixed them.	3.2	3.2	3.2	3.2
...I get nervous when I drive in this area.	2.8	2.7	2.5	2.6
Community Inter-relationships				
...I trust people in the community less.	2.9	2.7	2.6	2.6
...it is harder to get help from people who live here.	2.9	2.6	2.3	2.3
...people are more likely to call the police if someone is acting suspiciously.	3.4	3.3	3.1	3.1
...people act with less courtesy to each other in public spaces.	3.1	3.1	2.7	2.8
Public Services				
...important public services like education are stretched thin.	3.2	3.0	2.9	2.9
...I feel more vulnerable to crime and violence.	3.3	3.0	2.7	2.6
...we have more problems related to alcohol and drugs.	3.5	3.3	3.0	3.1
Inequality				
...the gap between the 'haves' and the 'have-nots' has grown.	3.6	3.6	3.3	3.3
Health				
...the physical health of people in my community has gotten worse.	2.9	2.7	2.4	2.5
Overall				
...I am more optimistic about the future of my community.	3.2	3.0	3.3	3.4

Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

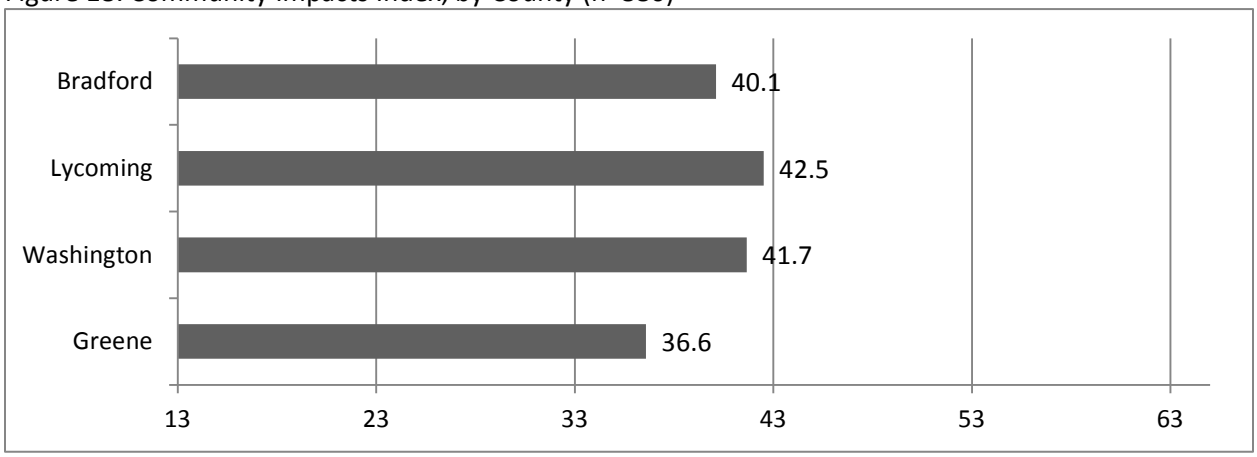
Overall Community Impacts

To further assess the community impacts as perceived by residents in the study counties, the researchers created an index that incorporated all the individual items described above. To create this index, all items were recoded so that higher values indicate more positive views of the impacts of Marcellus Shale development. This ensured that all individual survey items had the same meaning for

the response values. Second, the respondents' answers for each item were summed to create a composite index. The final Community Impacts Index has the potential for values that range from a minimum of 13 and a maximum of 65, and can be interpreted as higher values indicating that respondents view the community impacts as more positive than those with lower values. The following sections provide the mean scores for the Community Impacts Index by county, categories of well-density, natural gas industry employment and leasing status, housing tenure (renter vs. non-renter), gender, age, and household income. Significant differences across categories are noted.

As shown by Figure 18, the means for the composite index by county indicate that Lycoming County respondents had the highest mean rating for community impacts of Marcellus Shale development (42.5), followed by Washington County (41.7), Bradford County (40.1), and Greene County (36.6). In other words, Lycoming County respondents generally viewed the community impacts, across all items described above, as more positive than did respondents in the other counties. The differences between Greene and the other three counties were statistically significant ($p<.05$). The mid-point of the scale was 39; only Greene County respondents rated the community impacts below that midpoint.

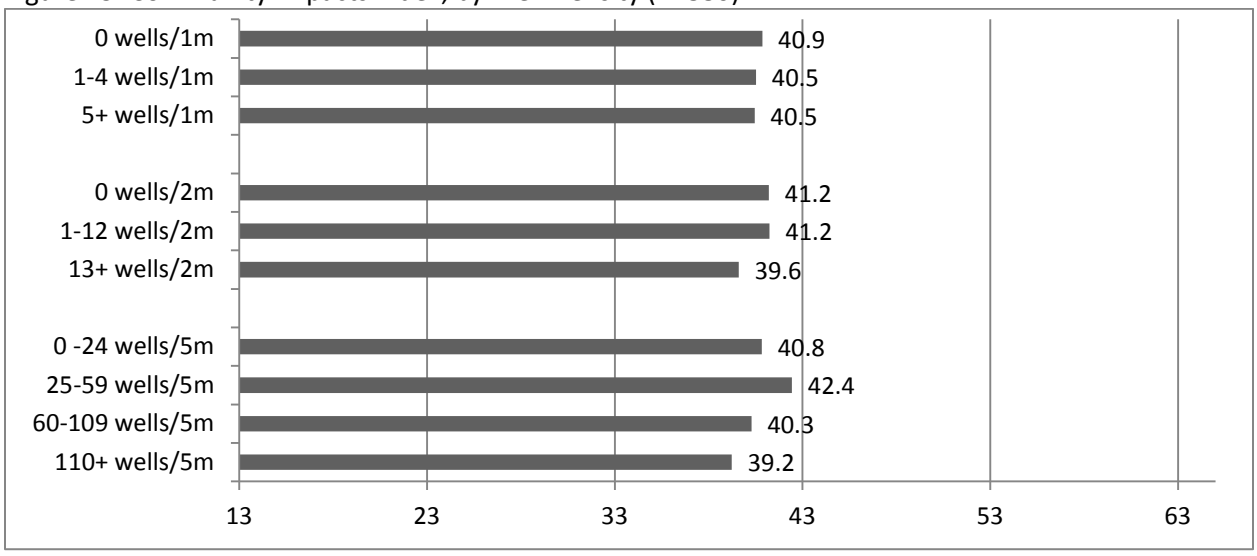
Figure 18. Community Impacts Index, by County (n=880)



Notes: Higher values indicated more positive views of impacts. Greene County mean Community Impacts Index was significantly lower ($p<0.05$) than Bradford, Lycoming, and Washington counties; Lycoming was significantly higher ($p<0.05$) than Bradford and Greene counties.

The community impacts index by well density is presented in Figure 19. Higher well densities for the 2- and 5- mile measures were associated with more negative views on the community impacts of Marcellus Shale development. Those respondents with 13 or more wells within 2 miles of their homes had a significantly lower Community Impacts Index mean than those with fewer wells near their homes. Those with 25-59 wells within 5 miles of their homes had a significantly more positive (higher mean) view of the community impacts than those with higher well densities.

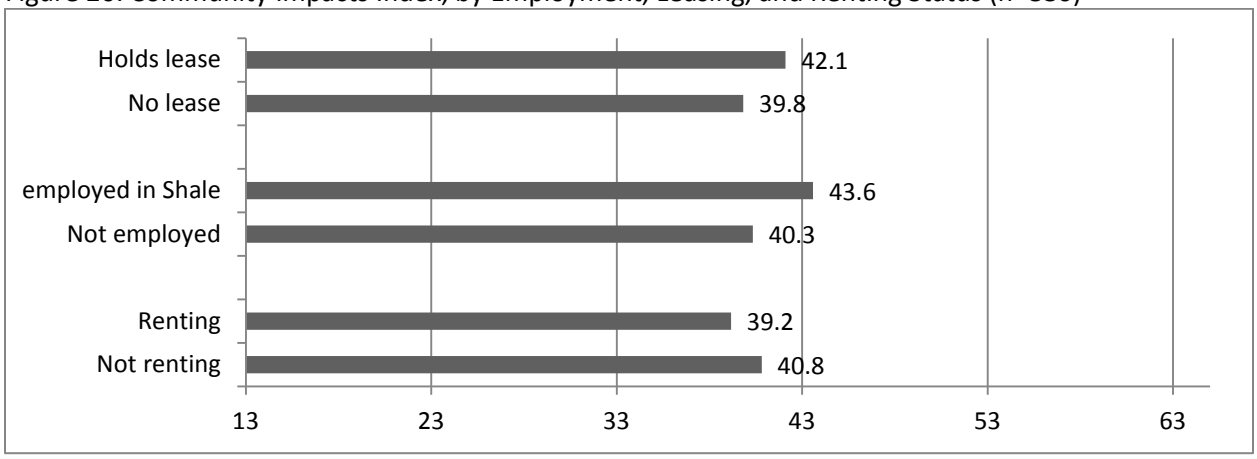
Figure 19. Community Impacts Index, by Well Density (n=880)



Notes: Higher values indicated more positive views of impacts. Those with 13 wells or more within 2 miles of their homes had a significantly ($p<.05$) lower mean Community Impacts Index value than those with 1-12 wells within 2 miles. Those respondents with 25-59 wells within 5 miles had significantly ($p<.05$) higher mean Community Impacts Index values than those with more wells (60-109 wells and 110 or more wells within 5 miles).

As shown in Figure 20, similar to the findings for the individual survey items, those who hold a lease had a significantly more positive view of the community impacts of Marcellus Shale development than those who did not have a lease; those who were employed in the natural gas industry also had significantly more positive views than those who were not employed in the industry. Those who were renting have more negative views of the community impacts of Marcellus Shale development than those who did not rent their homes, although this difference was not statistically significant.

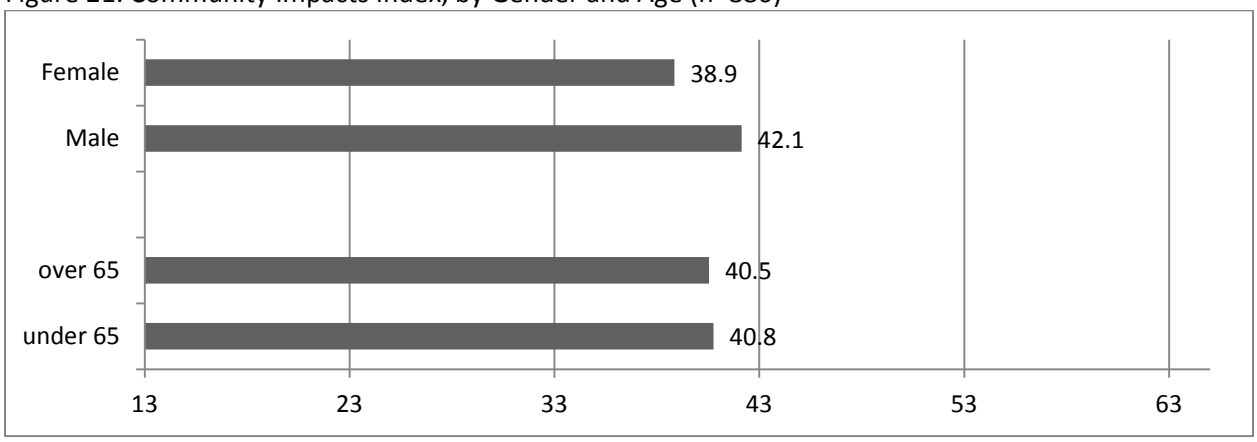
Figure 20. Community Impacts Index, by Employment, Leasing, and Renting Status (n=880)



Notes: Higher values indicated more positive views of impacts. Those who held a lease had a significantly ($p<.05$) higher mean value on the Community Impacts index than those who did not have a lease. Those who were employed in the natural gas industry had a significantly ($p< .05$) higher mean value than those who were not employed in the industry. Rental status was not significant. [10]

The community impacts index by gender and age is shown in Figure 21. Women had statistically significantly more negative views on the community impacts of Marcellus Shale development than men. There were no differences by age.

Figure 21. Community Impacts Index, by Gender and Age (n=880)

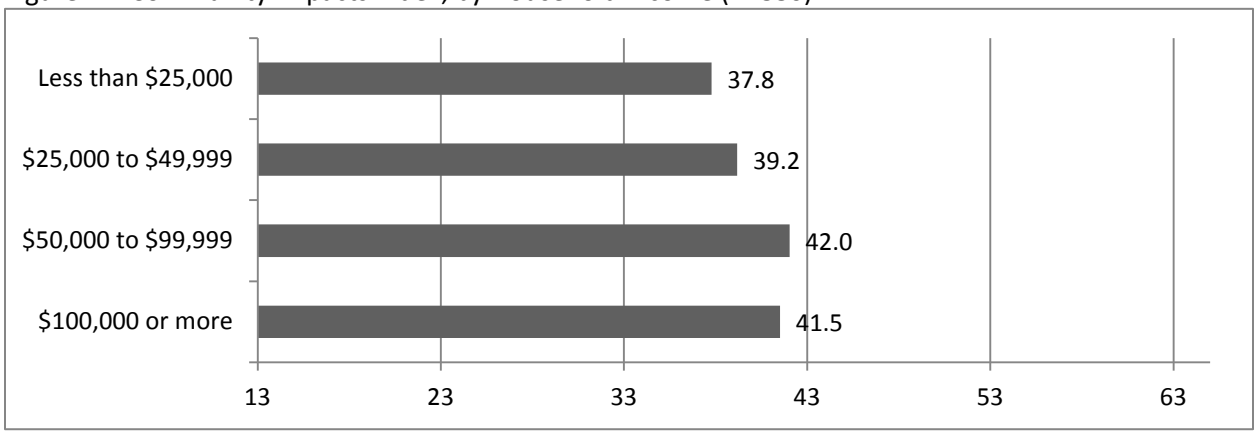


Notes: Higher values indicated more positive views of impacts. Women respondents had a significantly ($p<.05$) lower mean value on the Community Impacts index than men. Age was not statistically significant.

[10] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

Figure 22 shows the community impacts index by household income. As suggested by the individual item analysis, household income was associated with perceptions of community impacts of Marcellus Shale development. Those in the top two income categories ($50,000-$99,999 and $100,000 or more) had more positive views of the community impacts than those in the lower two categories (less than $25,000, $25,000-$49,999). These differences were statistically significant. The mean of the lowest income category, less than $25,000, was below the mid-point of the scale.

Figure 22. Community Impacts Index, by Household Income (n=880)



Notes: Higher values indicated more positive views of impacts. Those with household income of $50,000-$99,999 had a significantly ($p<.05$) higher mean value on the Community Impacts index than those with household income in lower categories (less than $25,000, between $25,000 and $49,999). Those with household income of $100,000 or more had a significantly ($p<.05$) higher mean value on the Community Impacts index than those with household income in lowest two categories (less than $25,000, between $25,000 and $49,999).

Overall Perceptions of Marcellus Shale Impacts to Communities

Respondents were asked to provide an overall assessment of the impacts of Marcellus Shale development on their household and on their community. Response options for both were “very negative impact (1),” “negative impact (2),” “neither negative nor positive impact (3),” “positive impact 4),” and “very positive impact (5).” The analyses below first present the overall response distribution and then the mean scores of each of the questions by county, categories of well density, natural gas

industry employment and leasing status, housing tenure (renter vs. non-renter), gender, age, and household income. All analyses were weighted and account for the survey's complex sampling design.

Table 28 shows the responses from the sample of the overall impact to households and communities due to Marcellus Shale development. The distribution of responses across the sample suggests that the overall impact on households had been generally neutral to positive, but that the perceived impact on the community had been more positive. The modal category for the impacts on the household is "neither negative nor positive" (40.7 percent); over one-third (38.0 percent) indicated that the overall effect on their households had been positive and one-fifth (21.3 percent) indicated that the overall effect had been negative. In contrast, about half (51.3 percent) indicate that the overall effect on the community had been positive, with about one-quarter (24.9 percent) indicating neutral impact and another quarter (23.8 percent) indicating negative impact on the community.

Table 28. Mean Values for Perceived Overall Impact to Households and Communities

	Very negative	Negative	Neither negative nor positive	Positive	Very positive
The overall effect on your household has been… (n=1,201)	6.3%	15.0%	40.74%	26.0%	12.0%
The overall effect on your community has been… (n=1,197)	4.4%	19.4%	24.9%	39.3%	12.0%

Perceived overall impact to households and communities by county is presented in Table 29. As suggested by earlier analyses, the perceived impacts on the respondents' households and communities are highest in Bradford County (3.4 and 3.5, respectively) and lowest in Greene County (3.1 and 3.2, respectively). The differences in these mean values were statistically significant.

Table 29. Mean Values for Perceived Overall Impact to Households and Communities, by County (n=880)

	Bradford	Lycoming	Washington	Greene
The overall effect on your household has been…*	3.4	3.2	3.2	3.1
The overall effect on your community has been…**	3.5	3.4	3.4	3.2

Notes: On a scale of 1 to 5, with 1=Very Negative; 3 = Neutral; and 5 = Very Positive. *The Bradford County mean value for impacts on the household was significantly ($p<.05$) higher than the other three counties. **The Greene County mean value for impacts on the community was significantly ($p<.05$) lower than the means for Bradford and Lycoming counties.

Tables 30-33 show the perceived overall impact to households and communities by well densities of number of wells within 1, 2, and 5 miles. The mean values for the perceived impacts on the household by well density measures suggested that those with 0 or fewer wells near their homes were lower than other well density categories, although only statistically significant for number of wells within 1 mile and 5 miles. For perceived community impacts, only the well density within 5 miles had statistically significant differences between the lowest category (0-24 wells within 5 miles) and the next category (25-59 wells within 5 miles).

Table 30. Mean Values for Perceived Overall Impact to Households and Communities, by Wells within 1 Mile of Respondents' Addresses (n=880)

	0 wells/1m	1-4 wells/1m	5+ wells/1m
The overall effect on your household has been…*	3.2	3.4	3.3
The overall effect on your community has been…	3.4	3.4	3.5

Notes: On a scale of 1 to 5, with 1=Very Negative; 3 = Neutral; and 5 = Very Positive. *The mean value for impacts on the household for respondents with 0 wells within 1 mile of their homes was significantly ($p<.05$) lower than those with 1-4 wells within 1 mile.

Table 31. Mean Values for Perceived Overall Impact to Households and Communities, by Wells within 2 Miles of Respondents' Addresses (n=880)

	0 wells/2m	1-12 wells/2m	13+ wells/2m
The overall effect on your household has been…	3.1	3.3	3.2
The overall effect on your community has been…	3.3	3.5	3.3

Notes: On a scale of 1 to 5, with 1=Very Negative; 3 = Neutral; and 5 = Very Positive.

Table 32. Mean Values for Perceived Overall Impact to Households and Communities, by Wells within 5 Miles of Respondents' Addresses (n=880)

	0 -24 wells/5m	25-59 wells/5m	60-109 wells/5m	110+ wells/5m
The overall effect on your household has been…*	3.1	3.3	3.3	3.2
The overall effect on your community has been…**	3.3	3.5	3.4	3.4

Notes: On a scale of 1 to 5, with 1=Very Negative; 3 = Neutral; and 5 = Very Positive. *The mean value for impacts on the household for respondents with 0-24 wells within 5 miles of their homes was significantly ($p<.05$) lower than those with 60-109 wells within 5 miles. **The mean value for impacts on the community for respondents with 0-24 wells within 5 miles of their homes was significantly ($p<.05$) lower than those with 25-59 wells within 5 miles.

Table 33 shows the perceived impacts to households and communities by employment, leasing and renting status. Not surprisingly, employment in the industry and having a lease were both associated with more positive impacts on both the household and the community. These differences were statistically significant.

Table 33. Mean Values for Perceived Overall Impact to Households and Communities, by Employment, Leasing Status (n=880)

	Employed by industry		Leasing/holds lease	
	Yes	No	Yes	No
The overall effect on your household has been…*	3.9	3.2	3.7	3.0
The overall effect on your community has been…**	3.8	3.4	3.7	3.2

Notes: On a scale of 1 to 5, with 1=Very Negative; 3 = Neutral; and 5 = Very Positive. *The mean value for impacts on the household for respondents employed in the natural gas industry was significantly ($p<.05$) higher than those not employed in the industry. The mean value for impacts on the household for respondents with a lease was significantly ($p<.05$) higher than those without a lease. Rental status was not significant. **The mean value for impacts on the community for respondents employed in the natural gas industry was significantly ($p<.05$) higher than those not employed in the industry. The mean value for impacts on the household for respondents with a lease was significantly ($p<.05$) higher than those without a lease.

The perceived overall impact to households and communities by rental status, gender, and age is shown in Table 34. Respondents who rent have no differences in means from those who do not rent, at either the household or the community level. Men reported statistically significantly more positive impacts than women on both the household and community effects, having mean of 3.4 for household

effects and 3.5 for community effects. Differences among age categories were not statistically significant.

Table 34. Mean Values for Perceived Overall Impact to Households and Communities, by Gender and Age (n=880)

	Renting home[11]		Gender		Age 65+	
	Yes	No	Female	Male	Yes	No
The overall effect on your household has been…*	3.2	3.2	3.1	3.4	3.3	3.2
The overall effect on your community has been…**	3.3	3.4	3.2	3.5	3.5	3.4

Notes: On a scale of 1 to 5, with 1=Very Negative; 3 = Neutral; and 5 = Very Positive. *Men had a significantly ($p<.05$) higher mean value for perceived effects on the household and the community. Rental status was not significant. Age was not significant.

Table 35 presents the perceived overall impacts to households due to Marcellus Shale development by income. Income was significantly related to perceived impacts on the household, as those in the two higher income categories ($50,000-$99,999 and over $100,000) had higher means (3.3 and 3.4, respectively) than those in the lower two categories (3.0 for less than $25,000; 3.1 or $25,000-$49,999). A similar pattern was identified for impacts on the community, although these were not statistically significant differences.

Table 35. Mean Values for Perceived Overall Impact to Households and Communities, by Income (n=880)

	Less than $25,000	$25,000 to $49,999	$50,000 to $99,999	$100,000 or more
The overall effect on your household has been…*	3.0	3.1	3.3	3.4
The overall effect on your community has been…	3.3	3.3	3.5	3.5

Notes: On a scale of 1 to 5, with 1=Very Negative; 3 = Neutral; and 5 = Very Positive. *Respondents with household income of $100,000 or more and those with incomes of $50,000-$99,999 had significantly ($p<.05$) higher mean values for perceived effects on the household than the two lowest income categories (less than $25,000, $25,000-$49,999).

[11] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

Overall Support and Opposition to Marcellus Shale Development

The final summary question asked respondents to describe their overall level of support or opposition for Marcellus Shale development. Answer categories were based on a 5-point Likert scale, which included strongly oppose (1), oppose (2), neither oppose nor support (3), support (4), and strongly support (5). The analyses below first present the overall response distribution and then the mean scores of each of the questions by county, categories of well density, natural gas industry employment and leasing status, housing tenure (renter vs. non-renter), gender, age, and household income.

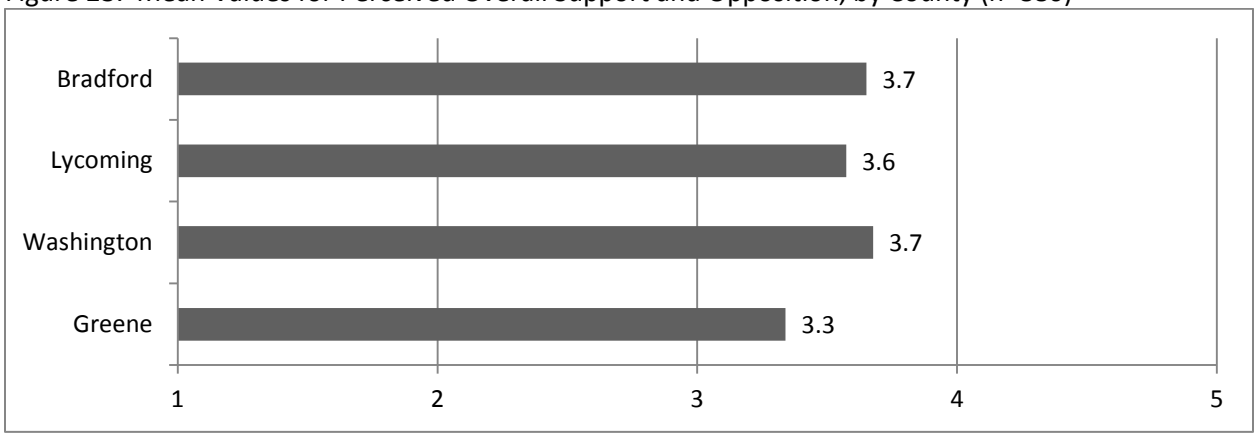
As shown in Table 36, the majority of all respondents (59.2 percent) supported Marcellus Shale development (31.2 percent indicating support and 28.0 percent indicating strong support); and less than one-quarter (22.7 percent) indicated opposition (13.1 percent indicating opposition and 9.6 percent indicating strong opposition).

Table 36. Overall Support and Opposition to Marcellus Shale Development

	Strongly oppose	Oppose	Neither oppose nor support	Support	Strongly support
To what extend to you oppose or support Marcellus Shale development? (n=1,191)	9.6%	13.1%	19.1%	31.2%	28.0%

Figure 23 shows overall support and opposition to development by county. Greene County respondents had the (statistically significant) lowest mean of the four counties; note though that the mean of 3.3 is slightly above the neutral category of 3.0, indicating a tendency toward support.

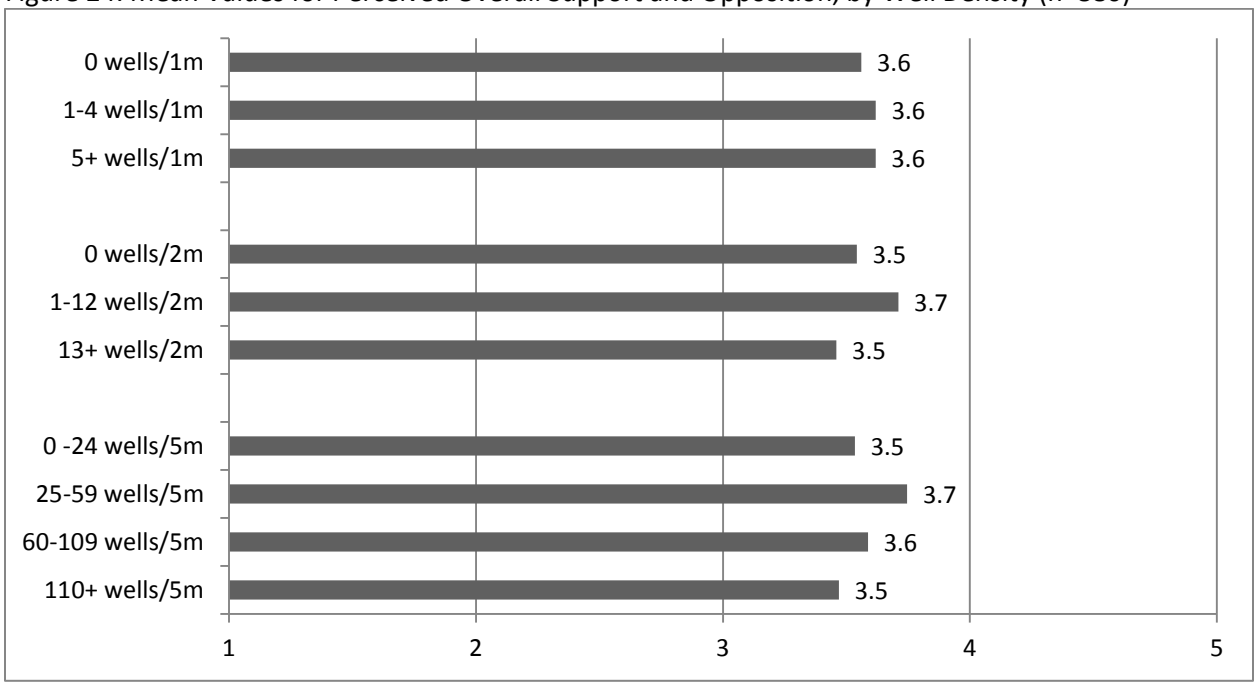
Figure 23. Mean Values for Perceived Overall Support and Opposition, by County (n=880)



Notes: On a scale of 1 to 5, with 1=Strongly Oppose; 3 = Neutral; and 5 = Strongly Support. Greene County respondents had a significantly ($p<.05$) lower mean value in their support/opposition of Marcellus Shale development than Bradford and Lycoming county respondents.

Figure 24 presents overall support and opposition to Marcellus Shale development by well density and indicates that well density has relatively little relationship with support/opposition for Marcellus Shale development. However, those with 1-12 wells within 2 miles of their homes have a statistically significantly higher mean than those with 13 or more wells within 2 miles of their homes. Those with 25-59 wells within 5-miles have a similar mean value (3.7) and the highest mean for categories of well density within 5 miles, but the differences for this measure of well density are not statistically significant.

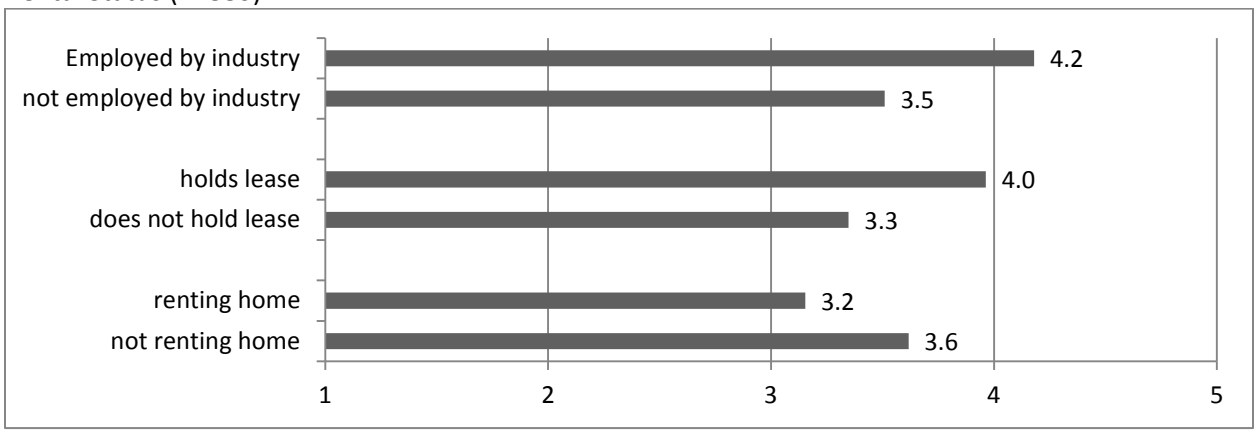
Figure 24. Mean Values for Perceived Overall Support and Opposition, by Well Density (n=880)



Notes: On a scale of 1 to 5, with 1=Strongly Oppose; 3 = Neutral; and 5 = Strongly Support. Respondents with 1-12 wells within 2 miles of their homes had a significantly ($p<.05$) higher mean value than those with 13 or more wells within 2 miles of their homes. No other statistically significant differences were found.

Figure 25 shows that the patterns for employment, leasing status, and rental status followed those of previous analyses. Those employed in the industry, those who had a lease, and those who were not renting their homes were more likely to support development. The mean for those employed in the industry was 4.2 and for those holding a lease was 4.0, significantly higher than those who were not employed (3.5) and who did not hold a lease (3.3).

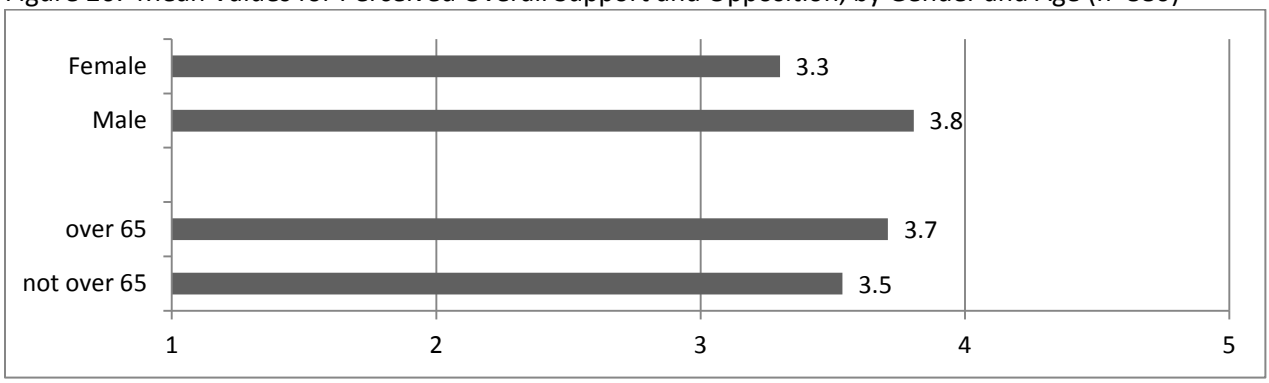
Figure 25. Mean Values for Perceived Overall Support and Opposition by Employment, Leasing, and Rental Status (n=880)



Notes: On a scale of 1 to 5, with 1=Strongly Oppose; 3 = Neutral; and 5 = Strongly Support. Respondents employed in the industry had a significantly (p<.05) higher mean value than those not employed in the industry. Those respondents who had a lease have a significantly (p<.05) higher mean value than those who did not have a lease. Those respondents who rent their homes had a significantly (p<.05) lower value than those who do not rent their homes. [12]

Figure 26 presents overall support and opposition by gender and age. Men were more supportive of Marcellus Shale development (mean of 3.8) than women (mean of 3.3), a difference that was statistically significant. No statistical differences were found for those under and over age 65, although older respondents did have a slightly higher mean (3.7 versus 3.5).

Figure 26. Mean Values for Perceived Overall Support and Opposition, by Gender and Age (n=880)

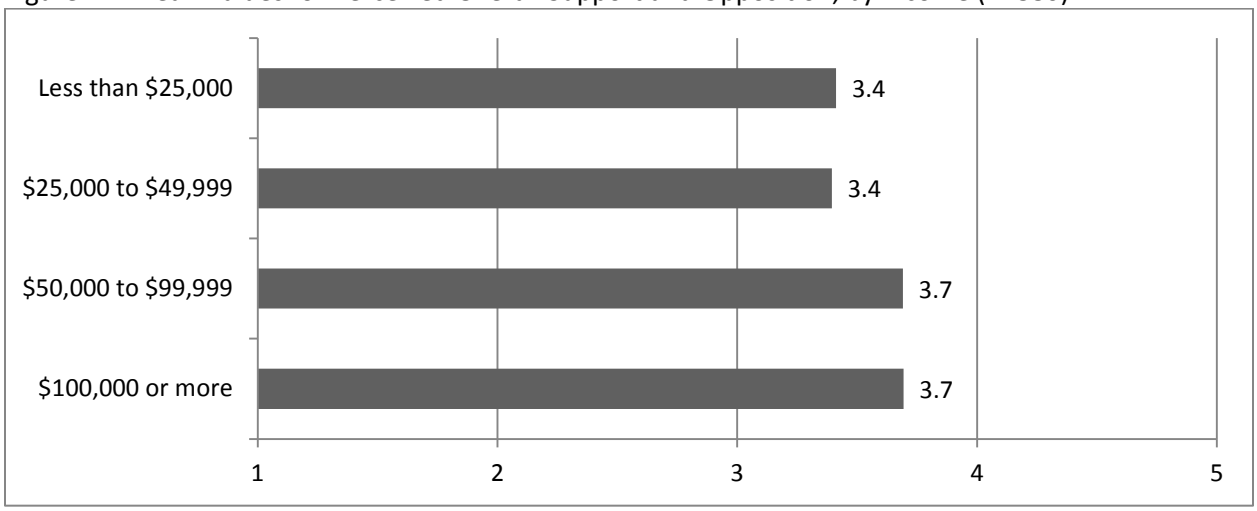


Notes: On a scale of 1 to 5, with 1=Strongly Oppose; 3 = Neutral; and 5 = Strongly Support. Female respondents had a significantly (p<.05) lower mean value than male respondents.

[12] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

Support and opposition by income categories are shown in Figure 27. Higher income residents were more supportive of Marcellus Shale development than those in lower income residents, with statistically significant differences between the two middle categories ($25,000-$49,999 and $50,000-$99,999).

Figure 27. Mean Values for Perceived Overall Support and Opposition, by Income (n=880)



Notes: On a scale of 1 to 5, with 1=Strongly Oppose; 3 = Neutral; and 5 = Strongly Support. Respondents with household incomes of $50,000-$99,999 had a significantly ($p<.05$) higher mean value than those with household incomes of $25,000-$49,999.

Perceived Environmental Impacts

This section reports the survey responses to questions regarding perceived environmental impacts of Marcellus Shale development. Respondents were asked to express how strongly they agree or disagree with a series of statements regarding the impacts of Marcellus Shale gas drilling activities on environmental amenities. Reponses were recorded on a 5-point Likert scale, which included: strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5). As a score of 3 indicates neutrality, an average score above 3 shows respondents tended to agree with the statement, a score of less than 3 shows respondents tended to disagree with the statement, and a score near to 3 indicates that respondents were mostly neutral.

Table 37 shows the distribution of responses to the statements regarding environmental impacts from Marcellus Shale Development. Responses were more likely to be neutral or in disagreement with the statement, however, there was some variation among the responses to different statements. Regarding the statement "I find it harder to do the outdoor activities I enjoy," nearly 60 percent disagreed or strongly disagreed with this statement. By contrast, the sample was split with regards to the statement "the landscape of this area has been spoiled," as nearly 42 percent disagreed or strongly disagreed and just over 42 percent agreed or strongly agreed. Regarding the statement, "the quality of my drinking water is worse," respondents were slightly more likely to disagree or strongly disagree (51.7 percent) although 29.5 percent were also neutral. In response to the statement, "water quality of streams and rivers in this area has worsened," over one quarter (26.9 percent) of respondents were neutral, although more respondents responded in disagreement (40.4 percent) than with agreement to the statement (32.9 percent). Finally, in response to the statement, "air quality in this area has worsened," 31 percent of respondents were neutral and 46.4 percent disagreed or strongly disagreed, while 22.6 percent responded they either agreed or strongly agreed.

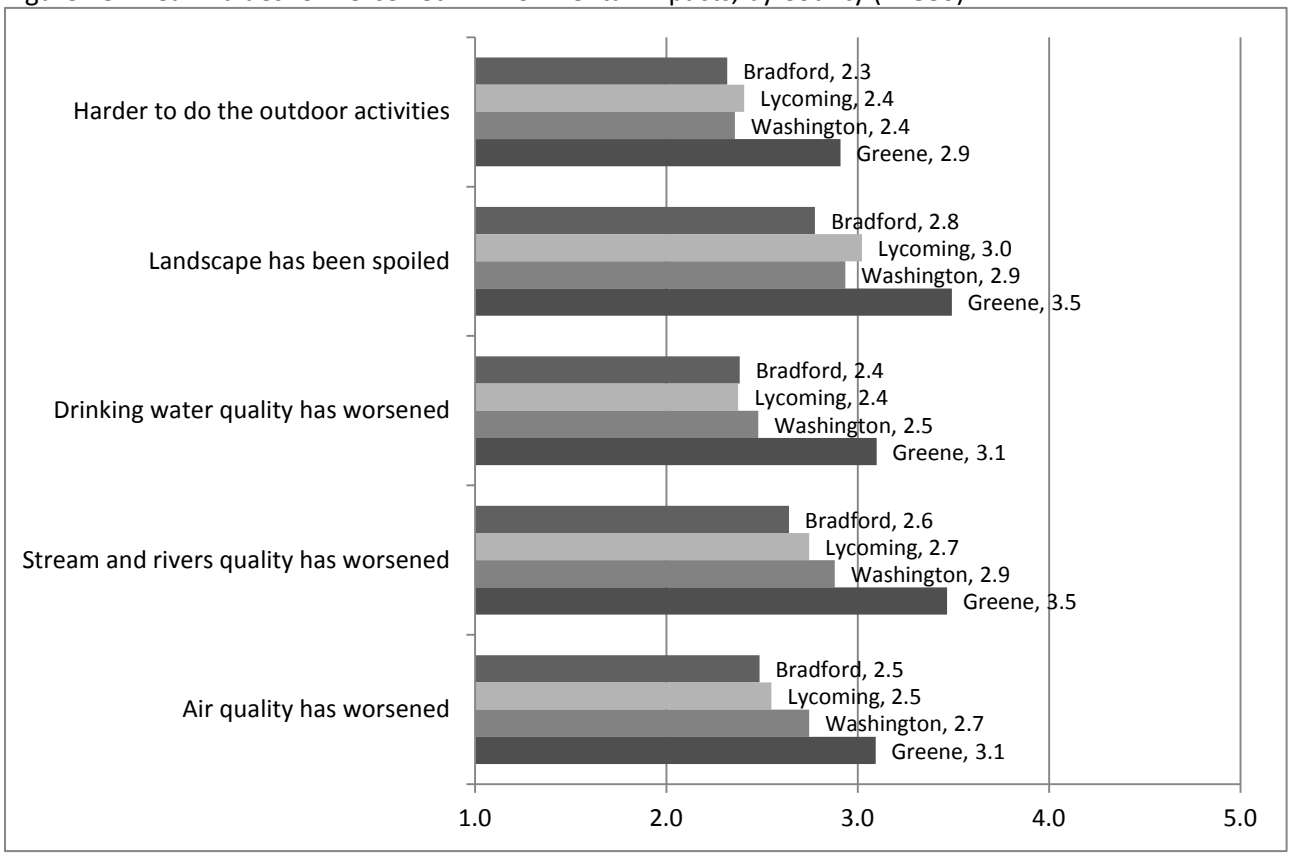
Table 37. Distribution of Responses to Statements Regarding Environmental Impacts from Marcellus Shale Development

Because of Marcellus Shale Development…	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
…I find it harder to do the outdoor activities I enjoy. (N= 1,215)	18.7%	41.8%	21.0%	12.3%	6.2%
…the landscape of this area has been spoiled. (N=1,217)	14.8%	27.1%	17.4%	24.5%	16.2%
…the quality of my drinking water is worse. (N=1,216)	18.4%	33.3%	29.5%	11.1%	7.7%
…water quality of streams and rivers in this area has worsened. (N=1,212)	12.9%	27.5%	26.9%	20.0%	12.9%
…air quality in this area has worsened. (N=1,218)	14.9%	31.5%	31.0%	14.0%	8.6%

Variation in Environmental Attitudes by County

Bivariate analysis was conducted to determine if there was variation in perceptions of environmental impact between counties. The responses to the five statements are presented in Figure 28. When comparing the four counties, Greene County stands out as having the highest scores, indicating that respondents were more likely to agree with statements that Marcellus Shale development has harmed their experience of environmental amenities. However, no mean score was less than 2 or higher than 4, indicating that perceptions hovered around the score of neutral on average.

Figure 28. Mean Values for Perceived Environmental Impacts, by County (n=880)

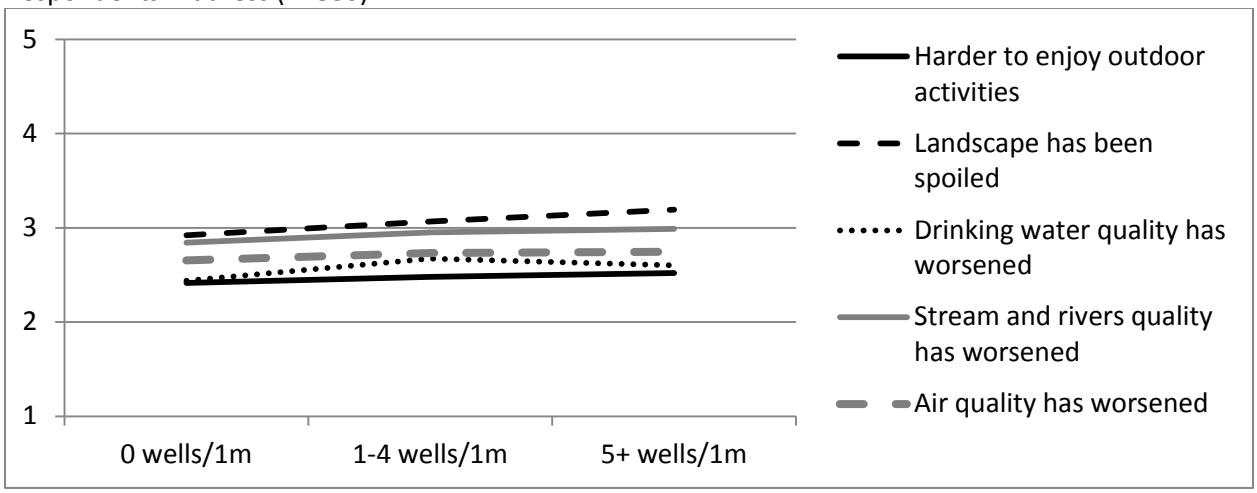


Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Environmental Attitudes by Well Density

Figures 29-31 present the results of the survey questions regarding the perceived environmental impacts from Marcellus Shale development by well density. Bivariate analysis was conducted to determine if there was variation in perceptions of environmental impact according to number of wells within 1 mile of their property and is presented in Figure 29. Respondents living in areas with greater well density were slightly more likely to agree that Marcellus Shale development has had a negative impact on environmental amenities. However, the scores did not rise above the neutral score of 3, with one exception of the variable measuring whether or not respondents perceived that the landscape had been spoiled.

Figure 29. Mean Values for Perceived Environmental Impacts, by Number of Wells within 1 Mile of Respondents' Address (n=880)

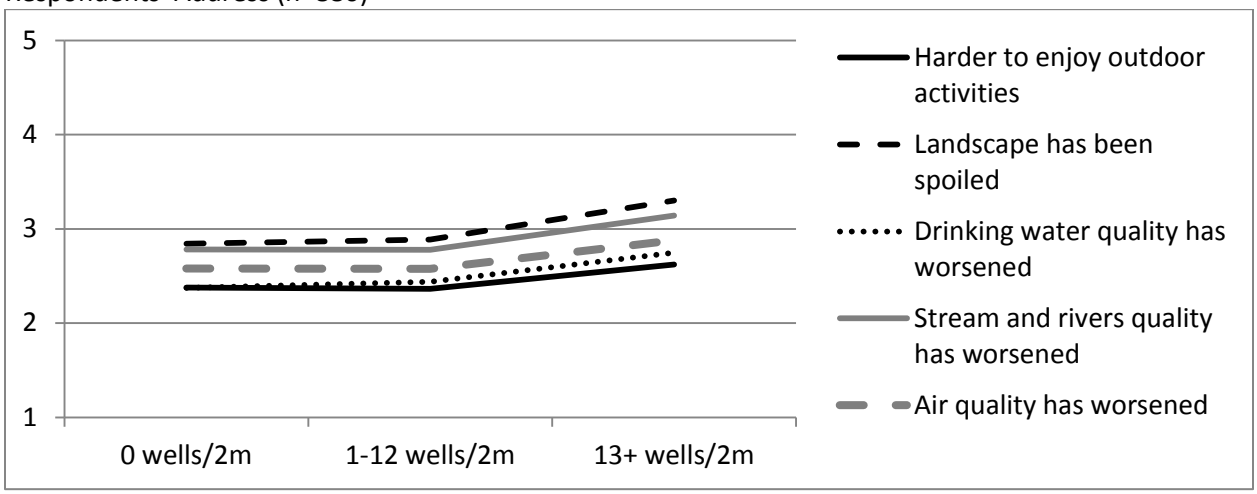


Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Bivariate analysis was conducted to determine if there was variation in perceptions of environmental impacts according to number of gas wells within 2 miles of respondents' residences. The results are presented in Figure 30. Respondents with 13 or more wells within 2 miles of their residences had higher means across all the individual items, indicating greater agreement in the perception that

environmental quality had worsened because of Marcellus Shale development across multiple amenities (recreation, landscape, water, air).

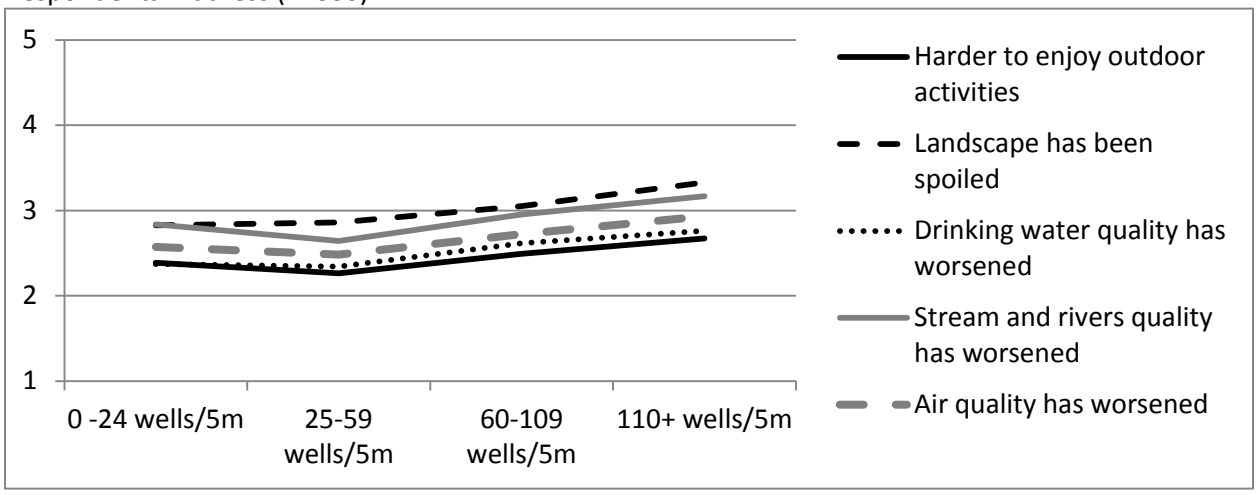
Figure 30. Mean Values for Perceived Environmental Impacts, by Number of Wells within 2 Miles of Respondents' Address (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Bivariate analysis was conducted to determine if there was variation in perceptions of environmental impacts according to number of gas wells within 5 miles of respondents' residences as shown in Figure 31. Similar to the earlier results, respondents with the highest number of wells (110+ wells) within 5 miles of their residences were slightly more likely to agree with the statements that the Marcellus activities were negatively affecting environmental amenities. The pattern was not linear. Respondents with 25-59 wells within 5 miles of their homes had the lowest scores among the categories, suggesting the least perceived impacts. However, there was a pattern of higher scores as density increases.

Figure 31. Mean Values for Perceived Environmental Impacts, by Number of Wells within 5 Miles of Respondents' Address (n=880)

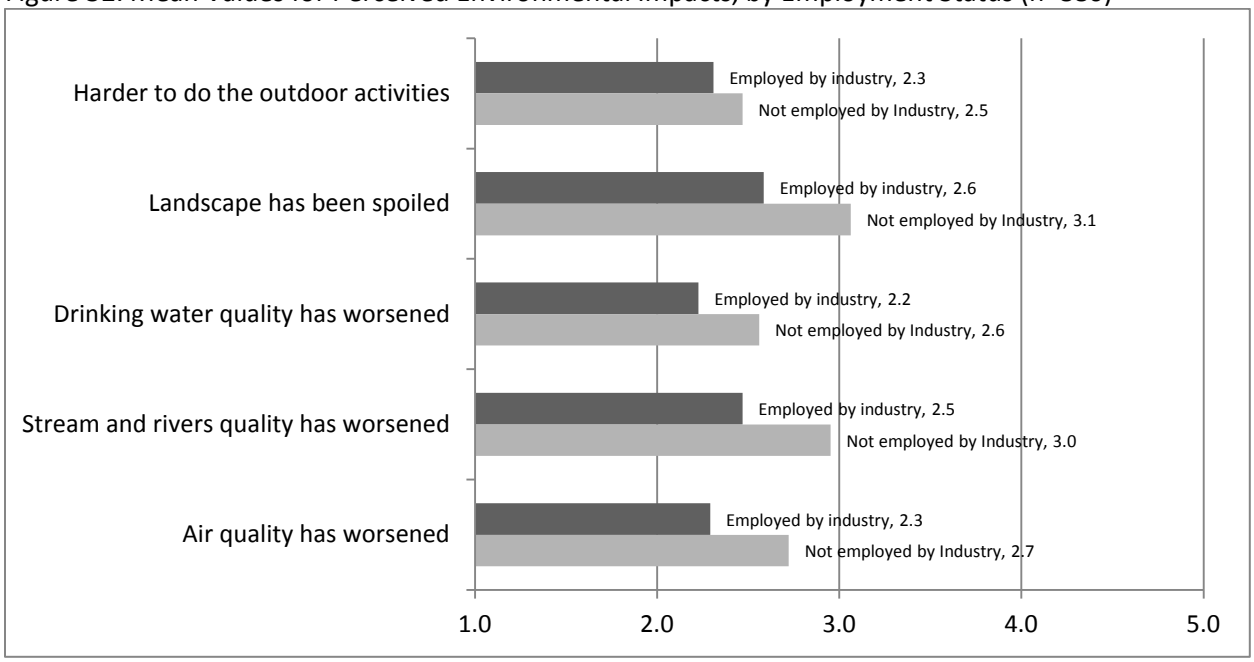


Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Environmental Attitudes by Employment with Natural Gas Industry and Land Leasing Status

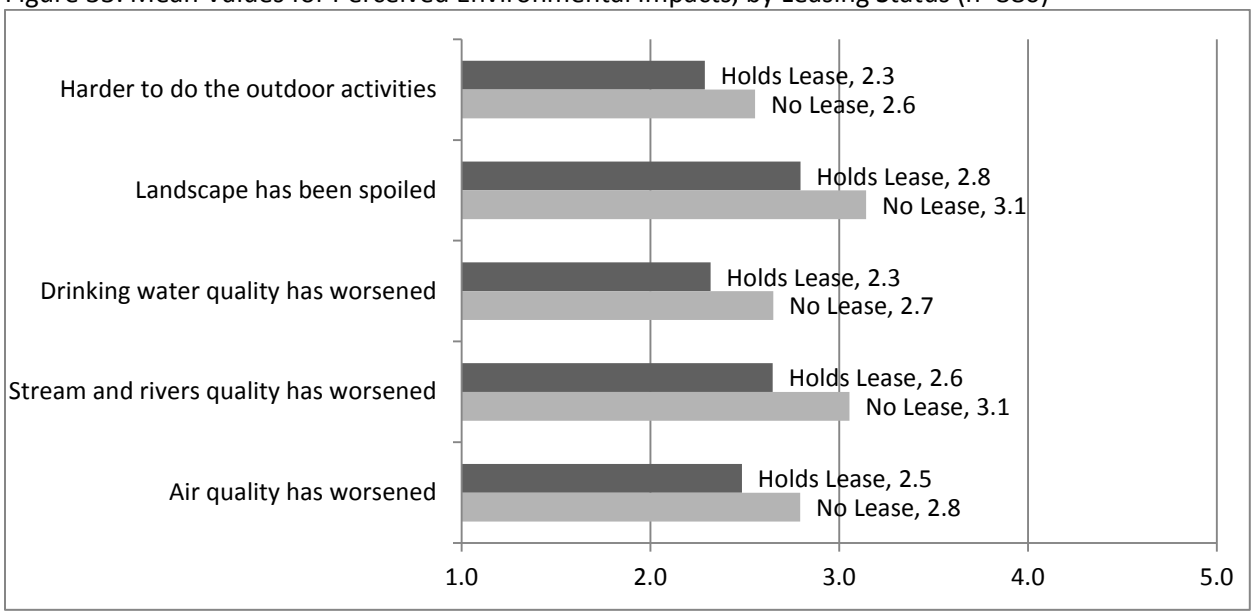
Bivariate analysis was conducted to determine if there was variation in perceptions of environmental impacts according to whether or not the respondents were employed in the gas industry or if they held a lease on property containing a well. Shown in Figures 32-33, respondents who were not employed by the industry had higher means than those who were employed on statements that Marcellus Shale activities have negative impacts on environmental amenities. Similarly, those who did not have a lease were more likely than those who did have a lease to agree with the statements that Marcellus Shale activities have negative impacts on environmental amenities.

Figure 32. Mean Values for Perceived Environmental Impacts, by Employment Status (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 33. Mean Values for Perceived Environmental Impacts, by Leasing Status (n=880)

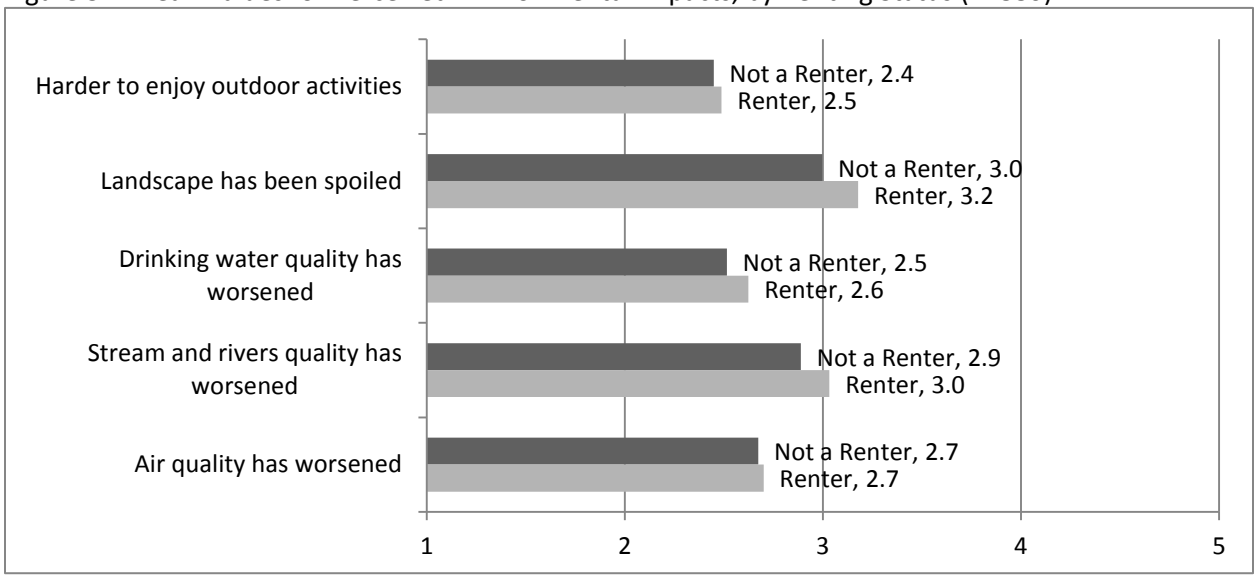


Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Environmental Attitudes by Renting Home, Gender, and Age

Bivariate analysis was conducted to determine if there was variation in perceptions of environmental impacts according to whether the respondents were renting, male or female, and 65 years of age or older. Figures 34-36 show these results. Renting respondents, females, and older residents had slightly higher scores than homeowners, males, and younger residents. Females were more likely than males to think that Marcellus Shale activities have been detrimental to environmental amenities.

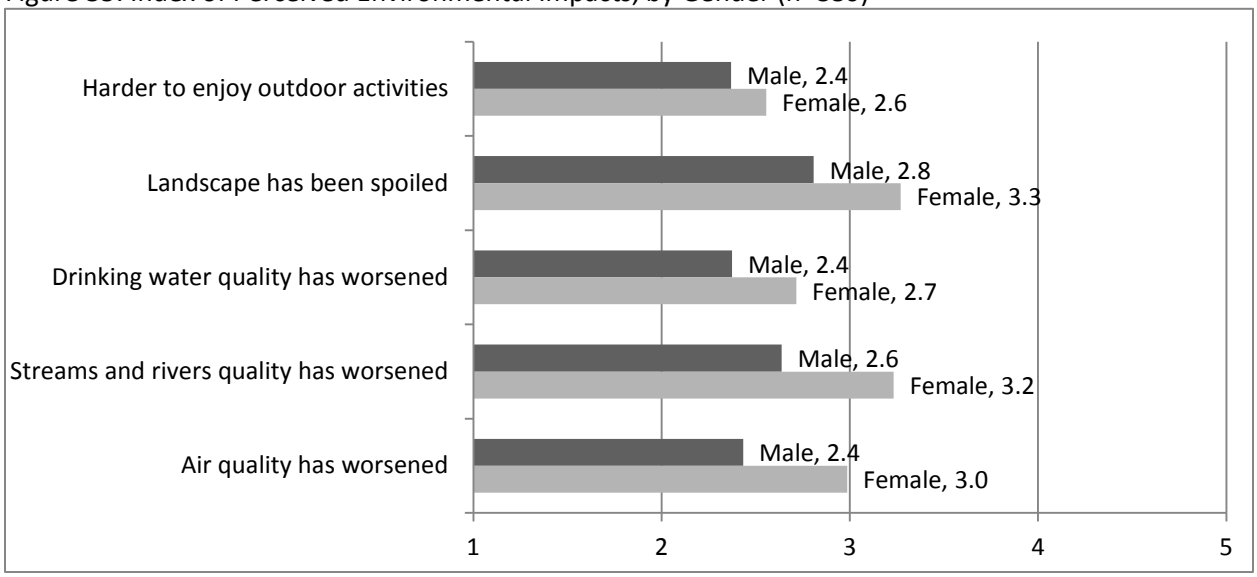
Figure 34. Mean Values for Perceived Environmental Impacts, by Renting Status (n=880) [13]



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

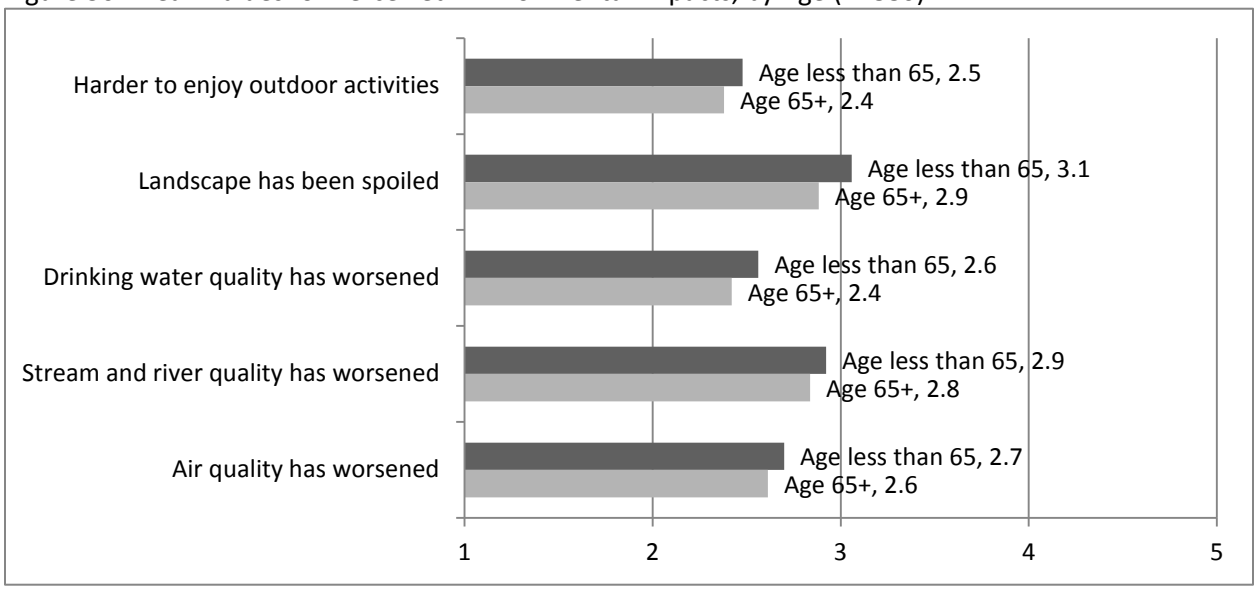
[13] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

Figure 35. Index of Perceived Environmental Impacts, by Gender (n=880)



Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Figure 36. Mean Values for Perceived Environmental Impacts, by Age (n=880)



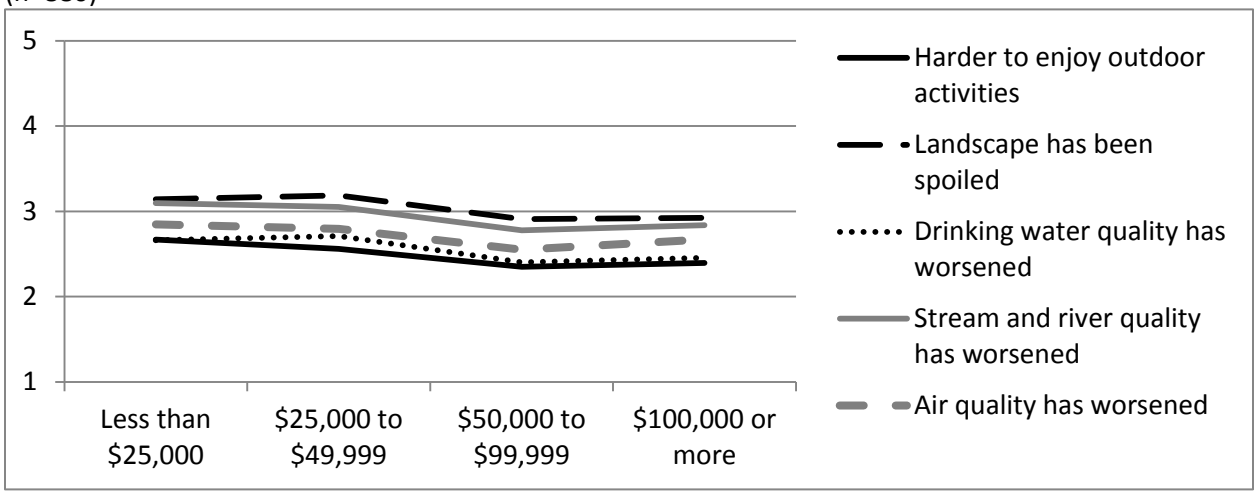
Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Variation in Environmental Attitudes by Income

Bivariate analysis was conducted to determine variation in perceptions of environmental impacts according to income. The results are presented in Figure 37. Incomes were condensed into four

categories to make interpretation more straightforward. In general, scores decreased as income increased, meaning that respondents with the highest incomes were more likely to disagree with the statements that Marcellus activity was harming environmental amenities. Respondents in the $50,000 to $99,999 income range tended to have the lowest scores.

Figure 37. Mean Values for Perceived Environmental Impacts, by Income Quartiles (in Thousands) (n=880)



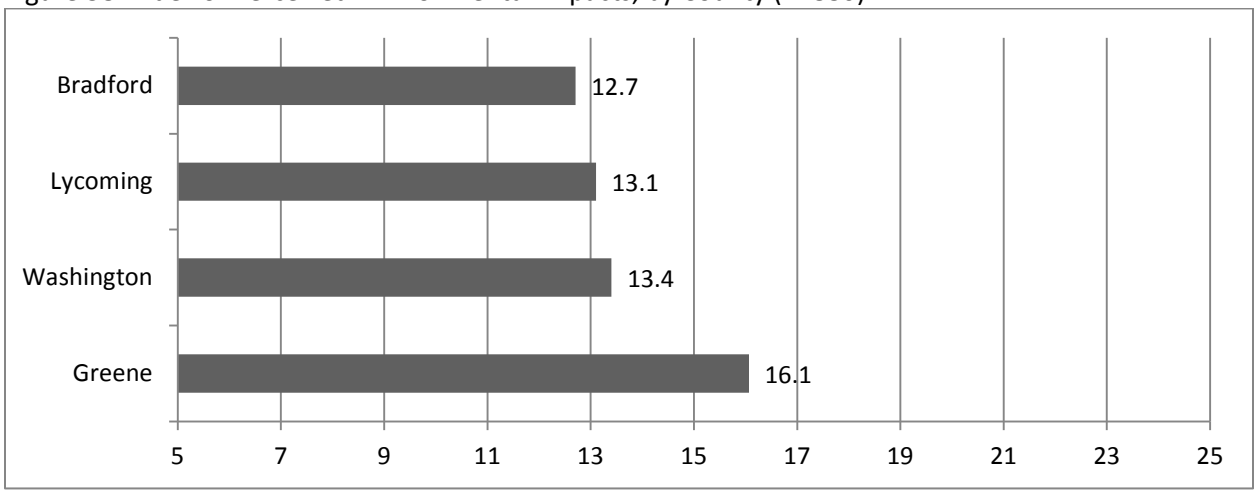
Note: On a scale of 1 to 5, with 1=Strongly Disagree; 3 = Neutral; and 5 = Strongly Agree. Tests for statistical significance are not provided for these individual survey items.

Index of Perceived Environmental impacts

Combining the variables into an index helps to make the distinctions between categories more pronounced. Indexes for responses were made by summing the five variables and are presented with these results. These scores can be interpreted as follows: a score of 5, which was the lowest score possible, would indicate strong disagreement with all 5 attitudinal measures. A score of 25, the highest score possible, would indicate strong agreement with all five attitudinal measures. All of the items were worded such that agreement suggested greater environmental impacts; consequently, higher values of the index also indicate greater perceived environmental impacts overall. Scores near the mid-point of 15 indicate general neutrality.

Figure 38 shows the index for these environmental attitudes by county. When the scales are combined into an index, the differences between Greene County and the other three counties becomes more apparent. The perceived environmental impacts from Marcellus Shale development are not significantly different among Bradford, Lycoming, and Washington counties, but they were significantly different from Greene County. These results indicate that Greene County respondents were significantly more likely to agree with the statements regarding greater environmental impacts than respondents from other counties.

Figure 38. Index of Perceived Environmental Impacts, by County (n=880)

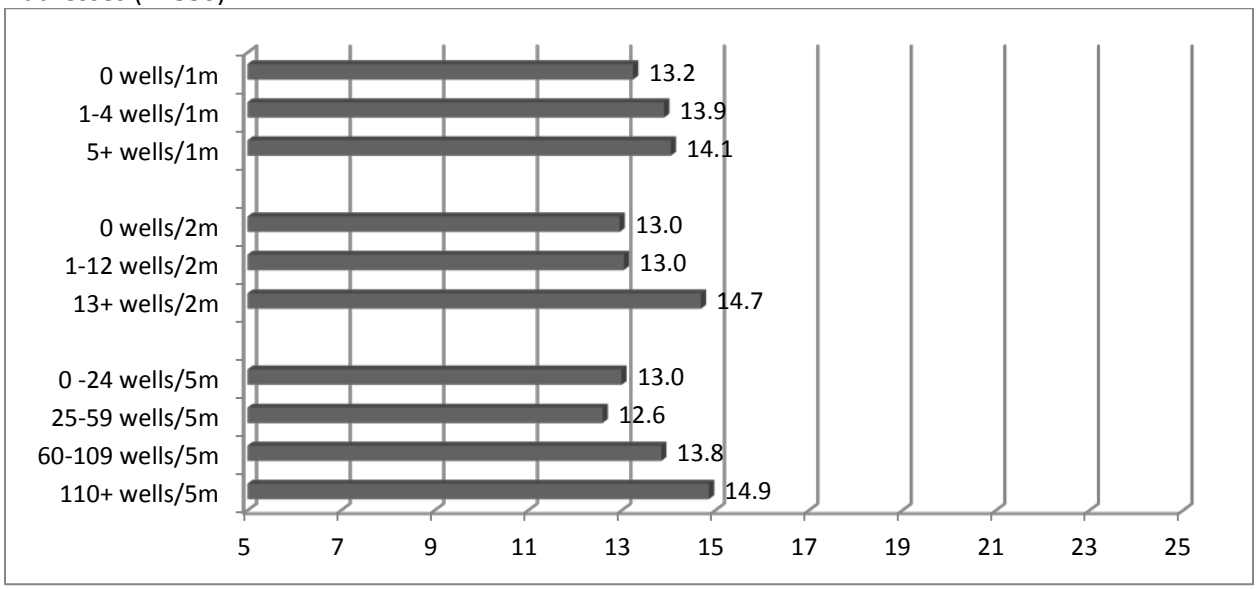


Note: Higher values indicate more negative views of environmental impacts. Greene County respondents had a significantly ($p<.05$) higher mean value than Washington, Bradford, and Lycoming county respondents.

Figure 39 shows the indexes for environmental atittudes by well density within 1 mile, 2 miles, and 5 miles. For the indexes within 1 mile, there is a consistent pattern across the individual variables. As well density increases, the respondents were more likely to think that environmental amenities are being harmed. However, these changes were not statistically significant. Respondents living in areas with 13 or more wells within 2 miles of their home were more likely to perceive negative environmental impacts than respondents with fewer than 13 wells within 2 miles. These differences were statistically significant. Examining the differences by number of wells within 5 miles revealed a similar pattern, that

those with a higher number of wells consider Marcellus Shale activities to be detrimental to environmental activities. Those with more wells (60-109 and 100 or more wells within 5 miles) have a statiistically significantly higher mean value for perceived environmental impacts than those who have fewer wells (0-24 and 25-59 wells within 5 miles). This indicates that those with more wells perceive more negative environmental consequences of Marcellus Shale development. However, it is important to clarify that the index score does not exceed 15, which indicates generally neutral perceptions of the environmental impacts of the Marcellus Shale activity.

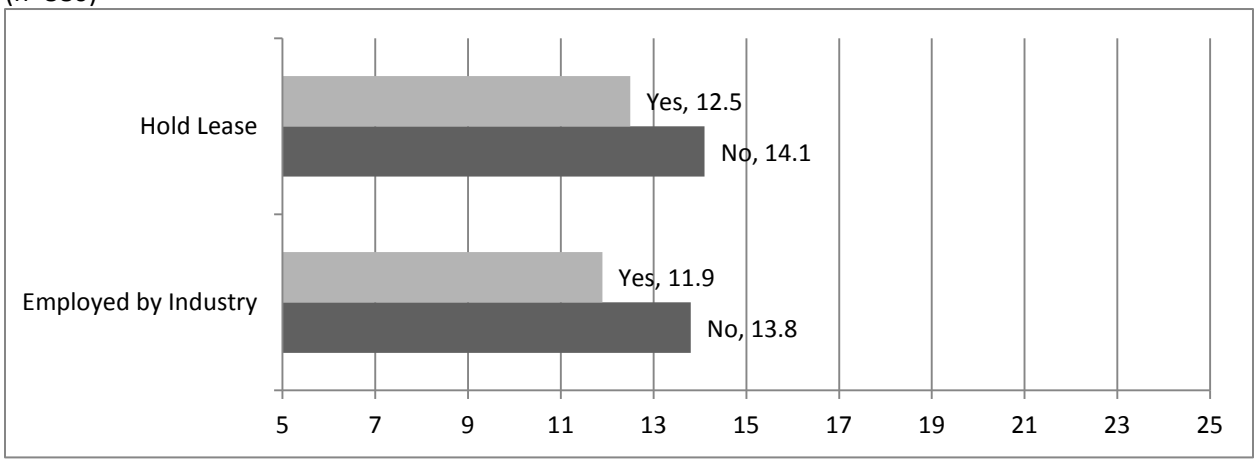
Figure 39. Index of Perceived Environmental Impacts, by Number of Wells Near Respondents' Home Addresses (n=880)



Note: Higher values indicate more negative views of environmental impacts. No statistically significant differences are found comparing the means by number of wells within 1 mile of respondents' homes. Respondents with 13 or more wells within 2 miles of their homes had a significantly ($p<.05$) higher mean value (more negative environmental impacts) than those with fewer or no wells within 2 miles of their homes. The mean value for environmental impacts for respondents with 0-24 wells within 5 miles of their homes was significantly ($p<.05$) lower than those with 110 or more wells within 5 miles. The mean value for respondents with 25-59 within 5 miles of their homes was significantly ($p<.05$) lower than those with 60-109 and 100 or more wells within 5 miles.

Figure 40 presents the indexes for environmental attitudes by employment and leasing status. Consistent with the individual variables, the indexes indicate that those who were not employed in the gas industry and those who were not benefiting from a lease were significantly more likely to think that Marcellus Shale development activities were harming environmental amenities. However, the index scores were all lower than 15 and indicate that respondents were generally neutral.

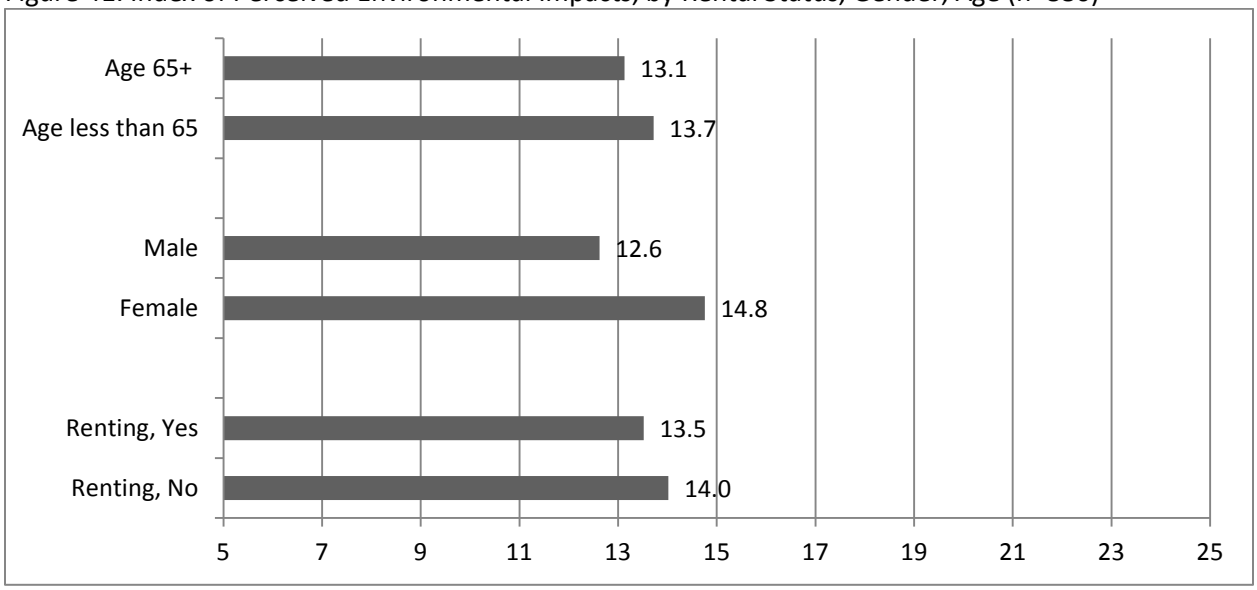
Figure 40. Index of Perceived Environmental Impacts, by Employment in Industry or Leasing Status (n=880)



Note: Higher values indicate more negative views of environmental impacts. Those respondents who held a lease have a significantly ($p<.05$) lower mean value than those who did not have a lease. Respondents employed in the industry had a significantly ($p<.05$) lower mean value than those not employed in the industry.

Figure 41 shows the index for perceived environmental impacts by rental status, gender and age. The index shows that women were much more likely than men to perceive negative environmental impacts than men.

Figure 41. Index of Perceived Environmental Impacts, by Rental Status, Gender, Age (n=880)

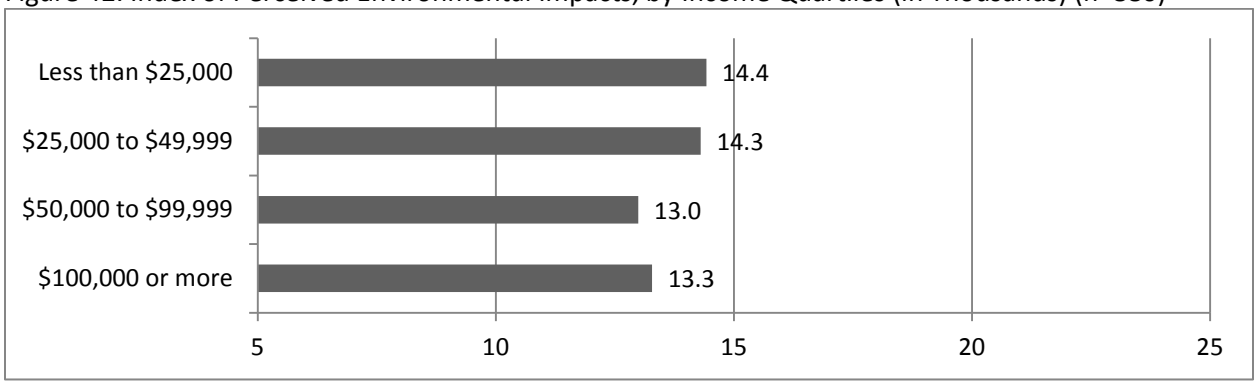


Note: Higher values indicate more negative views of environmental impacts. No statistically significant differences are found for age and rental status. Male respondents have a statistically significant ($p < .05$) lower mean value than female respondents. [14]

The results examining the environmental index by income (see Figure 42) indicates that $50,000 to $99,999 and the $100,000 or more categories were significantly different from the less than $25,000 and $25,000 to $49,000 categories. This means that wealthier respondents were significantly more likely to have less negative perceptions regarding Marcellus activities' impacts on the environment than less wealthy respondents. However, all income categories were below neutral.

[14] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

Figure 42. Index of Perceived Environmental Impacts, by Income Quartiles (in Thousands) (n=880)



Note: Higher values indicate more negative views of environmental impacts. Respondents with household incomes less than $25,000 and $25,000-$49,999 had significantly ($p<.05$) higher mean values than those with household incomes of $50,000-$99,999.

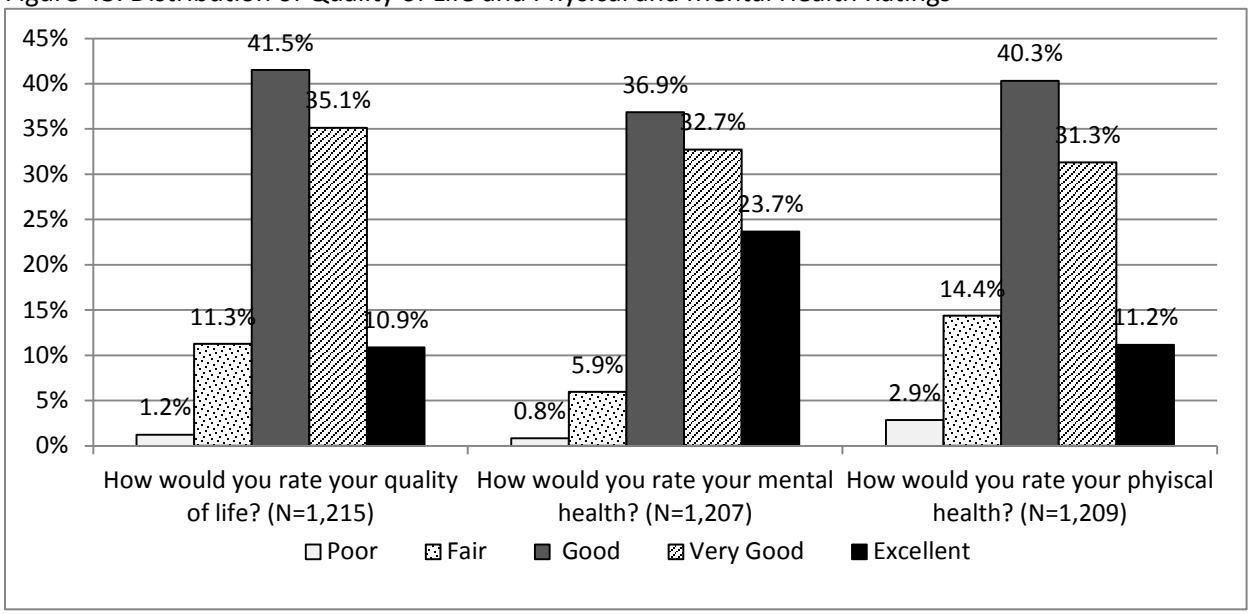
Health and Well-Being

This section describes the survey results related to health and well-being. Four health and well-being items were included on the survey. Respondents were asked to rate their physical health, mental health, and quality of life on a 5-point Likert scale, with the options: poor (1), fair (2), good (3), very good (4), and excellent (5). They were also asked to rate their current level of stress, with the options: very low stress (1), low stress (2), neither low nor high stress (3), high stress (4), and very high stress (5).

As shown in Figure 43, the majority of respondents rated their quality of life, mental health, and physical health as good or very good. Mental health ratings were better overall than physical health or quality of life ratings. Of the three measures, physical health was rated most poorly, with 17.3 percent of respondents indicating poor or fair physical health. This was slightly higher than the overall rate of 14 percent of residents indicating fair/poor health across Pennsylvania (County Health Rankings 2015[15]).

[15] Robert Wood Johnson Foundation. 2015. *County Health Rankings*. http://www.countyhealthrankings.org/app/pennsylvania/2015/measure/outcomes/2/data.

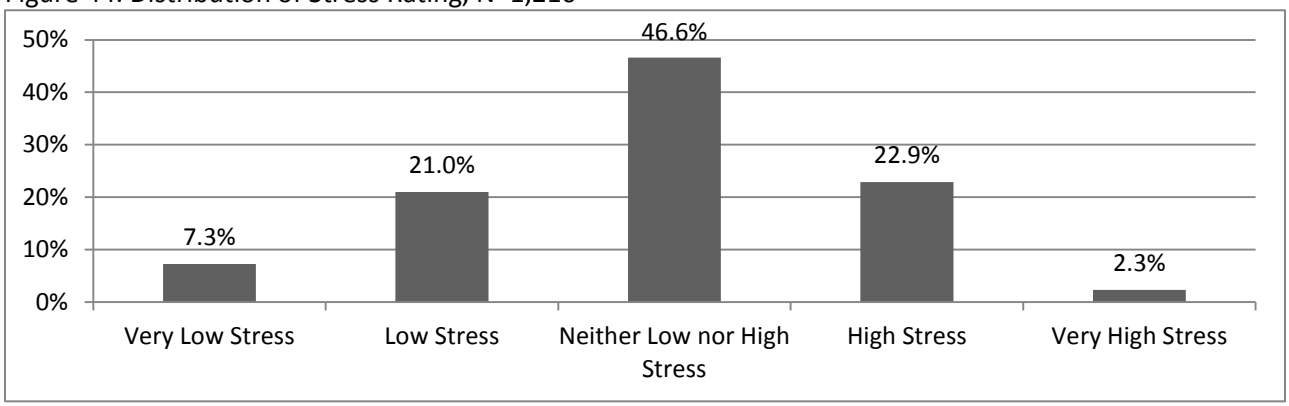
Figure 43. Distribution of Quality of Life and Physical and Mental Health Ratings



When comparing the weighted percentage of survey respondents reporting poor/fair health for each study county to results compiled by the Robert Wood Johnson Foundation County Health Rankings, based on pooled data from the 2006 to 2012 Behavioral Risk Factor Surveillance System, findings suggest that this survey's respondents from Bradford, Lycoming, and Greene counties were less healthy on average, and respondents from Washington County were healthier, on average, than the residents of these counties as a whole. That is, the County Health Rankings indicate the following percentages reporting fair/poor health for each county: Bradford (14 percent), Lycoming (14 percent), Washington (16 percent), and Greene (26 percent). The percentages reporting fair/poor health for each county in this survey sample was: Bradford (16 percent), Lycoming (19 percent), Washington (12 percent), and Greene (21 percent). It is important to note, however, that the percentages reporting fair/poor within the survey samples from Bradford, Washington, and Greene counties fall within the margins of error for each county reported in the County Health Rankings table. Only Lycoming County falls outside of the margin of error reported in the national County Health Rankings, suggesting that respondents from Lycoming County were likely less physically healthy than Lycoming County residents overall.

Figure 44 presents the distribution of stress ratings among respondents. Nearly half of respondents indicated having neither low nor high stress, 28.3 percent indicated very low or low stress levels, and only 2.3 percent indicated having very high stress.

Figure 44. Distribution of Stress Rating, N=1,210



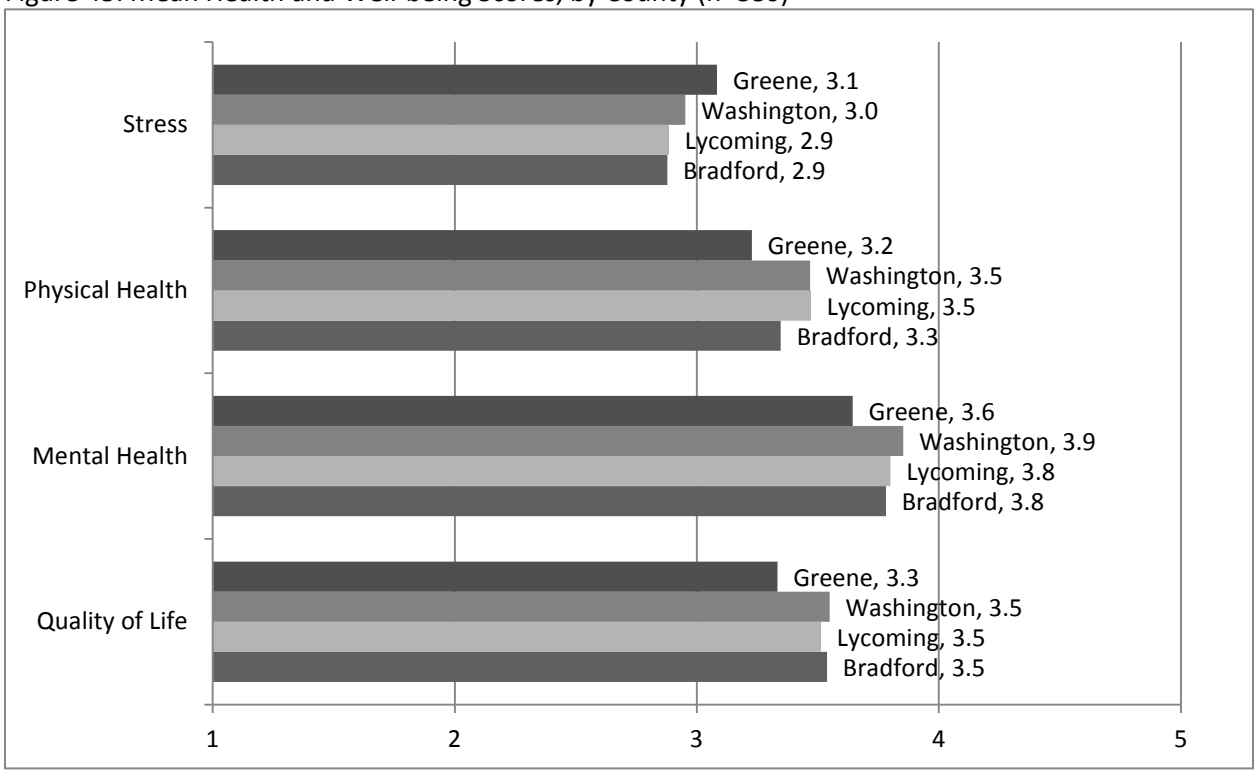
The figures presented in the next sections show the mean scores of each of these four health outcomes by county, categories of well-density, natural gas industry employment and leasing status, housing tenure (renter vs. non-renter), gender, age, and household income. Adjusted Wald tests were used to identify whether there were significant differences in mean scores across categories of interest. All analyses were weighted and account for the survey's complex sampling design.

Variation in Health and Well-Being by Study County

Figure 45 displays mean health and well-being scores by study county, with higher scores representing higher mean health and well-being. The only significant difference was for Greene County, which had a lower mean quality of life than any of the other three study counties ($p<0.05$). Residents of Greene County also reported significantly worse physical health than residents of the other three study counties ($p<0.05$). None of the other differences were statistically significant. Washington County residents reported the best mental health, and Greene County residents reported the worst mental health, but none of the differences were statistically significant. Green County residents reported the highest stress. The mean stress score for Greene County was significantly higher than for either Bradford

or Lycoming counties ($p<0.05$), but the difference between Washington and Greene counties was not statistically significant.

Figure 45. Mean Health and Well-being Scores, by County (n=880)



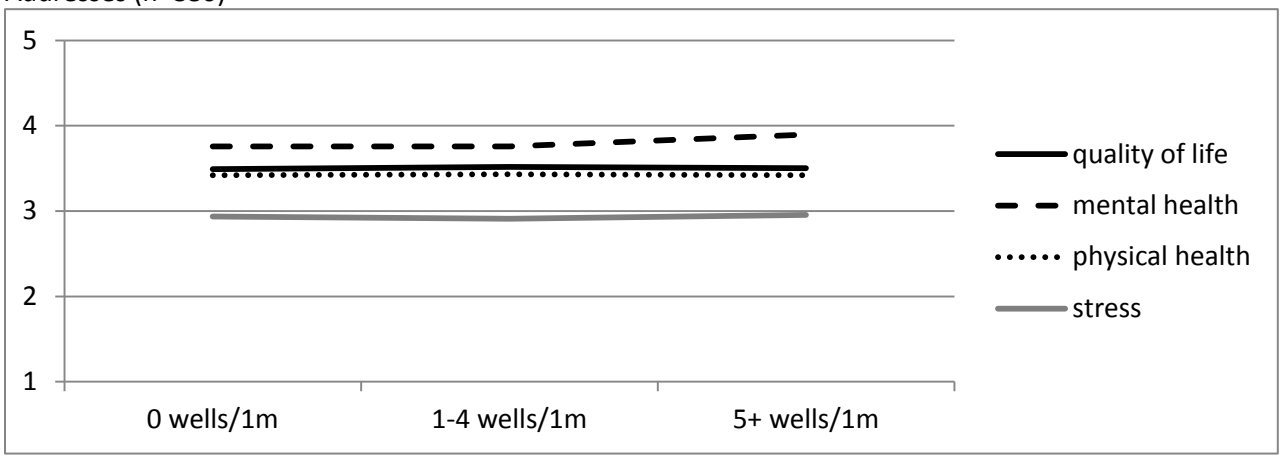
Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. Greene County's mean quality of life was significantly lower ($p<0.05$) than Bradford, Lycoming, and Washington counties. Greene County mean physical health was significantly lower ($p<0.05$) than Bradford, Lycoming, and Washington counties. There were no significant differences in mean mental health among any of the counties. Greene County's mean stress was significantly higher ($p<0.05$) than Bradford and Lycoming counties.

Variation in Health and Well-Being by Well Density

Figures 46-48 display mean health outcome scores across categories of well density within 1, 2, and 5 miles of the respondent's residence. As shown by Figure 46, average quality of life, physical health, and stress remained fairly stable across the categories of well density within 1 mile of respondents' households. Average mental health was higher among respondents with 5 or more wells

within 1 mile of their households versus those with fewer wells, but these differences were not statistically significant.

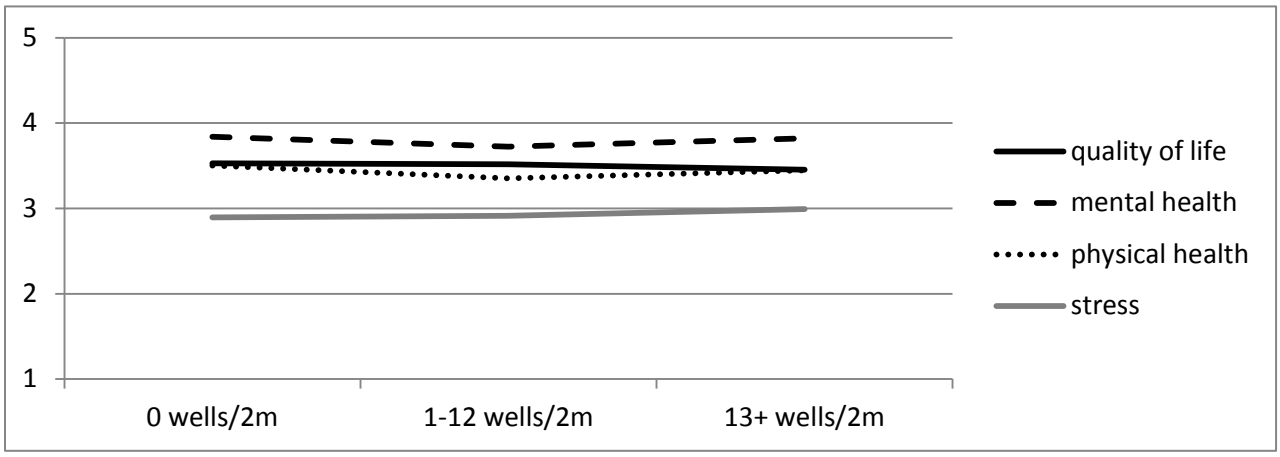
Figure 46. Mean of Health Outcomes, by Number of Wells within 1 Mile of Respondents' Home Addresses (n=880)



Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. No significant differences in mean health outcomes among any counties

There were also no significant differences in any health outcomes across categories of well density within 2 miles of respondents' homes as shown by Figure 47. Average stress increased and quality of life decreased at higher levels of well density within 2 miles of respondents' homes, but these differences were not statistically significant.

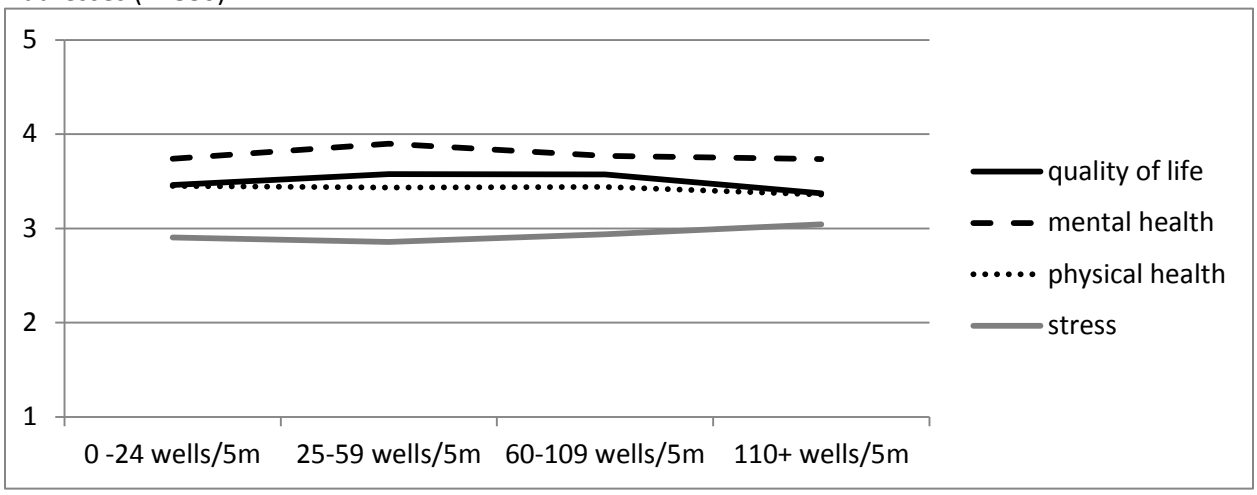
Figure 47. Mean of Health Outcomes, by Number of Wells within 2 Miles of Respondents' Home Addresses (n=880)



Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. No significant differences in mean health outcomes among any counties.

As shown in Figure 48, there were significant differences in health outcomes when accounting for well density within 5 miles of respondents' homes. Those with substantial well density (110+ wells) within 5 miles of their homes had significantly higher stress and lower quality of life compared to those with 25-59 wells within 5 miles of their homes. There were no significant differences between the means of those with the lowest well density and those with the highest well density.

Figure 48. Mean of Health Outcomes, by Number of Wells within 5-Miles of Respondents' Home Addresses (n=880)

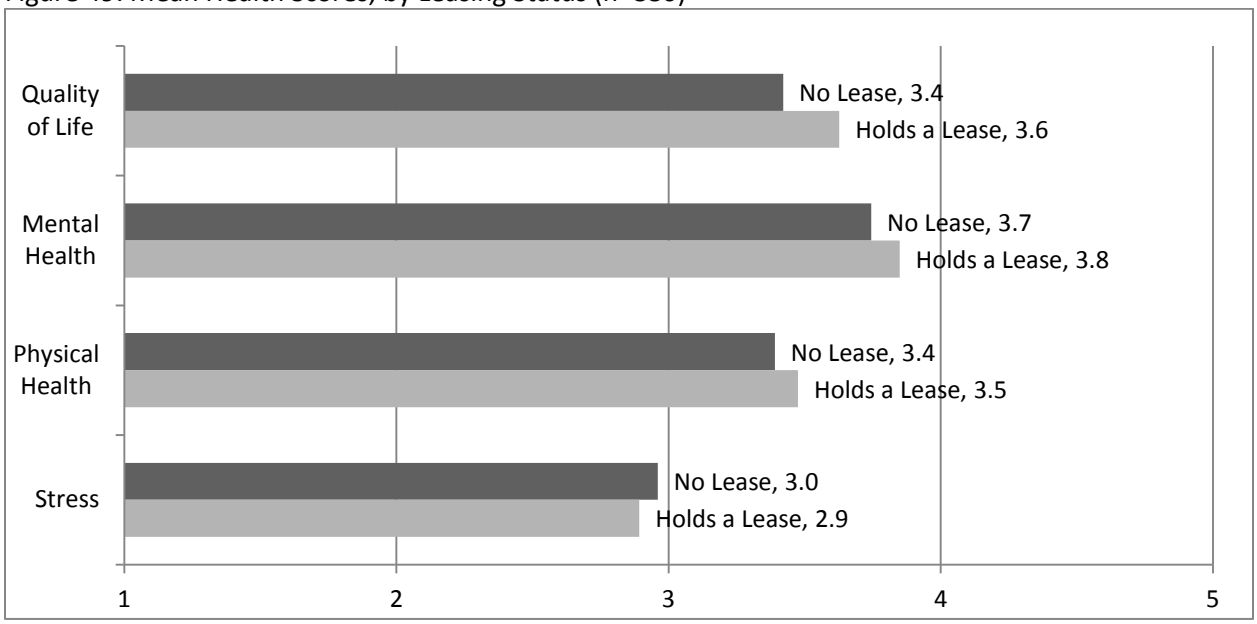


Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. There were the following significant differences in means ($p<0.05$): 110 or more wells within 5 miles significantly lower quality of life vs. 25-59 and 60-109 wells within 5 miles; 110 or more wells within 5 miles significantly higher stress vs. 25-59 wells within 5 miles.

Variation in Health and Well-Being by Employment with Natural Gas Industry and Land Leasing Status

Figure 49 displays mean health outcomes by whether anyone in the respondent's household was employed by the natural gas industry and by leasing status. Although there were no significant differences in mean quality of life between those with household members employed by the natural gas industry versus those not reporting such employment, those who held leasing rights to their land had statistically significantly higher mean quality of life versus those who do not hold such rights ($p<0.05$).

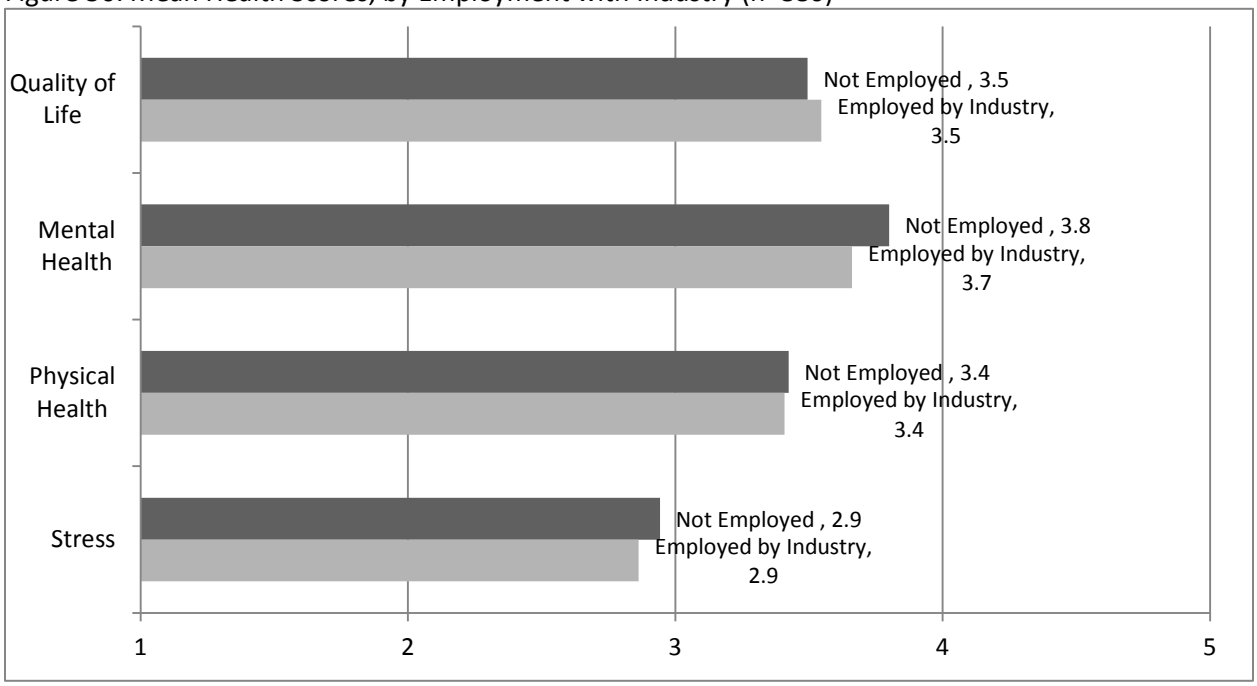
Figure 49. Mean Health Scores, by Leasing Status (n=880)



Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health and stress. Respondents who hold a lease had significantly ($p<0.05$) higher mean quality of life vs. those who do not hold a lease. No significant differences in mean physical health, mean mental health or mean stress.

Figure 50 shows that respondents who were employed in the industry or had a household member who was employed in the industry reported worse physical and mental health but lower average stress than those without anyone in the household employed in the industry. Those who reported holding a lease reported better average physical and mental health and lower average stress versus those who did not hold a lease. However, these differences were not statistically significant.

Figure 50. Mean Health Scores, by Employment with Industry (n=880)

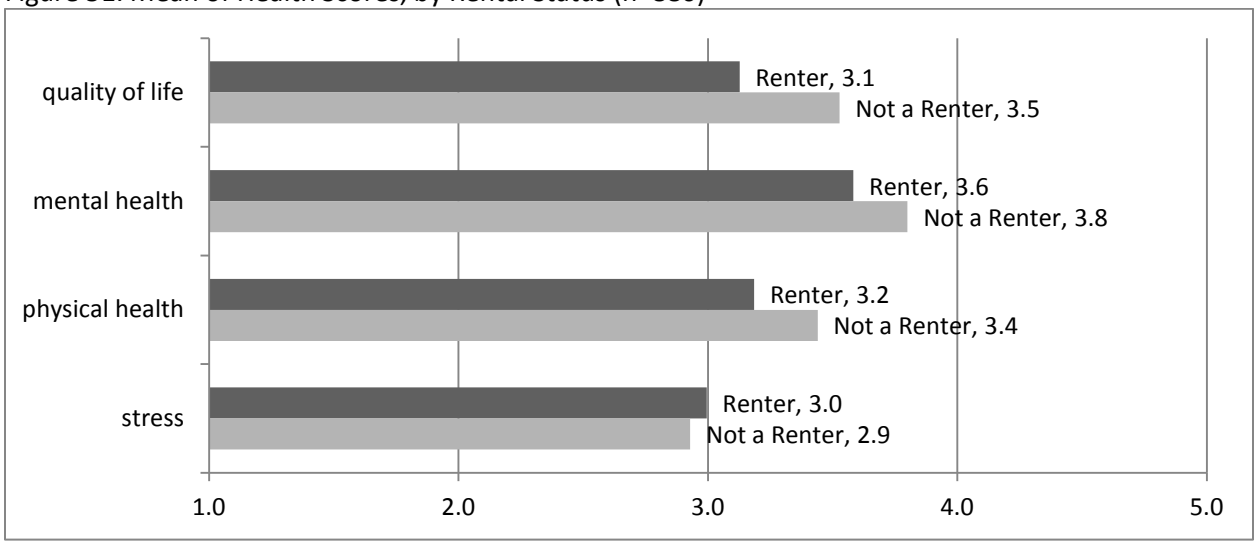


Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health and stress. No significant differences in mean quality of life, in mean physical health, mean mental health or mean stress.

Variation in Health and Well-Being by Rental Status, Gender, Age, and Household Income

Figure 51 presents mean health outcomes for renters versus non-renters, males versus females, and respondents aged 65 and older versus those younger than age 65. Renters reported significantly lower mean quality of life relative to non-renters ($p<0.05$). Although renters also reported worse mental health, worse physical health, and higher levels of stress compared to non-renters, those differences were not statistically significant.

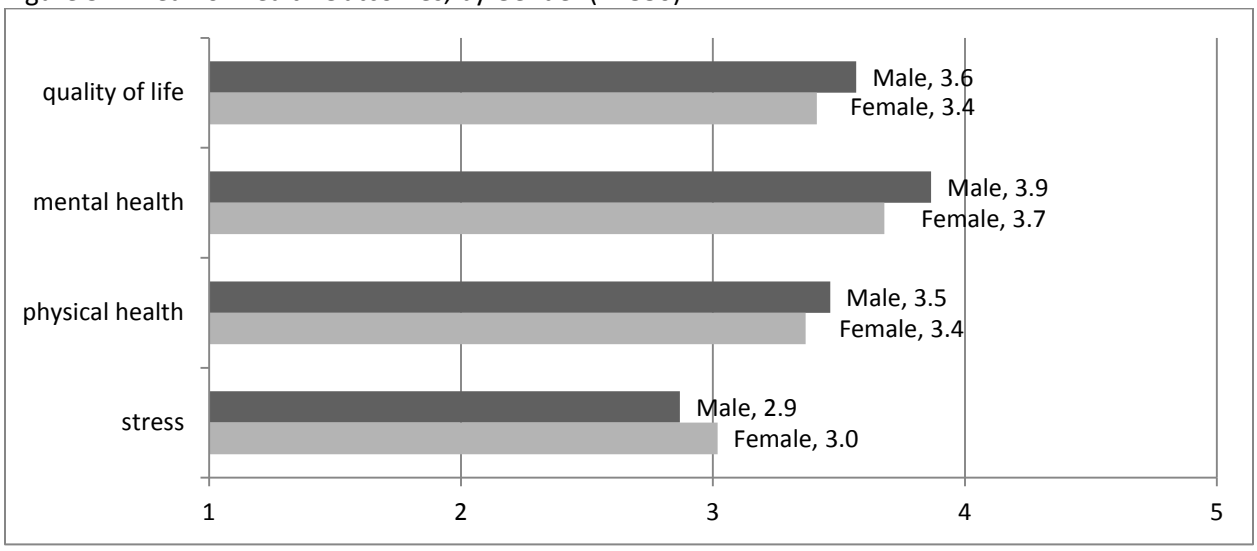
Figure 51. Mean of Health Scores, by Rental Status (n=880) [16]



Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. Non-renters had significantly higher ($p<0.05$) quality of life means vs. renters.

Figure 51 shows mean health outcomes by gender. Males reported significantly better quality of life and mental health and significantly lower stress than females ($p<0.05$). Although males also reported better physical health than females, the difference was not statistically significant.

Figure 52. Mean of Health Outcomes, by Gender (n=880)

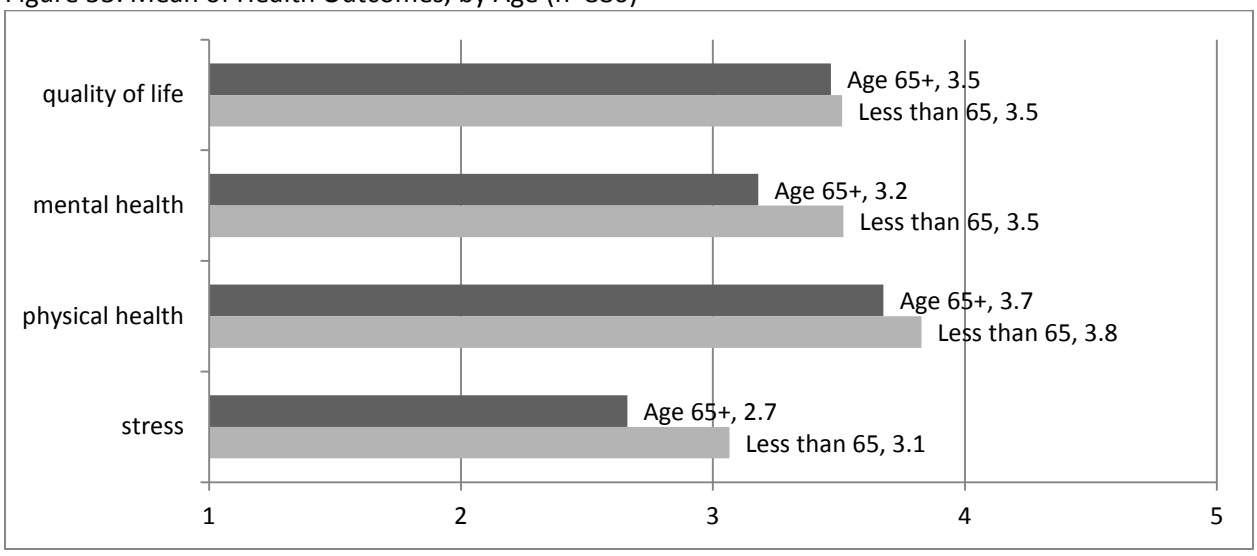


[16] For the purposes of this analysis, the "no" category includes homeowners as well as those who selected "living with a friend or relative at no cost" and "other." As noted in Table 3, these latter two categories make up less than 3 percent of the sample.

Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. Males had significantly higher ($p<0.05$) quality of life and mental health and significantly lower ($p<0.05$) stress than females.

Figure 53 demonstrates that those aged 65 years or older had significantly worse physical and mental health compared to those younger than age 65, but older respondents also have significantly lower stress than younger respondents ($p<0.05$). There was no significant difference in quality of life between younger and older respondents.

Figure 53. Mean of Health Outcomes, by Age (n=880)

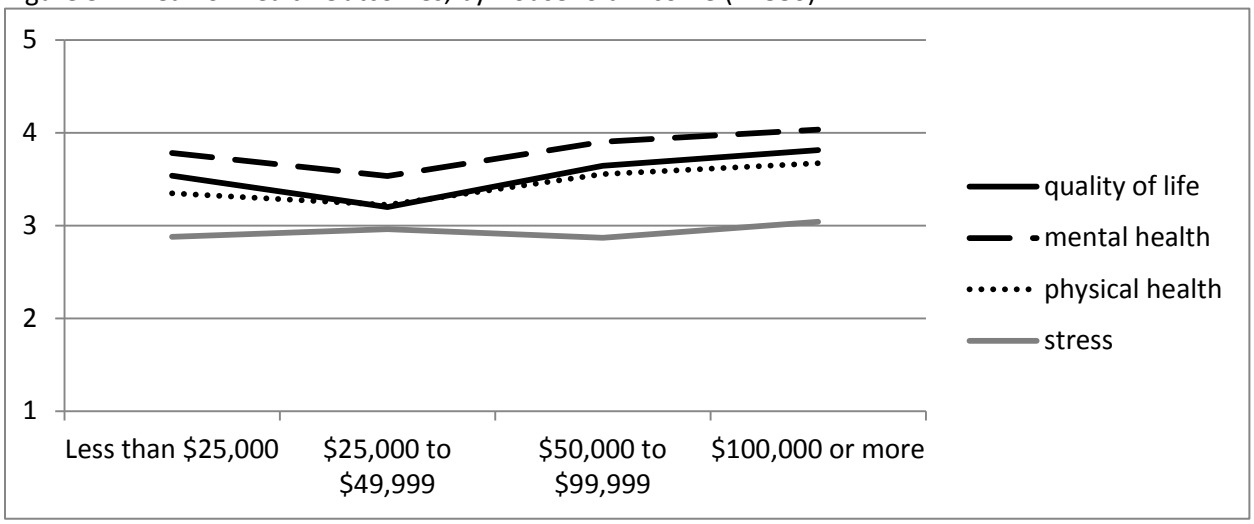


Notes: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. Those aged 65 years or older had significantly lower physical health, mental health, and stress scores vs. those under age 65.

Finally, Figure 54 displays several significant differences in health outcomes across the categories of household income. Quality of life, physical health, and mental health all follow the same trend. Those with household incomes of $25,000 to $49,999 had significantly lower mean quality of life and physical health than any of the other income groups ($p<0.05$) and significantly lower mean mental health compared to all respondents except those in the less than $25,000 category of household income ($p<0.05$). Those in the highest household income category ($100,000 or more) had significantly higher mean quality of life compared to all of the lower income groups and significantly higher mean physical

and mental health compared to the two lower income categories ($p<0.05$), but not the $50,000 to 99,999 category. In terms of stress, however, the trends differed. Those in the highest income category have the highest mean stress score, but the difference is statistically significant ($p<0.05$) compared only to those with household incomes of $50,000 to 99,999, who had the lowest mean stress score.

Figure 54. Mean of Health Outcomes, by Household Income (n=880)



Note: On a scale of 1 to 5, with high values indicating higher quality of life, mental health, physical health, and stress. Respondents with household incomes less than $25,000 had significantly ($p < .05$) higher mean values for quality of life than those with incomes of $25,000-$49,999 but lower mean values than those in higher income categories. Those with incomes $25,000-$49,999 had statistically significantly ($p < .05$) lower mean values for quality of life than those with higher incomes. Respondents with household incomes less than $25,000 had significantly ($p < .05$) lower mean values for mental health than those in higher income categories. Those with incomes $25,000-$49,999 had statistically significantly ($p < .05$) lower mean values for mental health than those with higher incomes. Respondents with household incomes less than $25,000 had significantly ($p < .05$) higher mean values for physical health than those with incomes of $25,000-$49,999 but lower mean values than those in higher income categories. Those with incomes $25,000-$49,999 had statistically significantly ($p < .05$) lower mean values for physical health than those with higher incomes. Those with incomes $50,000-$99,999 have significantly ($p < .05$) lower mean values for stress than those with incomes over $100,000.

Written Comments Regarding Marcellus Shale Development

This section reviews the written comments given on the survey. Respondents were offered a text box at the end of the survey to respond to the following question: “Do you have any final comments you would like to share with us related to Marcellus Shale development?” The survey of 1,291

Pennsylvanians yielded 409 comments to this question. Analysis of these comments identified 19 themes. Tables 38 and 39 display the number and corresponding percentage of comments and themes.

Table 38: Types of Written Comments

Overall Type of Comments	N	%
Negative	213	52.1%
Positive	76	18.6%
Mixed	40	9.8%
Other	80	19.6%
Total comments	409	100%*

*Total does not equal 100 percent due to rounding error.

First, comments were initially coded as negative, positive, mixed, or "other" (comments typically related to the survey itself). Of the 409 comments, 52.1 percent were negative and 18.6 percent were positive. To delve further into these comments, specific topics or themes were identified and tallied. Because many comments had multiple themes within them, the comments could have multiple codes assigned to them. As a result, the total number of themes identified (879) was greater than the actual number of comments. The percentages in Table 38 represent the given item divided by the 409 comments, e.g. 13 percent of comments contained a generally positive statement. All quotations presented are dictated verbatim.

Table 39. Written Comments and Themes

Thematic Analysis of Written Comments	N	%
Positive Themes		
Generally positive statement	54	13.2%
General economic benefits	28	6.8%
Jobs (Both direct and Indirect)	24	5.9%
Leasing benefits	21	5.1%
Improved roads	8	2%
Energy Independence	7	1.7%
Negative Themes		
Environmental concerns	89	21.8%
Truck traffic concerns	63	15.4%

Lack of trust in companies	58	14.2%
Generally negative comment	54	13.2%
Negative aesthetics of industry and equipment	36	8.8%
Inequality concerns	24	5.9%
Negativity about workers	18	4.4%
Political greed and/or failings	14	3.4%
Not local/good jobs	9	2.2%
Health concerns	8	2%
Other Themes		
Comment about survey or to surveyors	60	14.7%
Political statement	4	1%
Other	16	3.9%
Total themes	879	

Note: Theme percentages reflect the given proportion out of the 409 total comments. * Total does not equal 100 percent due to rounding error.

Type of Comments

These comments were prompted by the final question of the survey: "Do you have any final comments you would like to share with us related to Marcellus Shale development?" The question was worded in this manner so that respondents could mention the issues most important to them; the project team was not specifically asking for a positive or negative opinion.

As noted above, of these 409 comments, 213, or 52 percent, reflected a negative impression of the natural gas industry; 76 respondents, or about 19 percent, indicated a positive opinion of the industry. Forty respondents indicated mixed opinions of the industry, the most common opinion being a recognition of economic benefits while describing environmental concerns and/or truck traffic concerns. For example:

> "*We need a future. But, we also need water and safe food. I am glad people are working. However, will they see a well-deserved retirement before the effects of this kill them and their children. Do it! But do it safely! Please! For my kids' sake*."

The remainder of the comments, 19 percent, fell into the category of "other." These consisted mostly of comments directed to the research team, usually about the survey itself. For example:

> "*In my case all answers are based on some observations but mostly assumptions. Some questions were valid 1 or 3 years ago but not now*."

Positive Themes

Within the respondents' 409 comments, six major positive themes were identified. Thirty-eight percent of these were simply general and positive statements about the industry, such as *"Drill baby! Drill Now."* The second most common positive theme emerged from those comments that mentioned the general economic benefits of the industry in Pennsylvania. For example:

> "*I believe the Marcellus Shale development has been a wonderful thing for our local economy. After the steel and glass industries left our area, our little city was dead, nobody wanted to stay here. Now, our economy is better. Far from ruining our landscape, farmers can now farm instead of selling their land to developers who really do ruin our landscape with ugly housing developments. Thank you Marcellus Shale!*"

Another 17 percent of positive themes involved the increased jobs, both directly and indirectly, that the industry had provided. These typically involved phrases approximating, "*we need the jobs*" or "*I'm in the digging business. It has helped me a lot. I've done clearing 4 gas pads, and lots of other work. So it has helped me a lot.*" The financial benefits from royalties and or leasing land were also frequently mentioned. The most in-depth example of this is below:

> "*Before the gas companies (pre-Talisman) came, us dairy farmers were struggling. In fact our farm would probably been sold without Talisman [Talisman Energy, Inc.]. Our*

first check came December 2010. The next year we sold our cows, paid off all debts, went on vacation, living a good life or a better financial life I guess. In 2012 my high school sweetheart died. I was left financially well thanks to the gas industry. Money isn't everything but in my case it was a blessing. I believe everything happens for a reason and God was looking out for me. I am grateful for this."

The final 10 percent of positive themes were split between those who said the industry has improved country roads (8 respondents) and those who said the industry was important for American energy independence (7 respondents).

Negative Themes

The respondents' comments contained not only more negativity in general, but also a wider array of negative themes, 10 different themes in total. The most common of these negative themes were environmental concerns, accounting for 24 percent of all negative themes. Some examples include:

"We need to know what is in frack water since they use 100,000 gallons of it for every well they drill. Its very scary!!! That's a lot of dangerous chemicals going into the ground!!!"

"I think Marcellus Shale should be stopped from fracturing the wells they drill. It ruins the water and the land in future."

"We have intermittently smelled a strong toxic odor very early in the morning. We have never in the 35 yrs. of living here smelled anything like this. We called DEP - upon

checking they could find no source. This all started when a well was developed close to our home."

"I feel M/S Dev. needs to be closely monitored by private citizens, local organizations and government so that farmlands and streams and rivers are kept clean for our future generations"

The second most common complaint, accounting for 17 percent of negative comments, regarded the increased truck traffic and/or deteriorating roads. For example:

"Too many trucks in the area - noise pollution, air pollution and the roads are falling apart. Also the expanding population makes going anywhere a pain - too much traffic, etc."

"When gas development started, traffic was very heavy. It has gotten better but still more than what we experienced before gas development."

"The only problem I have is that I don't feel safe on the roads with how fast the gas industry workers drive around my house."

The third most common negative theme (16 percent) related to a lack of trust in the natural gas companies. For example:

"Chesapeake energy is taking advantage of landowners. They paid me larger amount of money for a one year extension on the lease with me to complete a pad and want to reclaim one year later. They are poorly managed co. and not to be trusted."

The final two significant negative themes included expressions of aesthetic negativities related to the drilling sites, compressor stations, and other infrastructure associated with the industry (10 percent) and expressions of the industry only being financially beneficial to the few who got royalties while living costs rose for the rest of the population (6 percent), creating inequality. Examples of both of these below:

> *"I used to drive to work on Rte 519. The gas development is so horribly ugly, I go to work on Rte 980 now. I'm unhappy about this; my drive to work used to be really beautiful…"*

> *"Since Marcellus Shale came into the area, I believe not just myself, but many others have gone from comfortable living to living paycheck to paycheck. More people have gone into the poverty level then people who have benefited from the gas industry. I hope to leave Pennsylvania within the next year!"*

Summary of Perceived Impacts of Marcellus Shale Development by Geographic Characteristics, Well Proximity, and Socio-demographic Characteristics

This section briefly reviews the survey findings related to the determinants of perceived impacts of Marcellus Shale development, which was a primary goal of this project.

Differences by County

Across the topics analyzed here, it is striking that Greene County respondents consistently have the most negative perceptions of the industry's impact. Respondents from Greene were less likely to report economic benefits and more likely to report costs, expressed greater concerns about roads and traffic impacts, expressed more concerns about public services, reported more negative views of the overall impacts on households and communities, described more negative environmental impacts, and

had the lowest average support for drilling of the four study counties (although the mean was still above neutral). Bradford County respondents were not quite as negative as Greene County, except in relation to concerns about problems regarding drugs and alcohol and growing inequality because of Marcellus Shale development. Greene County also had the poorest reported quality of life and health and stress indicators of the study counties, although this is consistent with other research on the topic. Washington County and Lycoming County, by contrast, generally had more positive reports of the impacts of development than either Bradford or Greene counties.

This finding may reflect Greene County's past history as one of the poorest in the state, subject in the past few decades to industrial change and increased rates of poverty, unemployment, and outmigration. Due to its past history of resource extraction, the number of homeowners who do not own their gas rights tends to be higher in this part of the state. Survey results support this, in that higher percentages of home-owning respondents in both Washington and Greene counties (21.5 percent and 25.2 percent, respectively) do not own their gas rights than those in Bradford (8.6 percent) and Lycoming (9.5 percent) counties. The percentage of respondents indicating they leased their land and held the lease in the household also varied by county, highest in Bradford at 71.0 percent and Lycoming at 53.9 percent, followed by Washington (45.2 percent) and Greene (43.2 percent). Of those who hold the lease in the household, Greene County had the lowest percentage reporting having received leasing payments (78.4 percent, compared to 83.7 percent for Washington, 83.6 percent for Lycoming, and 89.8 percent for Bradford). The rates for receiving royalty payments also varied by county, with the percentage receiving payments highest in Bradford (70.1 percent) followed by Lycoming (44.7 percent), Greene (41.2 percent), and Washington (32.3 percent). These differences suggest that the distribution of economic benefits in Bradford County is quite broad, with a greater percentage owning gas rights, leasing, and receiving leasing and royalty payments, whereas Greene County residents are less likely to

receive these benefits. Overall differences by region and county seem likely to be related to historical patterns of land ownership and resource extraction as well as current patterns of the distribution of economic benefits.

Table 40. Differences in Marcellus Shale Development Variables by County (weighted sample)

	Bradford	Lycoming	Washington	Greene	Total
Do you or anyone in your household own any land in the Marcellus Shale region? (n=1203)					
Yes	271	274	173	145	863
	76.1%	74.9%	68.1%	63.9%	71.7%
No	85	92	81	82	340
	23.9%	25.1%	31.9%	36.1%	28.3%
Total	356	366	254	227	1203
	100.0%	100.0%	100.0%	100.0%	100.0%
Of those who own land…. Who owns the natural gas rights beneath this land? (n=794)					
I/we only own the surface land Someone else owns the gas rights	19	22	47	31	119
	8.6%	9.5%	21.5%	25.2%	15.0%
I/we own both the surface land and the gas rights	193	185	143	77	598
	87.3%	80.1%	65.3%	62.6%	75.3%
I do not know	9	24	29	15	77
	4.1%	10.4%	13.2%	12.2%	9.7%
Total	221	231	219	123	794
	100.0%	100.0%	100.0%	100.0%	100.0%
Of those who own land…. Is any land you own leased for Marcellus Shale development (whether or not you hold the lease) (n=791)					
No, the land I/we own is not leased for MS development	47	87	76	49	259
	21.0%	38.2%	34.4%	41.5%	32.7%
Yes, the land is leased but the lease is not held by anyone in my household	10	11	23	9	53
	4.5%	4.8%	10.4%	7.6%	6.7%
Yes, the land is leased and I (or someone in my household) hold the lease	159	123	100	51	433
	71.0%	53.9%	45.2%	43.2%	54.7%
I do not know	8	7	22	9	46
	3.6%	3.1%	10.0%	7.6%	5.8%
Total	224	228	221	118	791
	100.0%	100.0%	100.0%	100.0%	100.0%
Of those who own land and have leased land..... have you received any leasing payments for Marcellus Shale natural gas development? (n=428)					

Yes	141	102	82	40	365
	89.8%	83.6%	83.7%	78.4%	85.3%
No, but I/we expect to receive leasing payments in the future.	7	11	7	9	34
	4.5%	9.0%	7.1%	17.6%	7.9%
No, and I/we do not expect to receive leasing payments in the future.	9	9	9	2	29
	5.7%	7.4%	9.2%	3.9%	6.8%
Total	157	122	98	51	428
	100.0%	100.0%	100.0%	100.0%	100.0%
Of those who own land and have leased land..... have you received any royalty payments from production of Marcellus Shale natural gas (n=430)					
Yes	110	55	32	21	218
	70.1%	44.7%	32.3%	41.2%	50.7%
No, but I/we expect to receive royalty payments in the future.	21	42	56	24	143
	13.4%	34.1%	56.6%	47.1%	33.3%
No, and I/we do not expect to receive royalty payments in the future.	26	26	11	6	69
	16.6%	21.1%	11.1%	11.8%	16.0%
Total	157	123	99	51	430
	100.0%	100.0%	100.0%	100.0%	100.0%

These county differences highlight the need for further exploration, particularly related to the more mixed experiences in Greene and Bradford counties. As these two rural counties have experienced some significant benefits, they also report particular concerns about community and environmental impacts. The history of these counties, as well as their unique geographical and demographic characteristics, are likely influences on the experiences of residents with development. Further exploration of how the industrial development has unfolded in each county – including the activities of natural gas companies, accidents, and local political reactions – is needed to understand the development of these differing perceptions.

Differences by Well Density

The well density measures indicated a mixed pattern of perceived impacts. Higher well density is associated with more positive views on the economic impacts, although these respondents also report increased cost of living (particularly rent). Higher well density is associated with both greater benefits

and costs associated with development. As those near wells are more likely to be leaseholders or know leaseholders, they may see more direct economic benefits and personal costs (such as lawyer fees). Higher density of wells is also associated with concerns about driving and roads, diminished trust among community members, and concerns about health of community members. Overall, those with the highest number of wells within 2 and 5 miles of their homes have more negative views of the community impacts of Marcellus Shale development as measured through the composite index. When asked specifically to describe the overall impacts on households and communities, those with some wells – but not the highest number of wells – had the most positive views. Those with the highest well density generally reported greater environmental impacts across all measures (outdoor activities, aesthetics, air and water quality). Those with a high number of wells within 5 miles also reported higher levels of stress and lower quality of life. These results suggest that high well density brings opportunities to benefit economically but also a greater likelihood of bearing costs of development and exposure to a broader set of environmental and social concerns that development brings.

Differences by the Ability to Benefit Financially

The ability to financially benefit is an important influence on perceived impacts of Marcellus Shale development. Both leasing status and employment in the industry by someone in the household were associated with more positive economic, community, environmental, and higher quality of life and health. Improved financial status itself, through increased wages/salaries and through leasing/royalty income, can lead to more positive views of the industry and its impacts on the individual, household, and community. Higher income may lead to the expectation of improved quality of life for all as that money is saved or spent locally. Indeed, when respondents were asked about how they have or expect to spend leasing and royalty income, their primary choices seem to reflect a desire to take care of existing responsibilities and create a cushion for the future – nearly half of respondents receiving

economic benefits indicated they would make home repairs (48.4 percent), save or invest for the future (45.7 percent), and pay debts (44.2 percent).[17] Economic ties to the industry may lead to more positive attitudes and sensitivity to the potential economic benefits the industry can bring to the communities and to individual families; in contrast, negative views may be seen as a threat to economic stability and growth.

Overall, employment ties were reported by about 10 percent of the respondents, and receipt of leasing and/or royalty income was reported or expected by about 43 percent of the respondents. These percentages suggest that in relative terms there is greater potential economic impact from leasing and royalty income than from employment, consistent with other studies (Hardy and Kelsey, 2015). Landownership and leasing patterns are likely to be substantial influences on the perceived impacts of shale development.

Differences by Renter Status, Gender, Age, and Income

Although analyses of aggregate statistics show relatively little overall change in housing costs, qualitative research and media reports emphasize localized inflation in housing costs, particularly rental rates, in the early stages of shale development. The proportion of renters in this survey is relatively small, but a few differences are found between renters and non-renters. Renters consistently report more negative views related to the economic impacts of development. They see fewer economic benefits and more economic costs (particularly related to housing costs). Renters were less supportive of development than were homeowners. There are four main mechanisms through which rental status

[17] This is in comparison to options that reflected more "luxuries," including taking vacations or travel (27.6 percent) or buying a vehicle (23.1 percent). About equal percentages have or plan to save money for children's college expenses (22.7 percent) and receive medical or dental care (22.2 percent) they may have been putting off. Major life changes (such as buying or building a new home, quitting job/retiring, or starting a business) were not as popular, with less than 10 percent selecting these choices.

matters. First, renters are unable to benefit through the primary direct means through which wealth is created in natural gas development (leasing/royalty income). Second, renters are directly subject to rapid fluctuations in the housing market, as has been identified in other literature. Third, renters tend to have lower incomes and to have fewer resources to respond to rapid changes in housing markets and other increases in the cost of living, and are therefore more vulnerable and more insecure. Finally, renters living near development have to contend with changes to traffic and other problems with no compensation. They are therefore subject to a series of risks to their financial status and living conditions with no opportunity to benefit.

The second demographic variable chosen for analysis is gender. Research on environmental attitudes and perceptions of risk related to technologies consistently find that women are more concerned about environmental conditions and tend to rate risks higher for a range of technologies (e.g., Liu et al., 2014; Davidson and Freudenburg, 1996). Previous research on the Marcellus Shale region specifically has found that women perceive greater risks associated with development (Brasier et al., 2012). Multiple reasons have been identified for these differences, including socialization processes that result in women's greater concern for health and well-being of family members in contrast to men's greater responsibility for economic support, and household division of labor in which women oversee daily activities that could be affected by development (transporting children, cooking, paying bills, etc.). The findings from this analysis are consistent with these studies: women consistently report more negative views of Marcellus Shale development across indicators related to economic, community, environmental, and health effects. They were less supportive overall, and tended to see the overall effects on households and communities in a less positive light.

Another population that may have a greater vulnerability to rapid economic change is those over age 65, as they are more likely to have fixed incomes and depend on the value of their housing for

economic security. In this analysis, age was not a significant influence on perceived impacts of Marcellus Shale development.

In contrast, income was a significant influence on several perceived impacts. Generally speaking, those with higher incomes report more positive impacts of development. Those in the top income categories were more likely to indicate that natural gas development has provided more economic opportunities and less likely to describe increased cost of living in communities experiencing development. However, it should be noted that respondents from both low-income (less than $25,000) and high-income (greater than $100,000) households report experiencing both benefits and costs of development, and at similar percentages. Those in the lowest income category (less than $25,000) reported significantly less positive views on the overall impacts on the community using the combined index measure. They also had less positive views on the overall effect on their household and had a lower level of support for development. They were also more likely to report more negative impacts of natural gas development on the environment than those in the top income categories.

Conclusion

The analyses described here were intended to examine differences between groups; where feasible, statistical tests were used to determine if those differences were unlikely to have occurred due to chance. However, it should be noted that for many of the perceived impacts measured here, the means were often near or above neutral, indicating general neutrality or positive views of development. Further, some of the key explanatory variables used here (e.g., leasing status, geographic proximity to wells, rental status, income, etc.) are likely correlated. For example, there is likely a strong relationship between income and rental status and between county and leasing status. To further examine these relationships, multivariate analyses will need to be conducted that estimate the relationships between

individual variables while holding the others constant. Doing so will provide a means to identify the main or primary influences on perceived impacts of development.

One important point that these results raise: there is no one, singular answer to the question "what is the impact of natural gas development?" The impacts vary by social group, by geographic location, by point in time, and by the type of impact that is of interest. There are multiple narratives of the effects of development depending on these key differences among people and places. It is therefore critical, to understand the effects of development, to further describe these differences across people, place, and time, and the processes by which these factors influence one's experience of natural gas development.

The study's findings demonstrate that residents of the communities with Marcellus Shale development generally view activity positively, although such attitudes vary across counties, depending on, for example, if a resident has a financial interest in the development or their homeownership status. Many respondents reported negative impacts or experiences, however, and the large number of written negative comments on the survey indicates that perspectives on Marcellus Shale are strongly divided.

Policy Considerations

Marcellus Shale development has been a polarizing issue in many communities, and within the Commonwealth overall. The results of this project suggest that the impacts are dynamic and complex, and are influenced heavily by the pace of development, the location of development, and pre-existing characteristics of the population. Further, individuals near the development tend to see the impacts in multivariate terms; it is not wholly a positive or a negative, but involves tradeoffs. The share of households reporting improved household financial circumstances is relatively small, similar to the share of households reporting negative impacts. Economic benefits from development are also unevenly felt.

The responses would thus suggest that many residents of these counties view Marcellus Shale development as neither the savior of the local economy, nor as a villain, but rather as just another type of business that creates opportunities and challenges. State policy thus should approach Marcellus Shale development similarly to how it treats other businesses and activities, with few special exemptions or attention.

The impacts of Marcellus Shale development warrant coordinated state, county, and municipal planning efforts to account for the variety of impacts, and their spatial and temporal dimensions.

Further, the localized impacts (in both time and space) of development warrant policies that are flexible, responsive to local needs, and adaptable as industry and local communities respond to industrial and technological changes. Moreover, policies must be able to account for sharp changes in development, including the pace and scale of development and rate of natural gas production, and shifting investment to mid-stream and downstream activities. Given the complex factors that influence natural gas prices and production rates, local and county level planning should use revenues from collected fees towards one-time investments. The regional nature of Marcellus Shale development suggests that where municipal and county level planning accounts for unconventional gas development, these efforts should reflect locality-specific needs but also be coordinated so as not to duplicate infrastructure.

Another implication of Wave 2 is that standard methods of public data collection do not match the need to document impacts at a relatively fine scale, particularly for units smaller than counties and for annual time scales. Federal data sources have proven inadequate for documenting change when they are primarily multi-year, lagged by several years, and available primarily at the county level for consistent analyses. Comprehensive monitoring at the municipal level is needed, allowing targeting of

attention, resources or programs to areas or population groups especially affected. An example of such targeting is the emphasis in Act 13 on affordable housing in Marcellus Shale communities. Other measures for tracking employment impacts and leasing and royalty revenue are also necessary on a finer scale. Such monitoring is needed to continually assess impacts and to evaluate the effectiveness of such targeting. For example, regular, comprehensive data collection efforts (e.g., surveys, transient population counts, housing censuses, etc.) could be targeted to affected areas, to more accurately assess the effectiveness of resource re-allocation such as Act 13.

Finally, policy approaches are needed that effectively recognize disparities in experiences that may be uneven within a given place and between particular areas. Segments of the population are more vulnerable to rapid economic and industrial change. The vulnerabilities may be more pronounced in certain areas due to existing socioeconomic conditions, such as industrial decline and histories of resource extraction. Policies need to consider mechanisms to compensate those groups negatively affected, and offer security for those most vulnerable to disruption because of the changes. Stresses to social services that service these communities need to be routinely monitored and adapted to meet emerging needs. Great caution should be used in allocating funds generated from development to social services, however, due to the potential for Marcellus Shale development to fluctuate overtime. The expectations of broad economic benefits of Marcellus Shale development may risk overlooking how rapid economic growth can create uneven labor market opportunities in which some benefit while others may experience new and unexpected hardships. This vulnerability could be lessened by ensuring that social services and housing agencies have the necessary resources and flexibility to rapidly adapt to changing client needs and demographics. Vulnerable segments of the population are too easily forgotten amidst assumptions of more generalized economic benefits from shale gas development.

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Appendix A: Statistical Tables

Table 41. Number of Respondents by Category of Independent Variables

	Total Sample (unweighted)	Trimmed Sample (N=880)[18]	
		Unweighted Sample	Weighted Sample
County	(n=1287)		
Bradford	380	270	228.39
Lycoming	387	270	263.19
Washington	280	181	241.91
Greene	240	159	139.63
Wells within 1 mile of home	(n=1289)		
0 wells	653	449	502.52
1-4 wells	336	227	195.09
5 or more wells	300	204	175.52
Wells within 2 miles of home	(n=1289)		
0 wells	243	156	226.83
1-12 wells	562	397	363.78
13 or more wells	484	327	282.51
Wells within 5 miles of home	(n=1289)		
0 -24 wells	272	185	224.24
25-59 wells	294	204	204.76
60-109 wells	409	281	254.11
110+ wells	314	210	190.01
Member of Household Employed in the Natural Gas Industry	(n=1289)		
Yes	137	105	98.18
No	1152	775	774.94
Household has Leased Land for Shale Development	(n=1289)		
Yes	497	388	336.56
No	792	492	536.56
Household Renting Home	(n=1257)		

[18] The trimmed sample includes only those cases with complete data (i.e., not any missing answers) for all of the items in the analysis presented here.

	Total Sample (unweighted)	Trimmed Sample (N=880)[18]	
Yes	85	55	60.78
No	1172	825	812.35
Gender	(n=1216)		
Men	806	608	491.95
Women	410	272	381.18
Age	(n=1211)		
65 years old or older	442	276	246.89
Under 65 years old	769	604	626.23
Total Household Income	(n=1141)		
Less than $25,000	189	110	104.19
$25,000 to $49,999	292	222	215.42
$50,000 to $99,999	412	338	347.65
$100,000 or more	248	210	205.87

Table 42. Distribution of Independent Variables by County (N=1289; weighted sample)

	Bradford	Lycoming	Washington	Greene	Total
Wells within 1 mile of home					
0 wells	39.5%	73.0%	62.7%	48.1%	57.6%
1-4 wells	42.9%	11.8%	13.8%	25.0%	22.3%
5 or more wells	17.6%	15.2%	23.5%	26.9%	20.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Wells within 2 miles of home					
0 wells	11.4%	44.2%	28.4%	15.1%	26.7%
1-12 wells	56.8%	31.2%	39.6%	37.7%	41.1%
13 or more wells	31.8%	24.6%	32.0%	47.2%	32.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Wells within 5 miles of home					
0 -24 wells	18.6%	43.2%	22.7%	15.1%	26.4%
25-59 wells	15.5%	28.0%	23.4%	23.1%	22.8%
60-109 wells	50.5%	18.6%	28.9%	16.5%	29.2%
110+ wells	15.5%	10.2%	25.0%	45.3%	21.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Member of Household Employed in the Natural Gas Industry					
Yes	9.6%	12.6%	5.5%	13.7%	9.9%
No	90.4%	87.4%	94.5%	86.3%	90.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Household has Leased Land for Shale Development					
Yes	49.4%	32.2%	26.4%	24.1%	33.4%
No	50.6%	67.8%	73.6%	75.9%	66.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Household Renting Home					
Yes	10.5%	7.9%	6.3%	5.7%	7.7%
No	89.5%	92.1%	93.7%	94.3%	92.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Gender					
Men	55.4%	54.1%	51.8%	50.7%	53.2%
Women	44.6%	45.9%	48.2%	49.3%	46.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Age					
65 years old or older	33.0%	36.6%	30.6%	34.8%	33.7%

	Bradford	Lycoming	Washington	Greene	Total
Under 65 years old	67.0%	63.4%	69.4%	65.2%	66.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Total Household Income					
Less than $25,000	21.2%	21.9%	19.4%	19.0%	20.5%
$25,000 to $49,999	34.3%	30.6%	24.6%	26.6%	29.1%
$50,000 to $99,999	25.3%	26.0%	28.2%	20.3%	25.5%
$100,000 or more	19.2%	21.5%	27.8%	34.2%	24.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Table 43. Descriptive Statistics for Variables Used in Study (n=880; weighted sample)

	Percentage	Mean	95% Confidence Interval	Median	Std. Deviation	Min.	Max.
Economic Impacts							
There are more economic opportunities that will keep our youth in the area[a]		3.63	3.56-3.70	4	1.07	1	5
The cost of living here has gone up[a]		3.67	3.61-3.74	4	1.01	1	5
People in my community have a lot more money[a]		3.04	2.97-3.11	3	1.02	1	5
My family's economic situation had improved[a]		2.77	2.69-2.84	3	1.15	1	5
Property values in this area have gone up[a]		3.54	3.47-3.61	4	1.08	1	5
Rent has become too expensive for local residents[a]		3.87	3.80-3.94	4	1.05	1	5
Household has received benefits from Marcellus Shale	51.58%		48.28%-54.87%	1	50.00%	0	1
Family has paid out of pocket costs due to Marcellus Shale	22.77%		20.00%-25.54%	0	41.96%	0	1
Community impacts							
It takes me a lot longer to drive around this area[a]		3.18	3.10-3.26	3	1.16	1	5
The roads are in better shape after the natural gas companies fixed them[a]		3.22	3.14-3.30	3	1.23	1	5
I get nervous when I drive in this area[a]		2.63	2.55-2.70	2	1.17	1	5
I trust people in the community less[a]		2.68	2.61-2.75	3	1.05	1	5
It is harder to get help from people who live here[a]		2.46	2.39-2.52	2	0.95	1	5
People are more likely to call the police if someone is acting suspiciously[a]		3.17	3.11-3.23	3	0.90	1	5
Important public services like education are stretched thin[a]		2.98	2.91-3.06	3	1.11	1	5
I feel more vulnerable to crime and violence[a]		2.82	2.75-2.89	3	1.11	1	5
The gap between the 'haves' and the 'have-nots' has grown[a]		3.39	3.32-3.46	3	1.10	1	5
The physical health of people in my community has gotten worse[a]		2.57	2.50-2.64	3	1.02	1	5
I am more optimistic about the future of my community[a]		3.25	3.19-3.32	3	1.03	1	5

	Percentage	Mean	95% Confidence Interval	Median	Std. Deviation	Min.	Max.
We have more problems related to alcohol and drugs[a]		3.17	3.10-3.25	3	1.17	1	5
People act with less courtesy to each other in public spaces[a]		2.85	2.78-2.93	3	1.13	1	5
Environmental impacts							
I find it harder to do the outdoor activities I enjoy[a]		2.46	2.38-2.53	2	1.12	1	5
The landscape of this area has been spoiled[a]		3.02	2.93-3.10	3	1.33	1	5
The quality of my drinking water is worse[a]		2.53	2.46-2.60	2	1.13	1	5
Water quality of streams and rivers in this area has worsened. [a]		2.91	2.83-2.99	3	1.21	1	5
Air quality in this area has worsened[a]		2.68	2.61-2.75	3	1.13	1	5
Overall attitudes							
The overall effect on you and you household has been.....[b]		3.24	3.17-3.31	3	1.05	1	5
The overall effect on your community has been...[b]		3.40	3.33-3.47	4	1.06	1	5
Considering everything, to what extent do you oppose or support Marcellus Shale development? [c]		3.58	3.49-3.66	4	1.29	1	5
Health and Well-being							
How would you rate your quality of life?[d]		3.49	3.44-3.55	4	0.84	1	5
How would you rate your mental health? [d]		3.78	3.72-3.84	4	0.90	1	5
How would you rate your physical health? [d]		3.41	3.35-3.47	3	0.92	1	5
How would you rate your current level of stress?[e]		2.94	2.88-3.00	3	0.87	1	5
Demographics and Independent Variables							
County							

	Percentage	Mean	95% Confidence Interval	Median	Std. Deviation	Min.	Max.
Bradford	26.17%		23.27%-29.07%	0	43.98%	0	1
Lycoming	30.25%		27.22%-33.28%	0	45.96%	0	1
Washington	27.75%		24.79%-30.70%	0	44.80%	0	1
Greene	15.84%		13.43%-18.24%	0	36.53%	0	1
Well density							
Number of Wells within 1 Mile		2.32	2.06-2.57	0	3.90	0	29
Number of Wells within 2 Miles		10.46	9.63-11.28	6	12.49	0	69
Number of Wells within 5 miles		68.77	65.11-72.44	61	55.58	0	284
Employment: Member of Household Is Employed within Natural Gas Industry	11.17%		9.09%-13.25%	0	31.52%	0	1
Leasing: Household Has Land That is Leased	38.33%		35.13%-41.54%	0	48.65%	0	1
Home Rental Status: Home is rented	7.00%		5.32%-8.69%	0	25.53%	0	1
Gender: Women	43.91%		40.63%-47.18%	0	49.66%	0	1
Age (in years)		56.04	55.13-56.95	57	13.78	22	98
Age: over age 65	28.51%		25.53%-31.49%	0	45.17%	0	1
Household income last year							
Less than $25,000	12.43%		10.25%-14.61%	0	33.01%	0	1
$25,000 - $49,999	24.74%		21.89%-27.58%	0	43.17%	0	1
$50,000 - $99,999	39.44%		36.21%-42.66%	0	48.90%	0	1
$100,000 or more	23.39%		20.60%-26.19%	0	42.36%	0	1

a On a scale of 1 to 5, with 1='Strongly Disagree; 3 = 'Neutral'; and 5 = "Strongly Agree."
b On a scale of 1 to 5, with 1='Very Negative'; 3 = 'Neither positive nor negative'; and 5 = "Very Positive."
c On a scale of 1 to 5, with 1='Strongly Oppose;' 3 = 'Neutral'; and 5 = "Strongly Support."
d On a scale of 1 to 5, with 1 ='poor;' 2='fair;' 3='good;' 4='very good;' and 5='excellent.'
e On a scale of 1 to 5, with 1='Very Low Stress; 3 = 'Neither low nor high stress; and 5 = "Very High Stress."

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