HEALTH IMPACT ASSESSMENT (HIA) PROGRAM GRANT: BUILDING CAPACITY FOR HIA ON THE U.S./MEXICO BORDER

FINAL REPORT
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HEALTH IMPACT ASSESSMENT (HIA) PROGRAM GRANT: BUILDING CAPACITY FOR HIA ON THE U.S./MEXICO BORDER

I.A. Introduction

Our goal for this HIA Program Grant was to develop a collaborative HIA program on the U.S./Mexico Border that built on our existing partnerships and expertise and that: 1) identified and engaged new institutional partners; 2) developed capacity at UTEP and other border universities to build a cadre of HIA practitioners who are bilingual and culturally competent for the border region; and 3) developed and implemented a process for BECC and other agencies such as USEPA and USDA to include HIA in infrastructure project decision-making. Through new partnerships, capacity building, and advocacy of a "health in all policies" approach to border infrastructure development, this program aimed to develop a strong foundation for sustainable use of HIA principles in the border region in the long-term.

Our program built upon our experience in a HIA Demonstration Project in Vinton, TX that focused on water and sanitation. Our Program Grant was comprised of the following core elements: 1) we conducted one full HIA in southern New Mexico on a different infrastructure topic (public transportation) to build experience and to engage new partners; 2) we conducted one "streamlined" HIA on water infrastructure that built on our previous experience and allowed us to pilot test a streamlined process and a "Health Impact Index"; and 3) we developed an interdisciplinary course aimed at undergraduate and graduate students at UTEP in order to train our students in HIA concepts and practice.

With respect to partnerships, our program was built on an existing relationship among UTEP, BECC, and WHO-PAHO. We expanded our network of institutional partners through the conduct of one full HIA in southern Doña Ana County, New Mexico, engaging New Mexico State University as a new institutional partner. Their Southwest Center for Survey Research in the College of Health Science and Social Services made a major contribution to our HIA effort. We engaged other state and local agencies and NGOs in New Mexico related to the public transportation HIA, including the lead agency, the South Central Regional Transit District of New Mexico (SCRTD) and an active community organizing NGO, the Empowerment Congress. In addition, for the streamlined HIA focused on water infrastructure, we developed a collaborative relationship with the city of Presidio, TX, who is considering extending water services out to the *colonia* of Las Pampas.

The border region presents some unique challenges because: 1) it cuts across so many jurisdictional boundaries, including international, national, and state; 2) it is for the most part bilingual; and 3) many of the small cities and towns are resource poor and limited in capacity. These factors present challenges in implementing an HIA program. However, our team is experienced in facing these challenges and in promoting public and stakeholder participation in the unique border setting. We are accustomed to collaboration with multiple jurisdictions, even including Mexican institutions and organizations; most of our personnel are bilingual; and we are experienced in working in poor communities with limited resources. Thus, we were poised to make significant contributions to building capacity for HIA in the region.

I.B. Results, Conclusions, and Recommendations

Transportation Matters HIA

Findings of the Assessment. We conclude that public transportation would have major impacts in rural southern Doña Ana County on: 1) health through improved access to health care and fresh fruits and vegetables; 2) education through improved access to community colleges, university, and adult learning opportunities; and 3) economic development through better access to jobs and job training and goods and services. Over 80% of residents responded that they would use public transportation to help improve their health, education, and/or economic status. Some of the priority purposes for accessing public transportation included: doctor appointments, obtaining pharmaceuticals, regular medical treatments, shopping at supermarkets or farmers markets, attending college, visiting a public library, getting a job, attending job training, and paying bills. Preferred destinations included Las Cruces, Anthony, and Sunland Park.

Predicted impacts include: 1) improved health, especially for seniors; 2) improved education, especially for young adults; and 3) improved economic status, especially for families, due to better jobs and better access to goods and services. A major negative impact is the cost of the bus system to the taxpayers.

Conclusions from the Assessment Process. Designing, implementing, and funding public transportation systems in rural areas is very challenging. By definition, they serve a relatively small population over a large geographic area. Though it seems that rural citizens should have access to public transportation similar to urban citizens, the expense is not shared proportionately over the population and must be principally borne by urban residents. In the case of southern Doña Ana County, the benefits would be significant to an underserved, disproportionately impoverished, racial minority community. Such communities as those prevalent in southern Doña Ana County are lacking in resources, economic opportunity, and political voice. An unexpected result was that young people could benefit significantly from improved access to higher education.

Recommendations. Based on our findings, we propose the following recommendations.

1. Based on the preponderance of residents in rural Doña Ana County that are in need of public transportation and who said that they would use public transportation if it were available, the SCRTD should implement the bus system for rural Doña Ana County.
2. In order to maintain the operations of the bus system, SCRTD should seek additional funding, including federal and state grants, local government funding, private funding, and any other source that might be available.
3. The routes should include stops at Doña Ana Community College campuses, clinics, hospitals, La Semilla, Women's Intercultural Center, and senior centers, as these were the most common preferred destinations.
4. Schedules need to be extended into the early evenings, as people need to board a bus to return home at or near 5:00 pm. There also needs to be service on Saturdays.
5. SCRTD needs to develop and implement a communications plan that would include: a) education of the potential users on how to access and use the bus system, b) education of the taxpayers about the benefits of the bus system; c) development of an "identity" that would improve awareness of the system; this could include a clever motto or slogan, brightly painted buses, a "mascot", improved logo, etc. d) identifying with the Livability

Principles of Viva Doña Ana; e) improving the visibility and conditions at bus stops to include better signage, advertising, benches, and shade; and f) marketing the bus system using flyers, posters, mailings, NMSU (for young people), and others.

6. SCRTD and the county should improve walking conditions around bus stops to include more pedestrian and biking paths to and around the bus stops.
7. Consider buses that use natural gas for fuel; emissions are much reduced compared to gasoline or diesel.
8. More paved roads are necessary for the bus system to fully serve the communities, to provide safer travel of residents to the bus system and to reduce air borne dust in the rural communities. This is the responsibility of the county.
9. Develop an evaluation plan that will document the ridership and overall customer satisfaction with the bus system.
10. Document the benefits of the bus system by collecting data related to health, educational, and economic outcomes, using important indicators that have already been identified for public transportation systems by agencies such as the U.S. Department of Transportation, the U.S. Centers for Disease Control and Prevention, and other agencies. Additional information about important indicators and resources for monitoring outcomes is provided in the Monitoring section of this report (Section III.G.).

Water Matters HIA

Findings of the Assessment. The quality of water from the City of Presidio, even after hauling and storing, is very good. Although we sampled residences and businesses only once, we found no instances of contamination. Residents and businesses were relieved to see this result.

The biggest health impacts related to hauled water include stress from fear of running out of water; the inconvenience, time, and stress associated with hauling water; the risk of accidents; and for businesses, worker safety. If the City of Presidio would extend their service, there are potentially significant positive benefits for economic growth and development, including not only businesses but also residential areas as well. Both residents and businesses are willing to pay the cost of connection and the monthly cost of piped water. In sum, the residents and businesses in the study area, including the *colonia* Las Pampas, are disillusioned and harbor dashed hopes from the past. They see no future for their community without water. As residents of the richest country in the world, they deserve better.

Recommendations. Based on our findings, we propose the following recommendations.

1. Providing piped water to residents and businesses north of Presidio along Hwy 67, including the *colonia* Las Pampas, will improve health related to stress, risk of accidents, and worker safety at businesses. It would also improve quality of life, highway safety, and employee safety, and increase the potential for economic growth and development in the area. Piped water could be achieved by several different ways, including a) extension of city water services; b) developing a community water supply based on one or more wells in the area; c) delivery of water from Shafter. All of these options are costly relative to the number of residents and businesses served. The most economical solution might be development of a community water supply if a reliable water source could be found. One attempt was made but failed to identify a reliable source of water. Identifying reliable groundwater sources is very "spotty" in this region.

2. Residents could reduce the amount of water that they have to haul by implementing rainwater harvesting to at least capture enough water for gardens, trees, and other landscaping.
3. The city of Presidio could consider a water delivery service using certified haulers; it might be cheaper than extending the main water line.
4. The city could improve the filling station by moving it to a more accessible location near the city limits and raising the filling point so that haulers drive under or parallel to the filling point, making it easier for clients to fill their tanks and avoiding falls from having to run a hose from the ground to the filling tank.
5. Residents and businesses could reduce their cost by having two tanks, one for potable water and one for non-potable water that could be used for landscaping and gardening.
6. The City of Presidio and/or the County should seek financial assistance from state and federal sources to provide water to residents and businesses who lack water.

Health Impact Index and Other Monitoring and Assessment Tools

We developed a "health impact index" (HII) to help "score" proposed projects with respect to their health impacts, utilizing a table of predicted impacts. This would require enough work to develop a scoping summary for the proposed project. A predicted impacts table could be developed using the scoping categories, the health determinants or outcomes and the related direction, magnitude, severity and likelihood of health impacts. The preliminary tests used weighting factors and both arithmetic and geometric means. The values for the Health Impact Index were all relatively small. Further work needs to be done to evaluate the use of the information provided by the predicted impact tables and a quantitative index.

Using the HII, we propose a streamlined HIA process that BECC could use in considering health impacts of proposed infrastructure projects without having to do a full HIA on every project. Our streamlined process includes: 1) screening, 2) scoping, 3)stream-lined assessment and predictions based on available data and information, 4) recommendations, and 5) report. For each scoping category, direct and indirect determinants of health can be identified. For each determinant of health or outcome, a matrix of predicted impacts in terms of direction, magnitude, severity, and likelihood can be developed, as for the HII. The calculated HII replaces the full assessment of an HIA. Thus, the stream-lined process keeps most of the elements of a full HIA, but includes a much shortened and less expensive assessment. This process needs to be more fully tested by BECC. Stemming from a contract that we implemented with BECC, we will be working closely with them during the period of September 1, 2016 – March 1, 2017 to identify processes to improve their monitoring and evaluation and their assessment of impacts.

Institutionalizing HIA

HIA Course. We developed an interdisciplinary HIA course aimed at undergraduate and graduate students at UTEP in order to train our students in HIA concepts and practice. The course was pilot tested in the summer of 2016. The HIA course was offered through the Public Health Sciences Department in the College of Health Sciences during the extended summer session. Michelle Del Rio, our HIA Coordinator, was the Instructor. Eleven students registered for the course, ten of whom were Hispanic and one was African American. All were undergraduate students, classified as seniors (9) and juniors (2), mostly majoring in Health Promotion. Many of them were first in their family to go to college, were parents already, and had experienced something related to health disparities that motivated them to explore HIA.

For several of the students, this course was their first introduction to HIA. Ten of the eleven students rated the course as "excellent"; one student rated it "good". Eighty-two percent of the students estimated how much they learned in the course was well above average (the highest choice), and 18% above average. Sixty-four percent estimated that the amount the course challenged them intellectually was also well above average; 36% estimated the amount that they felt challenged intellectually as above average. The course improved their understanding and appreciation for social determinants of health, and how public decision making is done often times without consideration for the adverse impacts on public health. In summary, the pilot course was a success. UTEP College of Health Sciences plans to offer the course again next year. NMSU College of Health Sciences is also interested in offering the course in their MPH curriculum.

New Partnerships. We expanded our network of institutional partners by conducting one full HIA in New Mexico, engaging New Mexico State University as a new institutional partner. Their Southwest Center for Survey Research in the College of Health Science and Social Services made a major contribution to our HIA effort by designing the surveys that we used, helping to administer the surveys, and analyzing the survey results. We engaged other state and local agencies in New Mexico related to the public transportation HIA, including the lead agency, the South Central Regional Transit District of New Mexico. This not only expanded our institutional partners but also provided an opportunity for these local and state agencies to learn about HIA and its utility. The NM DOT used our results in conducting their own transportation infrastructure assessment in the Santa Teresa area including the new port of entry on the U.S./Mexico border.

New Approaches. Our chief new contribution was to develop and pilot test a streamlined process for BECC that will promote a Health in All Policies approach along the U.S./Mexico border. This tool could be used not only by BECC but also EPA and USDA-RDA who also fund infrastructure projects on the border. Our work with BECC is ongoing and still in process. Under a separate contract with them, we will be working closely with them until March 1, 2017 to identify processes to improve their monitoring and evaluation and their assessment of impacts.

I.C. Lessons Learned

We identify the following lessons learned for the HIAs and other major activities that we conducted.

Transportation Matters HIA

1. A "culture" of public transportation use is lacking/missing in the region. In other regions of the U.S. a culture of public transportation use has developed that does not exist in the desert Southwest. To address this problem, we recommend a number of actions to close this "cultural gap". See Recommendation #5 under Transportation Matters.
2. There is a very large lack of agreement between survey results for respondents' interest in using the bus system and the actual ridership. Whereas at least 80% of respondents said that they would use the bus, ridership is only around 150/week. This is not uncommon in surveys that explore people's interest in accessing different services. It takes time and satisfactory performance by the bus service to bridge some of this difference.

3. Public transportation in rural areas has the potential to remove a physical barrier that prevents residents from accessing goods and services that are available in urban areas.
4. There is a "structural bias" in more urban areas with regards to rural areas. Urban residents ask "why should we bear the cost of providing services to rural areas? Rural residents cannot expect the same services as urban residents." In response, we tried to provide an assessment of the benefits of the rural bus system, to move the dialogue off of just the costs.
5. Lack of access to health care in rural areas contributes to health disparities.
6. Individual stakeholders have "hidden agendas". Triangulation among stakeholders and key informants can shed light on some of those hidden agendas.

Water Matters HIA

1. The community verified a longstanding struggle to obtain piped water in the area, having been promised when they purchased their land that piped water was coming but then after 15 years there is no piped water. For the first time, community members felt heard through the HIA process. They do not feel heard by the city of Presidio or other local government officials. Thus, there was an intangible benefit to the community, just in terms of feeling heard for the first time.
2. Our study area around Hwy 67 and Las Pampas included only about 20 residents in 12 households and four businesses. Obtaining access to water would certainly provide opportunities for the area to grow, but over the past 15 years it has been constantly shrinking. The amount of time, money, and resources spent on the HIA has to be questioned in terms of the number of people who will directly benefit. Yet without the HIA, the community had no voice. If we consider access to potable water a basic human right, then we have to conclude that the time, effort, and resources were worth it, if the residents ultimately get access to piped water.
3. There is a lot of potential to grow the international bridge traffic and that could impact businesses on the Hwy 67 corridor.
4. Presidio is a small town in a rural, relatively isolated area; it was difficult to find key informants for the purpose of the HIA.

General Lessons Learned from Conducting HIAs in Rural Areas

1. Conducting HIAs in rural areas reveals the complexity of rural areas compared to urban areas, including the political context of local control by locally powerful individuals and how it changes over time and the structural bias of urban residents against rural areas.
2. HIA provides validation and gives voice to marginalized rural residents.
3. The lessons learned in our program can not only be adapted to other similar regions in the U.S, but are unique in their relevance to Latin America and other regions of the world.

Institutionalizing HIA

1. The Health Impact Index and Stream-lined HIA Process

   We are confident that an appropriate Health Impact Index (HII) can be developed and used in a stream-lined HIA process. The HII needs further testing and development but this must be done by potential users like BECC. The stream-lined process that we propose maintains the basic HIA structure with stakeholder input, but shortens the assessment process by using predicted impacts based on the literature, professional experience, and stakeholder knowledge.

2. HIA Course

The first pilot course in HIA at UTEP proved to be both challenging and rewarding. A major challenge was how to simplify the goals and practice of HIA. In the end, the students felt empowered and saw great value in the HIA methodology. They envisioned using the tools of HIA, if not actually conducting HIA in their future careers. From this standpoint, the course trained and inspired new HIA practitioners. UTEP plans to offer the course again and NMSU is thinking of offering the course as well.

3. New Partners

NMSU became involved in HIA for the first time. They are considering offering the HIA course and now have the capacity to conduct HIA on their own. The value of HIA was also demonstrated to a number of new partners in New Mexico, which is one more step in institutionalizing HIA and "health in all policies".

4. BECC

BECC is not able to conduct a complete HIA for every project that they plan and certify. However, they are interested in using the tools of HIA and in implementing a stream-lined process focused on assessing, monitoring, and evaluating the health impacts of projects. This also involves identifying a set of key indicators that they can monitor. The identification of these key indicators and the institutionalization of a streamlined process is still to come but intentional work is in process and progress is being made.

Hauling water near Presidio, TX

Community meeting in Las Pampas

SECTION II. INTRODUCTION

II.A. Core Elements

Our goal for this HIA Program Grant was to develop a collaborative HIA program on the U.S./Mexico Border that built on our existing partnerships and expertise and that: 1) identified and engaged new institutional partners; 2) developed capacity at UTEP and other border universities to build a cadre of HIA practitioners who are bilingual and culturally competent for the border region; and 3) developed and implemented a process for BECC and other agencies such as USEPA and USDA to include HIA in infrastructure project decision-making. Through new partnerships, capacity building, and advocacy of a "health in all policies" approach to border infrastructure development, this program aimed to develop a strong foundation for sustainable use of HIA principles in the border region in the long-term.

Our program built upon our experience in a HIA Demonstration Project in Vinton, TX that focused on water and sanitation. Our Program Grant was comprised of the following core elements: 1) we conducted one full HIA in southern New Mexico on a different infrastructure topic (public transportation) to build experience and to engage new partners; 2) we conducted one "streamlined" HIA on water infrastructure that built on our previous experience and allowed us to pilot test a streamlined process and a "Health Impact Index"; and 3) we developed an interdisciplinary course aimed at undergraduate and graduate students at UTEP in order to train our students in HIA concepts and practice. The rationale for the course was that there is currently limited expertise and experience in the border region to conduct HIAs, while there is a large projected demand for trained professionals who are bilingual and culturally competent to conduct HIA in the border region. The course was pilot tested in the summer session of 2016, and included a mix of theory, process, and experiential learning. The streamlined process for assessing health impacts of potential projects, including a "Health Impact Index", was developed primarily in response to the need of BECC to provide some health impact assessment of their infrastructure projects that is affordable, timely, and efficient. The goal was to develop a process and tool that could provide some quantitative assessment and comparative analysis of proposed projects with respect to health impacts, in lieu of a full HIA for each proposed project. BECC was also interested in identifying monitoring criteria for completed projects that would enable them and other agencies to assess the health impacts of completed projects in the border region.

Our program provided a unique opportunity to strengthen HIA use and data collection related to social and environmental determinants of health and equity for the underserved border region. The border region is characterized by predominantly Hispanic populations, a high incidence of unemployment and poverty, limited infrastructure, and numerous small towns with limited capacity to improve infrastructure. In particular, many towns are lacking in basic water and wastewater treatment, lack paved roads and public transportation systems, and face land use issues, especially in areas where urbanization is encroaching on agriculture. As far as we know, there are no other HIA efforts focused on the border region and this particular suite of issues. Our overall intent was to create a model in the border region for including health in infrastructure decision making.

II.B. Partnerships

Our program was built on an existing relationship among UTEP, BECC, and WHO-PAHO. BECC is a chief beneficiary of our work, since it is responsible for certifying border infrastructure projects for funding by the North American Development Bank (NADB). The Board of Directors of BECC/NADB has encouraged BECC to develop and adopt a process to assess and consider health impacts in its assessment of project outcomes. The Director of BECC, Maria Elena Giner, has been committed to this objective. WHO-PAHO also remained a partner in our program. WHO-PAHO has a deep interest in HIA to safeguard public health and as a concrete means to advance the Health in All Policies (HIAP) agenda in the Americas.

We expanded our network of institutional partners through the conduct of one full HIA in southern Doña Ana County, New Mexico, engaging New Mexico State University as a new institutional partner. Their Southwest Center for Survey Research in the College of Health Science and Social Services made a major contribution to our HIA effort. We engaged other state and local agencies and NGOs in New Mexico related to the public transportation HIA, including the lead agency, the South Central Regional Transit District of New Mexico (SCRTD) and an active community organizing NGO, the Empowerment Congress.

In addition, for the streamlined HIA focused on water infrastructure, we developed a collaborative relationship with the city of Presidio, TX, who is considering extending water services out to the *colonia* of Las Pampas.

II.C. Challenges

The border region presents some unique challenges because: 1) it cuts across so many jurisdictional boundaries, including international, national, and state; 2) it is for the most part bilingual; and 3) many of the small cities and towns are resource poor and limited in capacity. These factors present challenges in implementing an HIA program.

Additionally, we were challenged in a couple of other ways in terms of conducting the two HIAs. In southern Doña Ana County, the rural area to be served (in which we conducted the public transportation HIA) was approximately 40 miles long and about 10 miles wide, including about 20 individual small rural communities with a total population of about 60,000 people. The distance between communities and the individual, independent nature of each distinct community presented difficulties in terms of having community meetings or achieving any cohesive consensus among the communities. Presidio, TX and Las Pampas are about 250 miles from El Paso (4 hrs travel time by car). This distance also presented challenges for conducting regular meetings and having ready access to people and information.

However, our team is experienced in facing these challenges and in promoting public and stakeholder participation in the unique border setting. We are accustomed to collaboration with multiple jurisdictions, even including Mexican institutions and organizations; most of our personnel are bilingual; and we are experienced in working in poor communities with limited resources. Thus, we were poised to make significant contributions to building capacity to use HIA in the region. The lessons learned in our program can not only be adapted to other similar regions in the U.S, but are unique in their relevance to Latin America and other regions of the world.

II.D. Acknowledgements

We gratefully acknowledge the advice, support and constructive criticism of the Health Impact Project Officer, Arielle Simoncelli, and the Technical Consultant, Jonathan Heller, from Human Impact Partners. We also acknowledge the hard work, commitment, and dedication of the UTEP and NMSU staff and students who worked on the project, including: Jane Aman, Tali Castillon, Mario Chavez, Marlene Flores, Jesus Placencia, Gustavo Puiatti, Amit Raysoni, Sam Simon, and Mayra Ruiz from UTEP, and Sandra Rivera-Timmons, Candace Stoughton, and Chris Spurny from NMSU.

The UTEP HIA Team: (l-r) Amit Raysoni, Mario Chavez, Michelle Del Rio, Jesus Placencia, and Bill Hargrove

Michelle Del Rio with Mr. & Mrs. Vazquez, residents of Las Pampas

SECTION III. "TRANSPORTATION MATTERS" HIA

"…transportation is part of the fabric that connects everything together in a community…"
- Mayor of Sunland Park, NM

III.A. Introduction

The Context

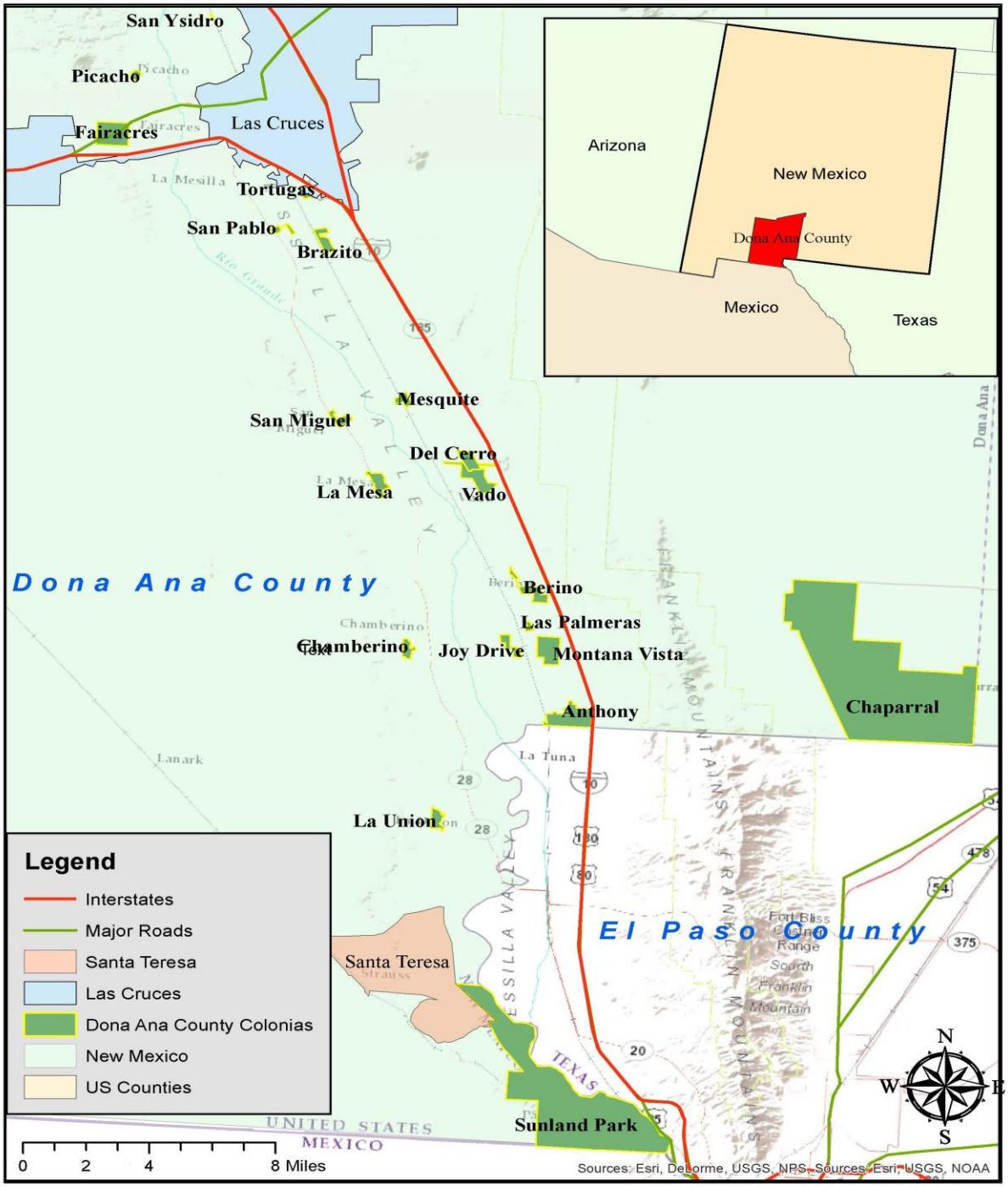
There has been recognition by many planning, development, and health organizations, such as the World Health Organization-Pan American Health Organization, U.S. Environmental Protection Agency, U.S. Centers for Diseases Control and Prevention, and U.S. Department of Transportation that the built environment plays a major role in determining health behaviors and outcomes at the individual, and community level. There is an even greater recognition that public health outcomes are influenced by multiple modes of transportation for different types of users of public transportation services (CDC, 2015, WHO-PAHO, 2010).

Most of the HIAs on public transportation are conducted in urban areas and focused around proposals of expanding or improving an already existing service; about 48 HIAs on transportation were reported by 2013 (Ross, et al., 2014). This HIA is unique in that it focuses on a decision to increase public transit service in Las Cruces and extend public transportation between Las Cruces and several rural towns/*colonias* in southern New Mexico along the U.S.-Mexico border, including Chaparral, Anthony, Santa Teresa, and Sunland Park. Conducting an HIA on public transportation in rural areas is challenging as there are no existing public transportation services, and it is difficult to plan a public transportation system that meets all residents' needs and local stakeholder's interests.

A map of the potential service area is presented in Fig. 1. These primarily low resource communities with high rates of poverty and very limited services available locally. Public transportation would have both direct and indirect benefits to the local community. Direct benefits include improved access to health care, while indirect benefits include improved access to a range of goods and services, such as fresh fruits and vegetables, job training, educational opportunities, recreational activities, and others. **Our goal is to assess the direct and indirect impacts of extending public transportation to rural areas of southern Doña Ana County, with special focus on access to: 1) health care, 2) fresh fruits and vegetables, 3) education (both formal and informal), and 4) jobs and other economic activities.** If approved, the bus service would be the first and only form of public transportation option for the study area residents who have limited access to basic health, government, and social services. The majority of households in the study area live below the poverty line and either own only one or no family vehicle. Many are older adults and cannot drive at all.

The lead agency and the key decision maker for this project is the South Central Regional Transit District (SCRTD) of New Mexico, which is a government agency that serves both Doña Ana and Sierra Counties. The SCRTD was created in November of 2006, pursuant to New Mexico Law Section 73 Article 25, NMSA 1978, et seq., to provide and coordinate public transportation services in the southern region of New Mexico. Their goal is to "increase personal mobility and improve access to employment, education, shopping, medical, social activities, and other critical services and at the same time reduce dependence on private vehicles, thereby improving air

Fig. 1. Map of the Transportation Matters project area



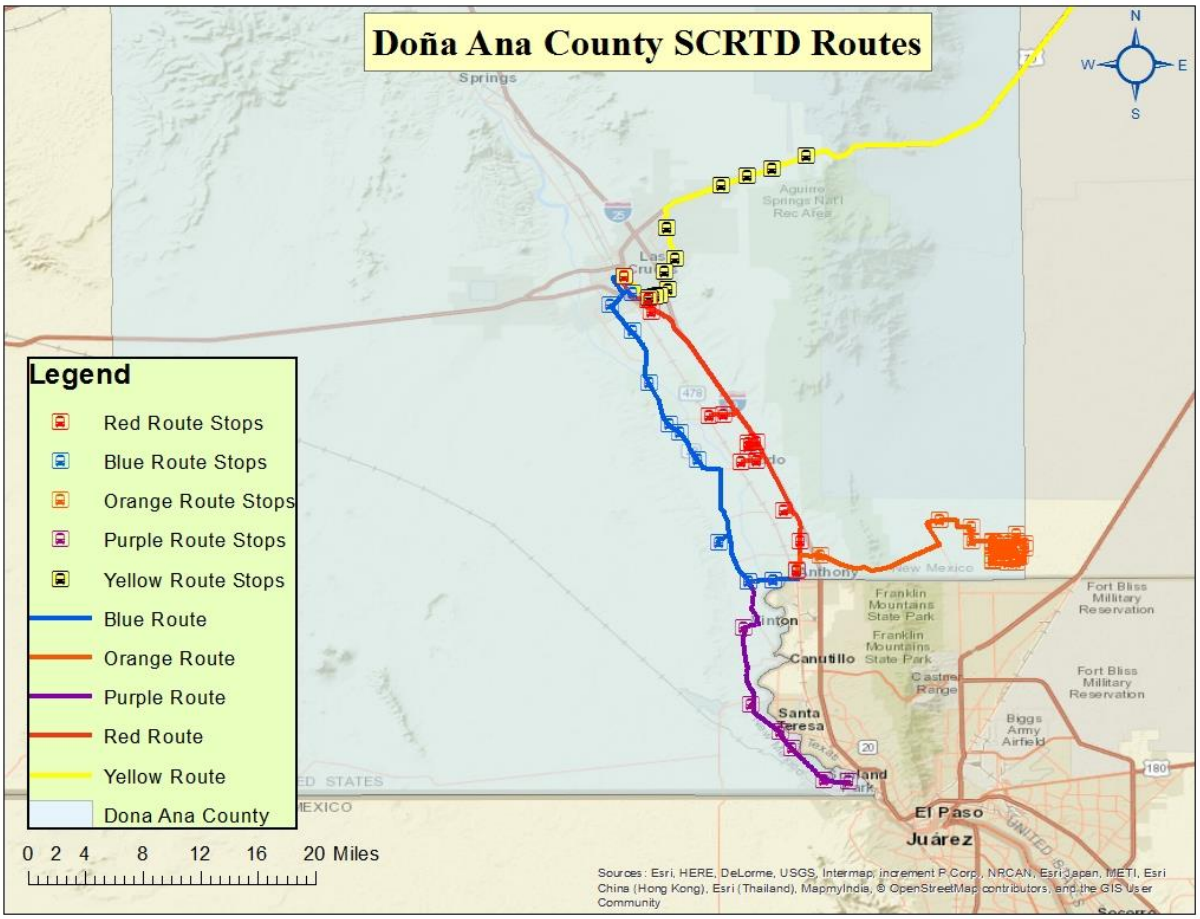
quality, diminishing traffic congestion, and increasing disposable incomes for public transportation passengers" (South Central Regional Transit District, 2016). The SCRTD is also supported by a number of federal, state, and local agencies such as the American Public Transportation Association, U.S. Department of Housing and Urban Development, U.S. Department of Transportation, New Mexico Department of Transportation), El Paso Metropolitan Organization, Las Cruces Metropolitan Organization, and local community

organizations, such as the Empowerment Congress, Anthony Water and Sanitation District, City of Las Cruces, the Camino Real Consortium, the Colonias Development Council, La Semilla Food Center, and the Anthony Youth Farm.

The Decision

The SCRTD first proposed rural services in 2014, and piloted a service that operated from June to November of that year. In that same year, the SCRTD proposed a county Gross Receipts Tax (GRT) increase in the November ballot to support and expand services. The proposal failed, and services were terminated due to lack of funding. Public transportation systems already exist in the northern part of Doña Ana County, but none in the southern part. A referendum on the November, 2014 ballot would have provided an increase in Gross Revenue Tax of ¼ of 1% to fund the expanded transit, but it failed. The SCRTD Board re-started a pilot program using some temporary funding from county and state government with an intent to put the referendum on the ballot again at a future date to sustain financial support. The bus routes for the restarted pilot program as of June, 2016, area shown in Fig. 2. Our HIA will inform decisions around maintaining the pilot program, putting the referendum on the ballot again, routes for the new transit system, and the operation and maintenance of the systems.

Fig. 2. Bus routes for the pilot program, June, 2016



A key question for the SCRTD is, "How can the final transit system plan accomplish the most positive impact on the users?" Using a community based participatory research approach, our HIA provided detailed information on the present lack of health care access and the potential direct benefits of public transportation to health outcomes. Additionally we collected information on other direct and indirect determinants of health and their impacts (i.e. access to fresh fruits and vegetables).

A number of decisions need to be taken regarding the expansion of public transportation in this region. The principle questions to be addressed include:

1. Should the SCRTD expand service to rural areas of southern Doña Ana County?
2. How should it be paid for?
3. Which communities/areas should receive service?
4. What bus service routes would optimize the health, education, economic, and other benefits for the most residents?

In addition to these important questions, numerous other questions need to be addressed as well over the coming months. November, 2016 is a key decision point as it provides opportunity to incorporate a funding mechanism on the ballot. In the interim, the SCRTD has found funding sources to re-start a temporary pilot program and is also interested in initiating a better marketing and communications plan to "sell" the expansion of service. Our HIA will provide crucial information on the impacts of the expansion and will inform the decisions about which communities to serve and the routes that would provide the maximum benefits.

Finally, although our HIA focused only on southern Doña Ana County (essentially the region between El Paso, Texas and Las Cruces, New Mexico), the outcomes of this study are relevant to other rural communities in the county, as well as to other rural areas in New Mexico and Far West Texas.

The Affected Population

Our assessment will focus on direct and indirect determinants of health in relation to the proposed public transportation project. The geographic focus is the area of Doña Ana County located south of Las Cruces. There are almost 60,000 people living in this area in a total of 20 small communities, 18 of which are unincorporated. Sunland Park and Chaparral are the two largest communities (with about 28,000 total in these two). Households in this area are mostly young families with about 40% of the total population comprised of young individuals less than 19 years old and with a median income of about $24,000/yr. About 40% of the households live below the poverty line.

Direct health impacts relate primarily to access to health care and fresh fruits and vegetables, as well as other conditions conducive to safety (such as less road accidents) and healthy living (such as walking to bus stop). An advantage to our HIA is the fact that the local Empowerment Congress had already conducted a survey among its members to assess the need for and benefits of public transportation in the area. Most households have only one car if any. Along with information collected by the Empowerment Congress, we conducted a literature review of the impacts of public transportation and collected a number of relevant documents (See Appendix A.1.). Some of the indirect determinants of highest priority according to the survey, literature

review, and stakeholder discussions, include access to: 1) education, both formal and informal; 2) jobs; and 3) shopping and other economic activity. Access to formal education is important for young people who want to attend either Doña Ana County Community College or NMSU but do not have their own car. Informal education includes such things as workforce development training, English classes, citizenship classes, and others. Other indirect impacts relate to job access and economic activities like shopping. Additional issues that we addressed include environmental and larger scale economic impacts related to economic development and the potential for small business development. We also considered environmental indicators of interest, including those related to air quality and safety factors. We focused on these impacts because these conditions are recognized as social and physical determinants of health that optimize health, functionality, and quality of life (USDHHS website in reference list).

The study area has a relatively young population, who could be considered to be vulnerable to lack of transportation; 40% of the population is under 19 years of age (US Census Bureau, 2010). The elderly, many of whom cannot drive, are also vulnerable. Also, people with health conditions that require regular treatment such as kidney dialysis for example, or who suffer from chronic illnesses are also vulnerable. Our HIA examined changes in health and quality of life indicators with special emphasis on the young, elderly, and individuals with severe chronic health conditions/impairments.

The Stakeholders

A stakeholder analysis was conducted and is included as part of our Stakeholder Engagement Plan, presented in Appendix A.2.

HIA Methodology

Health Impact Assessment (HIA) is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population (National Research Council, 2011). In addition, HIA provides recommendations on monitoring and managing those effects. Our HIA followed the six recommended steps of:

- Screening
- Scoping
- Assessment
- Recommendations
- Reporting
- Monitoring

Our Screening and Scoping reports are included in the Appendix (A.3. and A.4.) We summarize the results from those here and then focus on the Assessment, Recommendations, and plans for Monitoring.

Screening. During Screening, we discovered that the discussion of the SCRTD's proposal to provide public transportation services in the rest of the county was focused on cost alone and did not consider health impacts. The Screening step identified a need to assess access to health care services, affordable nutritious foods, green spaces, education, jobs, and positive social engagement. These effects were identified by previous community studies and organizations,

some government officials, county residents, and the transportation agency, SCRTD. With the idea that such assessment could then provide useful information as to whether provide such service, and if so how to design a service that could be coordinated and built on available transportation options and serve the whole county, but especially the rural communities access needs, it was determined that an HIA would be useful to inform the decision.

Scoping. During the Scoping phase, the HIA was planned with the technical and community expertise of the HIA leadership team, and advisory team members which included university partnership with NMSU, and SCRTD, and community organizations and service providers related to health, education, and economy. The HIA aimed to identify the direct and indirect health impacts of the proposed project and from having access to health care and social services, education, and economic opportunities, in hopes to inform and broaden the discussion of the decision beyond service cost and funding. For project feasibility reasons, the HIA focused in the southern section of Doña Ana County, the area between El Paso, Texas and Las Cruces, New Mexico, but outcomes of the study could be implied to the rest of the rural communities in the county as the transportation gaps identified were from all rural communities in the county. The key local decision makers regarding the expansion of public transportation to southern Doña Ana County include the Board and Citizens Advisory Committee of the South Central Regional Transportation District of New Mexico and the Doña Ana County Commissioners.

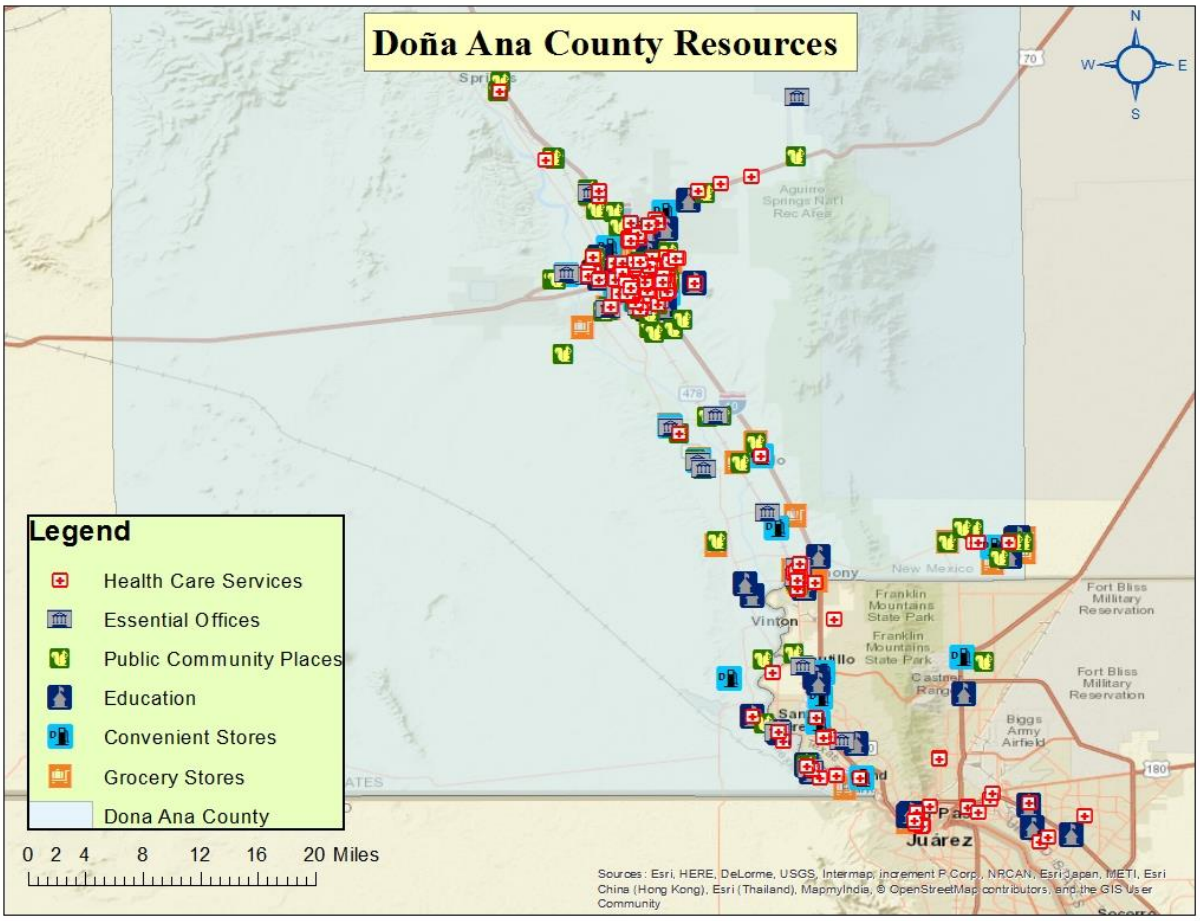
III.B. The Assessment

The key research questions that guided our assessment work and a brief description of the methodology used to address the research questions are included in the Scoping Summary in Appendix A.4. Below we provide more detail on our methodology for mapping key resources for goods and services, and for conducting the key informant interviews, community survey, and focus groups. All protocols were approved by the Institutional Review Board for Human Subjects Research at the University of Texas at El Paso (#637598-7). All subjects gave their informed consent for inclusion before they participated in interviews, focus groups, or surveys.

Mapping Resources. Key sources for important goods and services in Doña Ana County were categorized as: 1) healthcare, mental and social services; 2) groceries and fresh produce; 3) convenience and multi-purpose retail stores, 4) community or public gathering spaces; and 5) educational/learning centers. The resources were identified through the 2013 Doña Ana County Resources and Referral Manual and Google Maps using keywords to identify all possible resources mentioned by key informants and study participants. The major categories and examples for each are presented in Table 1. A map of the area showing sources of goods and services is presented in Fig. 3. These resources include health care services, public community spaces, government offices, educational opportunities, convenience stores, and grocery stores. It is clear from Fig. 3 that most essential services are concentrated in Las Cruces and near El Paso. Mapping was done using ESRI ArcMaps desktop version 10.3.

Some of the key resources that stakeholders want to access are located in El Paso, which is outside of the study area and cannot be served by the bus system since it would have to cross stateliness. Examples of these types of services include major hospitals in El Paso such as University Medical Center, William Beaumont Army Hospital, pharmacies in El Paso near the

Fig. 3. Sources of goods and services in southern Doña Ana County, NM.



bus transfer stations, and clinics that offer primary care, dental, or behavioral, mental, and social services to U.S. veterans.

In Table 1, supermarkets are businesses that offer wide options for groceries, but in addition offer other supplies such as household items, clothing, and electronics. Retail stores offer mainly non-food items but also offer some food items. Major convenient and multipurpose stores located in the rural areas were identified as sources for purchasing a variety of goods, including some groceries, personal hygiene items, and household items. School programs that offer meals for children during the summer months were not included since these are seasonal services and provide food for children only. Public community spaces were identified as places where people may commute and socialize, and in some cases get formal, informal or non-formals type of education.

Elementary and middle schools were not included as school buses provide transportation to these facilities. High schools were included because students have trouble attending after school or summer extracurricular and education activities. The Gadsden Independent School District Main office was identified as a place where parents communicate with the school system, and was included under this category with no specific sub-label.

Table 1. Key sources for important goods and services.

Healthcare Services	Groceries and Fresh Produce	Shopping, Paying Bills, Other Essential Services	Public/ Community Spaces	Education/ Learning Centers
Primary and preventive care • Clinics • Hospitals • Immunization • Family planning services	Retail outlets • Grocery store/ Super-market • Produce market • Farmers market	Retail stores • Family Dollar • Dollar General • Quick Pic (Others are concentrated in Las Cruces and El Paso)	Parks	High schools
Specialized and rehabilitation care • Oncology • Podiatry • Drug/alcohol abuse programs	Food assistance programs • Food pantry • WIC/ Food stamps	Paying taxes	Public libraries	Colleges or universities
Dental care	Food programs for seniors • Cooked meals	Utilities (electric, water, etc.)	Recreation/ community center	Vocational/ trade schools
Pharmacy		Post office	Sports facilities/ swimming pool	GED, ESL, or literacy programs
Behavioral, mental, or social services			Church/other religious	Museums/ educational exhibits

Key Informant Interviews. We interviewed a total of 44 key informants. A list of the agencies, organizations, or communities that they represent is provided in Appendix A.5. Key informants were identified through recommendations from HIA leadership and advisory committees and other key informants. The key informants represented professionals from a range of sectors including health, education, business or economic development, social services, and environment. We used a standard list of 14 open-ended questions to interview each individual. The questions focused on the impacts of public transportation with respect to health, education, economy, workforce development, and environment. Key informants were also asked about their concerns and recommendations for the bus service. The list of questions is provided in Appendix A.6. Each interview required about 45 minutes. The interviews were audio recorded, transcribed, and analyzed for qualitative codes. The results were organized into key themes, subthemes, and potential magnitude of impacts. Analysis by the research team and group

discussion was conducted to characterize impacts and create a rubric to quantify themes. After the characterization of the impacts, counts for how many times the theme was mentioned in any interview was recorded in a Microsoft Excel sheet. Counts were aggregated by subtheme to get a sense of magnitude and priority for different themes and subthemes. Main themes included health, education, economy, environment, safety, and infrastructure.

Focus Group. We conducted one focus group comprised of 13 *promotoras*, paraprofessional community health workers who work in the area. The list of discussion questions that were used for the focus group is presented in Appendix A.7.

Community Survey. For the community survey, we developed and administered a 21-question survey (in English or Spanish) for community members. The survey focused on health, education, and economics and was aimed at identifying what kinds of services residents would like to access. We obtained informed consent from each participant and parental consent for individuals less than 18 years old, but at least 15 years old. We did not survey anyone less than 15 years old. The survey instrument is presented in Appendix A.8.

We used a convenience sample approach by going to community health clinics, Doña Ana Community College, community centers, senior centers, church parishes, youth farms, and farmers markets and requesting participation in the survey with whomever we encountered. We did not ask them to complete the survey if they did not live in the area. We collected a total of 1054 surveys from 21 different communities in the study area. The demographics of survey respondents are summarized below in Table 2, compared to some statistics for Doña Ana County as a whole. Additional more detailed demographic statistics are provided in Appendix A.9.

Bus Ridership Survey. The passenger survey consisted of twelve questions asking users of SCRTD public transportation their intended destinations, travel time, physical activity gained from walking and cycling to bus stops, perceptions about the bus service, and some personal information such as age (range), gender, and community of residence. Questions were multiple choice, open ended, on a Likert scale rating format. Participants had to be 18 years of age or older in order to participate, and it required 5-10 minutes of their time including signed consent. Surveys were collected during two weeks of May 2016, two days out of each week. For two of the four lines of service, survey administrators rode the buses for two complete round trips to survey riders. For the other two lines, survey administrators waited at the transfer stations in Anthony and Las Cruces, and interviewed riders as they waited for their transfer bus.

III.C. Assessment Findings

Key Informants. The key themes for impacts of public transportation that were identified by key informants are summarized below in Fig. 4. This pie chart also reflects the relative importance of each theme by virtue of the number of times it was named or discussed by key informants. Impacts related to the economy was the most important theme followed by education. Direct impacts on health was third in importance.

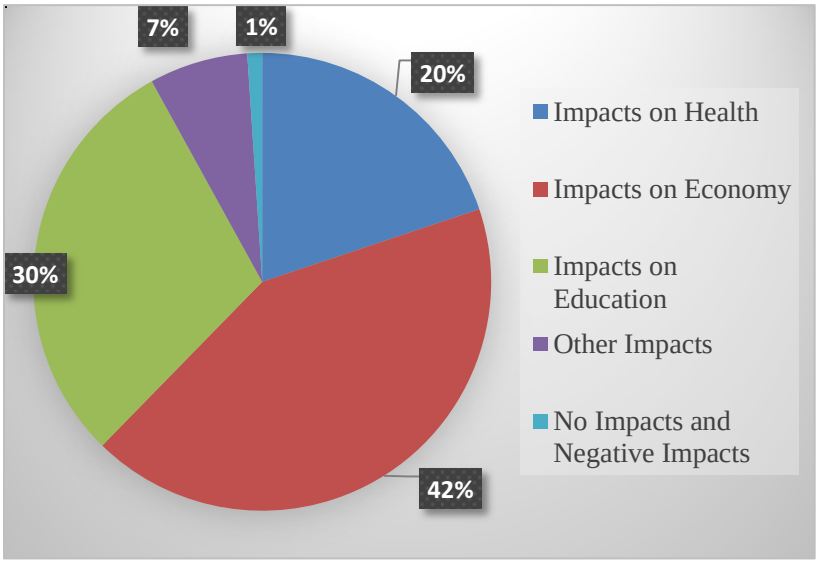
Some additional minor themes included safety (especially highway safety), environment (improved air quality), and infrastructure. Highway safety could be improved by reducing

Table 2. Demographics of survey respondents

Characteristic	Number of Individuals Responding	Percent of the Total Responding	Doña Ana County Statistics*
Residence			Population
Chaparral	296	28	16,252
Anthony	222	21	9,788
Montana Vista	116	11	8,592
La Union	74	7	3,029
Berino	63	6	4,158
Sunland Park	53	5	16,822
Other (15 other communities; not more than 20 from any one)	232	22	36,190
			DA County total: 209,233
Age			NA
Adolescents (15-25 yrs)	327	31	
Adults (26-59 yrs)	433	41	
Seniors (>59 yrs)	232	22	
Median age = 40 yrs			
Gender			NA
Male	517	49	
Female	539	51	
Preferred language			NA
English	591	56	
Spanish	465	44	
Veterans	63	6	NA
Physically impaired	137	13	NA
Household income < $20,000/yr	686	65	Median Income $38,426

* From UNM Bureau of Business & Economic Research, combination of 2010 U.S. Census Data and American Community Survey 2006-2010; http://bber.unm.edu/colonias

Fig. 4. Key themes of impacts identified by key informants.



substandard vehicles on the roads that do not have good brakes or brake lights, that frequently break down, and create a lot of emissions, and operators who are not insured. Improved air quality could be achieved by decreasing emissions and dust. It was recognized that mass transit could mitigate the risk for non-attainment of air quality for the area of southern Doña Ana and City of Las Cruces. With respect to infrastructure, many said that mass transit would improve the livability in rural communities, and because of the socialization from improved mobility that rural communities could become more vibrant. In addition, some key informants said that mass transit may reduce costs and needs associated to maintain roads and expand highways and streets to accommodate growing traffic.

A few negative comments were received and can be summarized as follows:

1. Transportation is not the limiting factor to accessing health care; therefore there will be no benefit of providing public transportation to health.
2. Transportation is not the limiting factor to obtaining better jobs; therefore there will be no benefit of providing public transportation to economics.
3. Buses will create more congestion.

We summarize the potential benefits of public transportation under each main theme in Table 3, as obtained from the 44 key informant interviews. The themes and subthemes under each main theme are listed in order of importance, based on the number of times key informants discussed impacts related to themes or subthemes.

The greatest impacts identified by key informants reflected opportunities for positive economic activity for the region (Table 3). The opportunities for economic development are created based on the improved physical access to goods and services, employment opportunities, and from predicted available household incomes. The types of goods and services to which most people were interested in having access were groceries stores and supermarkets and entertainments services like movie theaters and dining. It was also emphasized that transit would improve access to not only social and county services, especially to food pantries or services, and senior meals, but also to county services like local postal offices, and tax offices. Also mentioned, was access to daycare, community centers, government agencies, social work services, housing assistance, senior programs, workforce solutions, and support groups. The most common destinations to access these goods and services were Las Cruces and Anthony, NM.With respect to education, the impacts in order of magnitude were: 1) Access to formal education; 2) Access to non-formal education; 3) Access to self-learning opportunities/informal education; and 4) Improve communication and engagement in the community. The types of formal education opportunities mentioned were to access public schools at all grade levels, when parents' cars break down and in the case of high school students when parents cannot take them to school because it conflicts with parent's work schedule. While Gadsden district provides school bus transportation to students, there are some students who still depend on their parents to go to school and school related activities and when that dependency is not a reliable form of transportation, students miss school. There was also a high interest in having access to local community colleges and universities like DACC campuses, and NMSU. An interest was also expressed in having access to adult learning or adult basic education such as GED and English as a second language classes. DACC instructors indicated that the biggest challenge for their students to complete adult learning courses were transportation, followed by not having child care services.

Table 3. Results from 44 key informant interviews; identification of the potential benefits of public transportation

I.ECONOMICS	II. EDUCATION	III. HEALTH	IV. OTHER
1. Access to employment opportunities • Job opportunities • Job training • Job fairs • Hiring processes	**1. Access to formal education** • NMSU/DACC • Job training • Technical schools • Pre-K to 12 schools • Computers at school or library • Adult learning	**1. Access to health care services** • Clinics • Hospitals • Preventive care • Health education • Pharmacies	**1. Safety** • Replace substandard vehicles • Reduce automobile accidents
2. Access to goods and services • Pay bills • Better shopping • Social and county services	**2. Access to non-formal education** • Extracurricular activities • Life-enhancing classes at churches or community centers	**2. Access to fresh fruits and vegetables** • Better supermarkets • Farmers markets • Gardening education	**2. Environment** • Decrease emissions • Decrease dust
3. Opportunities for economic development • Growth of major economic centers • Rural development in response to local demand • Expanding tax base	**3. Access to self-learning opportunities** • Libraries • Historical sites or museums • Public meetings • Educational events	**3. Reducing risky behaviors due to isolation** • Alcohol abuse • Teen pregnancy • Depression • Suicide • Stress • Domestic violence	**3. Infrastructure** • Reduce road maintenance (though buses are hard on roads too) • Improve livability in rural communities
4. Reducing household costs • Owning/maintaining a vehicle • Gasoline • High cost of goods in rural areas	**4. Improve communications and engagement** • Between parents and schools • Between community resources and residents • Civic engagement	**4. Increase/promote physical activity** • Promote and preserve “walking culture”	

In regards to non-formal and informal education opportunities, there was interest in having access to life enhancing classes such as learning new hobbies, attending citizenship, nutrition, home gardening, grant writing, entrepreneurship, diabetes management, soft skills/professional development classes and public health education. Access to libraries was the most popular response in regards to having access to self-learning opportunities with the intention to improve literacy. Finally, the bus system was seen as a way to improve communication and engagement between parents, schools, and district, between community members and local resources, which would improve and promote civic engagement and discussion.

With respect to health care, four key themed impacts were identified: 1) Access to health care services, 2) Access to nutritious food options, 3) Reducing opportunities for risky behaviors due to isolation, and 4) Increase and promote physical activity. The types of health care services included those to address acute and chronic diseases plus preventative care as well. Health education was also included under health care services, such as classes for nutrition, hygiene, first aid training, extreme weather response, health insurance information, diabetes health education specialist, mental health conditions, health or social (cancer survivors, and substance abuse) support groups, family planning, and social work/case management.

Access to nutritious foods was highlighted with emphasis on having access to fresh fruits and vegetables. Some thought of rural communities as a "food desert". The bus system could provide improved access to supermarkets and grocery stores, farmers markets in Anthony, Chaparral, and Las Cruces, and also food assistance programs such as food pantries and food services offered either by Casa De Peregrino, Loaves and Fishes, Roadrunner Food Bank, Adelante Senior Meals, or WIC. There was also an interest in having access to master garden or educational classes for growing healthy foods at home.

Another positive impact identified was the outcome of reducing risky behaviors that rural community members engage in due to their isolation from many resources and positive social interactions. With a great emphasis to reduce risky behaviors that youth often engage in, such as alcohol or substance abuse, delinquency, and sexual activity (that can lead to teen pregnancy and sexually transmitted diseases STDs). Youth were identified as having the least opportunities to positively engage in social, educational, and recreational activities because either the services were not offered nearby or because this population is still dependent on parents for transportation. Also, they may not know how to drive nor own a vehicle. Youth's peak hour or season to engage in such health risky behaviors is afterschool from 3-6 pm, and during the summer vacation, according to one health sector key informant. A health provider mentioned that domestic violence positively correlated with the stress of being jobless and not being able to support their family financially. Being isolated from health care services encourages individuals to delay needed attention to their health condition or treatment which could lead to disease progression, an uncured condition, increase in emergency room visits, re-admittance to hospitals, and ultimately result in premature deaths.

Public transportation would also promote active transportation which is walking and cycling to bus services and to final destinations. This form of transportation increases and promotes physical activity for persons, allowing them to meet their recommended duration of physical

activity, as suggested by health professionals. This would also increase access to parks, outdoor activities, and recreational centers.

Predicted outcomes, concerns and challenges, and recommendations from key informants are summarized below in Table 4.

Table 4. Summary of predicted outcomes, concerns/challenges, and recommendations from key informants

Outcomes	Concerns/Challenges	Recommendations
• Improvement of overall health • Creation of a skilled workforce • Improvement of the local economy - Las Cruces - Anthony and Sunland Park - Smaller rural communities • Improvement of air quality • Building community and individual capacity	• Type of fuel that the buses will use • Lack of communication and marketing strategies • Structural bias against rural communities • How to engage people in a constructive way when they have been disappointed in the past • Lack of adequate pave roads • Travel times and routes • Financial sustainability of the bus system • Walking conditions at the bus stops - Long distances - Weather conditions - Lack of sidewalks - Stray dogs	• Develop a robust education and marketing plan • Provide a high quality route and schedule service • Provide and continue improving excellent customer service • Develop an evaluation plan • Have a strategy for expansion

We collected a number of personal stories and quotes from interviewees regarding the potential benefit of public transportation in the area. One of these stories, shared by an interviewee relates to the need for public transportation to help people reach their place of work.

…There was this person in Chaparral; he used to work in El Paso and, you know, … the family only had this one vehicle and one day his vehicle broke down and the guy was getting up and leaving his house at four in the morning because he had to take his bike. …This is an example of a guy that, you know, he had a situation and instead of focusing on, "I can't," you know, he pushed himself because, he had a need to work. He pushed himself to ride the bike all the way to El Paso, but there is a lot of people who don't even have a bike and once you have a bike, just thinking about the distance, you know, the closest distance from Chaparral to El Paso is about 15 to 20 miles, but not everybody lives in that short of distance. So, if you don't have a vehicle and you can't go to work or your vehicle breaks down, you just can't go to work. Even if you want to. So, having the transportation system as a back up or, even like people were doing, parking their vehicles and getting to work and saving that gas money. I think it would be very beneficial because there's a lot of people out there that still get a ride to make it to work and, you know, it's like a vehicle. You depend on your friend or your neighbor to get to work because if

you're whoever was getting you the ride can't make it to work then that's you too. – DAC Health and Human Services Department

Several other relevant quotes are shared below.

"Transportation is like an upside down funnel, transportation is the up, and all of the sudden it expands at the bottom of the funnel… health, employment opportunity, shopping, education, access to quality food, everything is that bottom of the funnel and in the top it is transportation, and if that is very small and limited, then other things are not quite as available, if we can find a way to go through that narrow opening at the top of the funnel, then suddenly we have these opportunities that improve our quality of life."- Empowerment Congress

"I think it would be a great asset through the years; countless times I recall seniors calling from the Hatch area, from Chaparral, from Sunland Park to see if there is available transportation to bring them to Las Cruces to chemotherapy appointments, just basic doctor appointments because they do not have the means or family support or anything to have them come into Las Cruces for these appointments. I think it would improve quality of life overall because if you have the means to travel to whatever you need access to, it improves your quality of life as opposed to not be able to get to those doctor appointments, or educational, or nutritional resources if you are not able to get to them, the quality of life is not as great as those who are able to get to those."-Adelante Seniors

"…all these things are intertwined, health care intertwines with transportation, intertwines with education, all these things intertwine."-NGAGE

These quotes illustrate the central place that transportation holds in terms of access to health care and resources, and educational and economic opportunities, especially among active community NGOs.

Focus Group. The focus group with *promotoras* identified a number of health issues and determinants of health in the rural area. These are listed below in Table 5.

With respect to providing public transportation, the *promotoras* Identified a number of predicted impacts, concerns or challenges, and recommendations. These are listed below in Table 6.

Community Survey. Table 7 lists the types of sites where surveys were collected. Most of the categories of sites are self-explanatory, but community events included "swap meets" (flea markets), non-profit organization monthly meetings, and a school supply drive event. Community centers included senior centers, NGO and county meetings in community venues, and adult basic education classes in community venues. Adult basic education programs were offered both at community colleges and community centers and were counted according to the venue where they were conducted. Youth programs included youth farm programs offered afterschool and during the summer for ages 14-24.

Table 5. Health issues and determinants of health identified by *promotoras* in the focus group.

Issues Related to Determinants of Health	Population Most Impacted	Challenges to Addressing Issues
• Water quality and sewage system • Road and pedestrian safety (paved roads, sidewalks, stray dogs) • Need for a community emergency and evacuation plan for both residents and first responders • Environmental evaluation of contamination due to dairy farms and/or other agricultural sources • Fly and mosquito control • Disease and mortality registry/monitoring of incidence of cancer, diabetes, and obesity • Recreation areas, walking trails, parks, indoor recreation centers; creating healthy environments • Shuttle buses within the community for seniors and/or for those who cannot drive to attend community activities or services • Public safety	• Elderly • Youth • Individuals without health insurance	• Not having money to address needs (as a whole community) • Uninsured, persons not having ealth insurance • Policies that make it hard to address needs (like the anti-donation policy) • Not having safe roads for driving and pedestrians • Identified needs in communities have not been addressed in the past

Table 6. Predicted outcomes, concerns or challenges, and recommendations relative to public transportation, identified by the *promotoras* focus group

Outcomes	Concerns/Challenges	Recommendations
• Improved access to work, education, medical services, stores, groceries, and outside community activities • Transportation for those who do not have cars, can't afford a car, depend on others, or cannot drive • An opportunity to socialize, and to engage in community meetings • Access to different options for employment not found locally • Save money on gas, creating disposable income for families to buy other necessities	• The buses are not accessible by everyone. They need to come "into the community", not just stop on main highway in order to serve all. • Having to travel long distances to access services	• The transportation must connect communities to each other, not just to Las Cruces • Bus schedule should align with work and school first, and then with other community services and activities • Should run every day, including weekends to provide opportunities for young and old to learn how to use the transit and to attend social or extracurricular events • Develop a robust education

• An alternative to using a personal vehicle • Creation of an environment appealing for employers because the workforce will have transportation to job • It will change the image of *colonias* (other than being a needy community) • It will assist meeting with probation requirements (for the young who cannot drive), and to pay citations		and marketing plan • Have direct destinations, and frequent runs to minimize the amount it takes to travel by bus • Buses should have air conditioning and Wi-Fi, and be disability and senior accessible • Variable fares should be charged considering family income, age, disability, and student status. No charge to older adults and disabled recommended • Having bus stops at locations where people commute and there are other transportation services • Comfortable and safe bus stops • Accessible to all

Table 7. Survey participation rate by venue

Venue Site (*N*=50)	Contacted	Agreed	Refused	Participation Rate (%)*
Clinic	380	300	80	78.9
Community College	543	347	196	63.9
Community Center	96	73	23	76.0
Community Event	71	44	27	62.0
Farmers Market	49	23	26	46.9
Food Pantry	124	89	35	71.8
Parish	198	148	50	74.7
Youth Program	30	9	21	30.0
Total	**1491**	**1033**	**458**	**69.3**

**Note*. Participation Rate is calculated by dividing agreed participants by contacted.

The average time required to complete a survey, including informed consent, was about 12 minutes (± 10 minutes), with a range of 3 to 60 minutes. Longer times were a result of the participant needing assistance reading or understanding the consent or survey form. In general, adults who were illiterate, could not see because they did not have their reading glasses, or preferred to have the survey read to them in English or Spanish resulting in longer times.

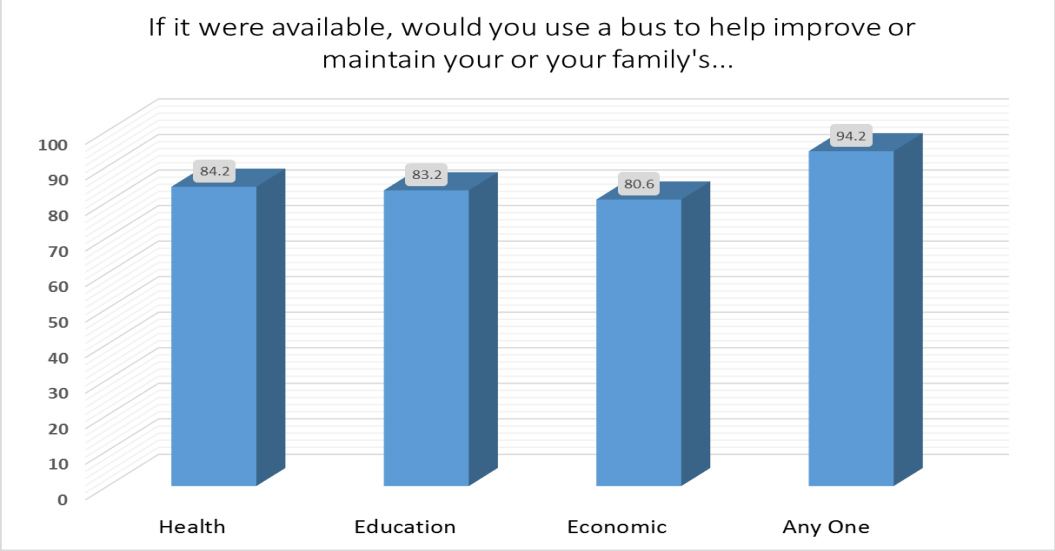
Table 7 also summarizes the total number of individuals who were approached, the number who refused and the total number of participants who agreed to complete the survey. A total of 458 refusals were recorded; thus the overall participation rate was 69.3%. Appendix A.10 summarizes the reasons given by those who declined. In summary, the most common reason for not participating was *I do not have time* (*n*=92). The next most common reason was that they had already participated (*n*=71), either themselves or the head of the family. Other common reasons for not participating included under age; ownership of a vehicle and did not need public transportation; non-resident of the area; opposed to public transportation; and refusal to sign the informed consent (lack of trust). Under age was a reason because individuals who were between the ages 15-17 needed parental consent prior to participating and individuals who were age 14 and under could not participate at all, as required by our IRB protocol. A few individuals were just learning English and did not speak Spanish and thus could not complete the survey due to a language barrier. These were primarily international students encountered at the university or community college. A few other random reasons were provided and listed in Appendix A.10.

For the 1056 respondents to our survey, when asked "if bus service were available, would you or someone in your family use the bus service to improve your…" health, education, or economic situation, an overwhelming majority (>80%) replied that they would (Fig. 5). The preferred destinations of respondents were:

Las Cruces	66% of respondents
Anthony	42%
Sunland Park	24%
Other	19%

The top five reasons for using the bus service for each general category of use are presented below in Table 8. Accessing health care was a major reason for using the bus service among older adults. Accessing education, and especially attending Doña Ana County Community College, was a major reason for using the bus service for young adults. A significant number of young adults (72%) would use public transportation to access job training. In fact, job related

Fig. 5. Percentage of respondents who would use the bus service



opportunities were a much higher preference among young adults than other demographic groups. 72% of young adults would use the bus service to access a better job. The high percentage of young adults who would use the bus service to attend community college or university was an unexpected result. Many young people who are still living at home with their families do not have a car or means to attend college. Public transportation would afford much more opportunity to attend college and lead to a better educated and trained workforce in this economically depressed region.

Table 8. The top five reasons for using the bus service for each general category of use

Health	Education	Economics
• Doctor appointments • Obtain medications • Shop at a supermarket for fresh fruits and vegetables • Regular medical treatment • Shop at a farmers market	• Doña Ana Community College • Public library • NMSU • Museum • GED	• Pay bills • Get a better job • Shop at better stores • Attend community meetings • Attend a job fair

Bus ridership survey. The results from the ridership survey are presented below. Table 9 presents the rider characteristics of those who completed the survey. Unfortunately, the number of bus passengers remained small over the summer months in 2016 with ridership ranging from 100-150 passengers per week. However, many of these passengers are the same individuals riding multiple days per week. Thus, we surveyed only 33 individuals; we did not complete the survey if respondents said that they had already answered the survey on a previous day or time. The majority of riders were mature adults ranging in age from 45-64 (55%). Their main means of transportation was the bus, and they rode most commonly two or five days per week.

The main purpose for riding the bus is presented in Fig. 6 below. The most common responses were: other (33%), work (24%), and health care/pharmacy (22%). Some of the common reasons associated with "other" included going to a meeting, a Senior Center for a meal, courts, visiting El Paso, filing a police report, visiting the casino, grocery shopping, a religious activity, recreation, seeking employment, and job training.

When asked "why did you take the bus?", the majority of respondents replied with either "I don't drive", "I don't have a car", or "to save money". The remainder listed other reasons ranging from owning an unreliable car or a shared car, to socializing and being more environmentally friendly (Fig. 7).

Riders were asked to rate a number of attributes of the bus system on a scale of 1-5 with 5 being the best and 1 being the poorest (Fig. 8). Riders were generally very pleased with the overall timeliness, cost, the ease of reading the timetables, the effectiveness, and the efficiency. Riders indicated that the schedules could be more convenient (rating of 3.97 on "the bus operates on convenient times". The majority of riders walk to their bus stop (61%) and travel an average of 0.78 miles in about 20 min (Fig. 9).

Table 9. Rider characteristics from bus surveys

Total Sample Size, n=33	
Participant Characteristics	
Gender	
Male	67% (n=22)
Female	33% (n=11)
Age	
18 – 24	12% (n=4)
25 – 44	24% (n=8)
45 – 64	55% (n=18)
65+ and over	9% (n=3)
Primary Transport	
Bus	55% (n=18)
Personal Vehicle	12% (n=4)
Bicycle	12% (n=4)
Carpool/Rideshare	6% (n=2)
Other	15% (n=5)
Trip Frequency	
5 days a week	24% (n=8)
4 days a week	9% (n=3)
3 days a week	9% (n=3)
2 days a week	21% (n=7)
1 days a week	9% (n=3)
2 – 3 times per month	6% (n=2)
Once per month	3% (n=1)
First time passenger	18% (n=6)

Fig. 6. The main purpose for riding the bus.

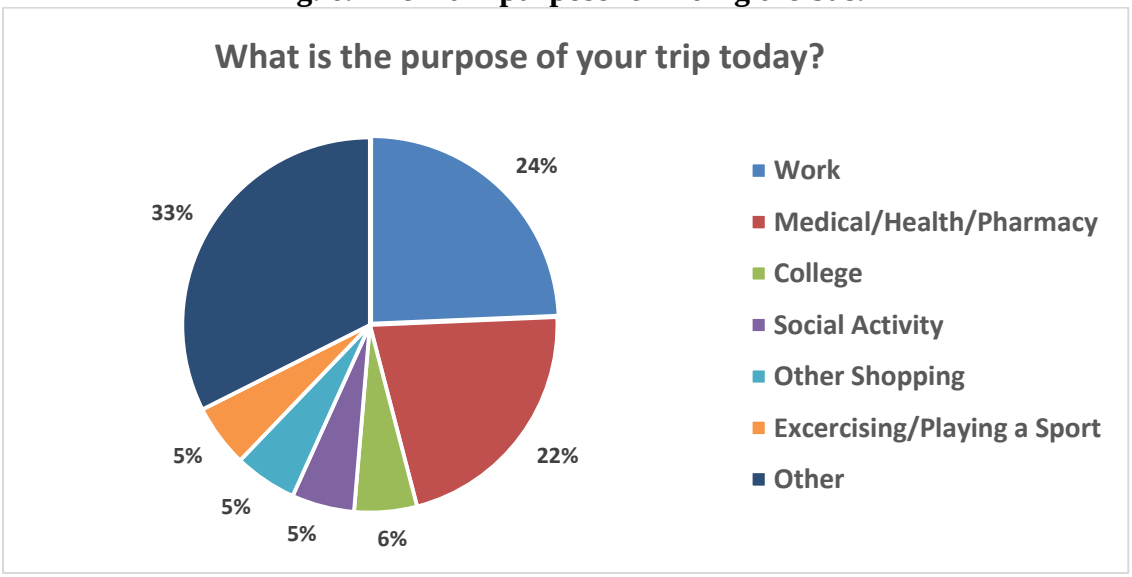


Fig. 7. Reasons for taking the bus

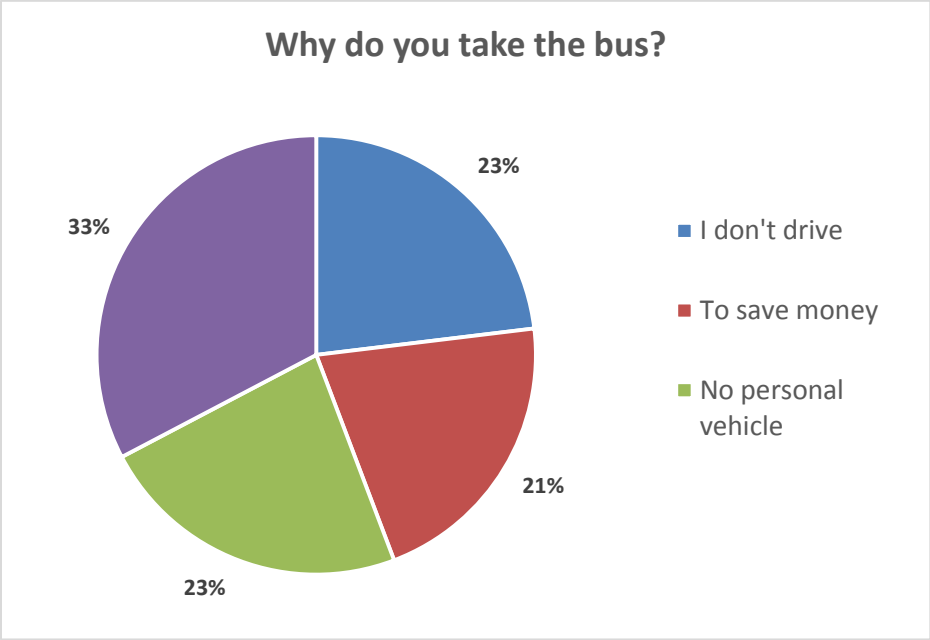
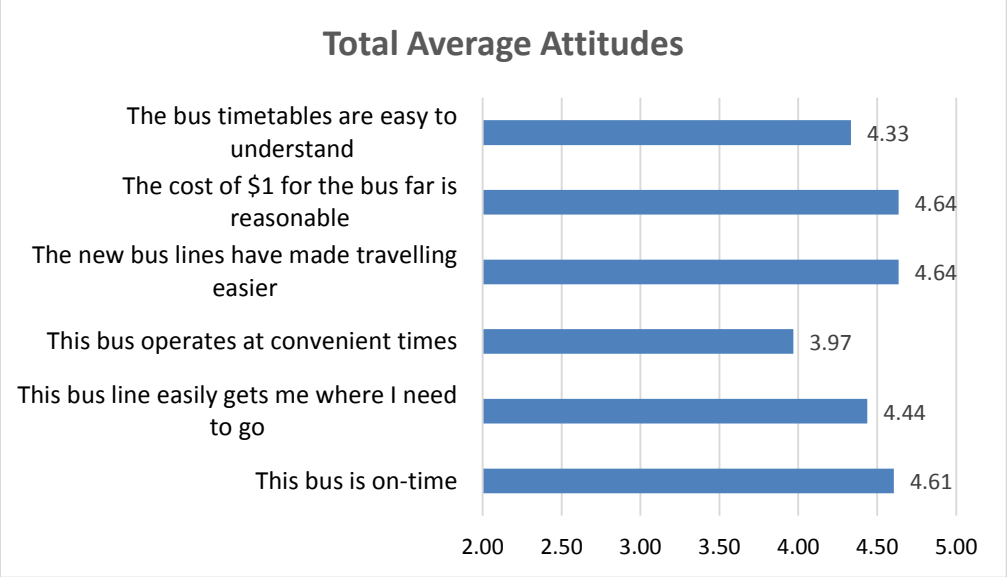


Fig. 8. Perceptions about the bus service



When asked, "what do you like about the bus service?", the most common answers included the friendly drivers, the low cost, and "Gets me where I am going" (Fig. 10). When asked what could be improved, the most common answer was "nothing", but also some wanted more routes, more times, and more riders/advertising (Fig. 11).

Fig. 9. How do you get to your bus stop?

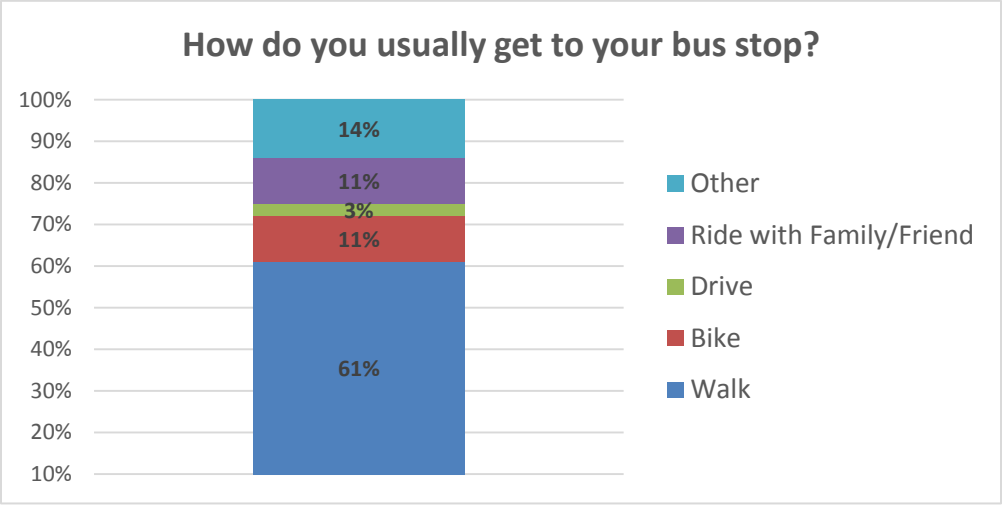


Fig. 10. What do you like about the bus service?

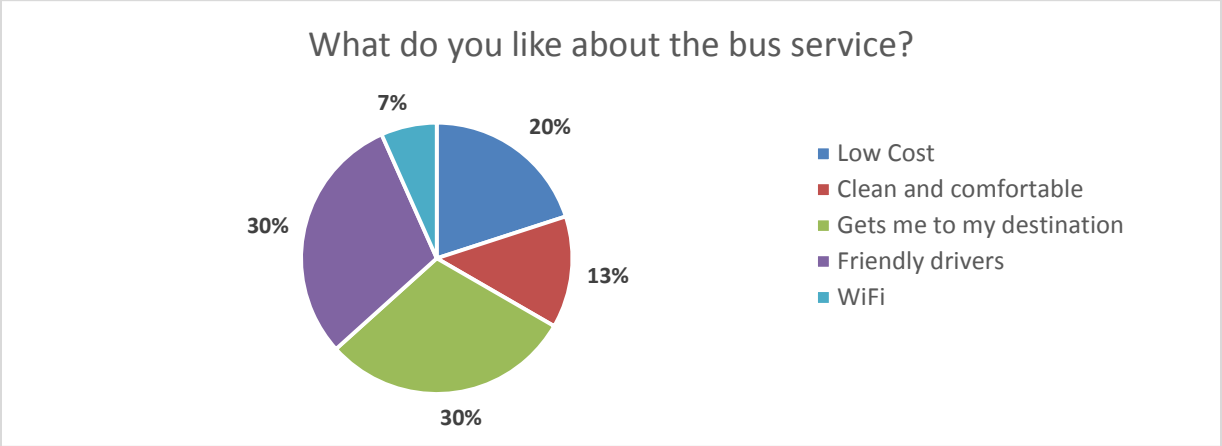
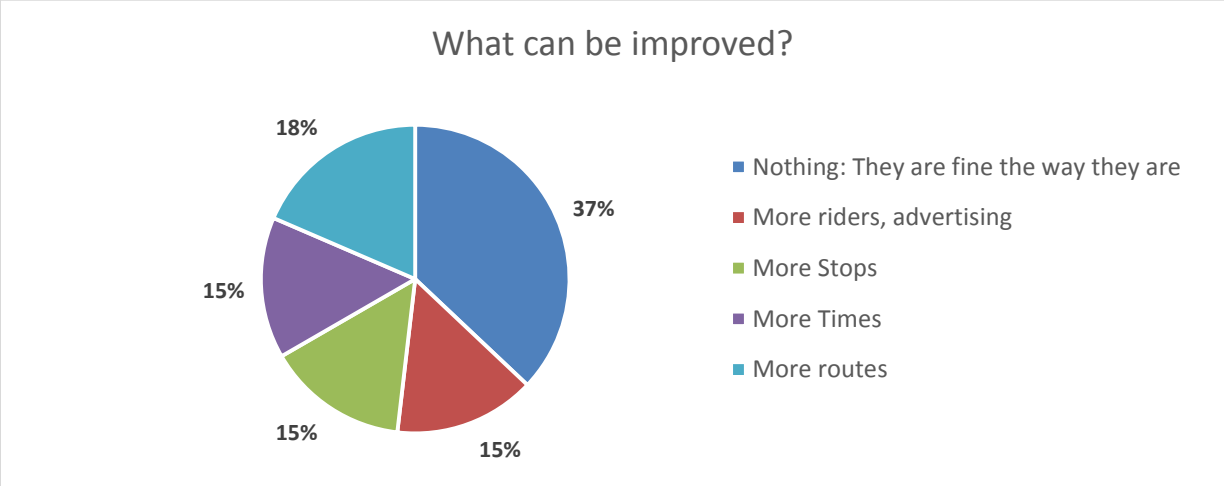


Fig. 11. What can be improved about the bus service?



Summary of Assessment Findings. Table 10 summarizes all the assessment findings.

Table 10. Summary of Findings

SCOPING CATEGORY	DIRECT OR INDIRECT IMPACTS	HEALTH DETERMINANT/ OUTCOME	EVIDENCE	
			INDICATORS	**RESULTS**
ACCESS TO HEALTHCARE AND HEALTHY CONDITIONS	**DIRECT**	Improved preventive, short- and long-term care	• Access to health care services • Access to pharmaceuticals • Access to other health related goods (health aids, and equipment) and services (therapy, rehab, specialized treatment, family planning, and immunizations)	• Identified as a key theme by key informants and focus group • Identified by respondents in community survey • Identified as a trip destination in passenger survey • # of Emergency Department (ED) visits by persons from rural communities • # of persons form rural communities hospitalized
		Improved nutrition	• Access to fresh fruits and vegetables • Access to quantity of food • Access to lower costs food	• Identified as a key theme by key informant and focus group • Identified by respondents in community survey • Identified as a trip destination in passenger survey • USDA poverty levels and lack of access to markets
	INDIRECT	Increased physical activity	• Walking or cycling to bus stops and traveling destinations • Access to recreational activities	• Total time travelled by walking or bicycling to bus stops and final destinations, compared to recommended physical activity guidelines • Identified as a trip destination in passenger survey to access sports or recreational activities
		Improved air quality	• Reduced number of personal motor vehicles replaced by public transportation	• PM, Ozone, CO_2, NO_2, and SO_2 monitoring • # of ED visits with diagnosis of asthma among children and older adults
		Improved road safety	• Reduced number of personal motor vehicles replaced by public transportation	• Identified as a key theme by transportation planning professionals • # of traffic related accidents per year • Commuting time • # of person miles travelled by mode of transportation
		Reduced personal stress	• Access to resources • Access to transportation alternative	• Perceived stress from isolation • #of persons using public transportation • Convenience of travel times, bus schedules, and destinations from passenger survey
		Reduced risky behaviors	• Access to safe leisure activities may reduce opportunities for persons, especially youth, in rural communities to engage in risky behaviors of depression, drug abuse, home and community violence, and unprotected sex.	• Perceived stress from isolation by key informants and focus group • Literature review shows that isolation leads to risky behaviors among teens and young adults
ACCESS TO EDUCATION	**INDIRECT**	Increased formal education	• Access to universities and community college • Access to adult basic education	• Identified as key theme by key informants and focus group • Identified as desired access in community survey

				• Identified as a trip destination in passenger survey • # of persons from rural communities attending NMSU and DACC • # of persons desiring high school or GED certificates • # of persons attending adult basic education courses
		Improved workforce skills	• Access to job trainings	• Identified as key theme by key informants and focus group • Identified as desired access in community survey • Identified as a trip destination in passenger survey • # of persons from rural communities attending technical schools or employment training
		Improved life skills/ informal education	• Access to informal education	• Identified as key theme by key informants and focus group • Identified as desired access in community survey • Identified as a trip destination in passenger survey • # of persons attending adult basic education courses
		Improve communication and engagement	• Access to social & recreational activities • Access to community meetings • Access to school district meetings	• Identified as key theme by key informants and focus group • Identified as desired access in community survey • Identified as a trip destination in passenger survey
ACCESS TO JOBS/ ECONOMIC ACTIVITY/ ECONOMIC IMPACTS	**INDIRECT**	Reduced unemployment	• Access to jobs • Improved workforce skills from access to education	• Identified as key theme by key informants and focus group • Identified as desired access in community survey • Identified as a trip destination in passenger survey • Employment rate
		Increased opportunity for economic growth	• Access to better shopping • Access to paying bills or citations • Reduce household costs for owing a personal vehicle	• Identified as key theme by key informants and focus group • Identified as desired access in community survey • Identified as a trip destination in passenger survey • Estimated household income dedicated to personal vehicle
		Increased costs to support SCRTD system	• Road maintenance for buses • Cost of public transportation service per person • Cost of public transportation from public funds	• # of persons using public transportation vs. personal vehicle • Identified as a key theme by key informants and focus group • # of buses on the road • # of trips of buses • Rating of bus fare rate in passenger survey
		Reduced societal costs	• Due to health care costs • Due to loss of productivity	• Health cost analysis • Identified by previous HIA studies and public health officials

III.D. Discussion

Why Desire to Use and Actual Usage Differ

Large differences in consumer preferences assessed through surveys and actual consumer choices are common. With respect to public transportation, in general in the U.S., there is insufficient research to understand and predict the relationship on "desire or willingness to use" and actual usage of public transportation. Few studies conducted outside the US, suggest that a high quality service, and strong marketing of public transportation are the most important factors in predicting actual usage of public transportation for new and continuing users (Dobbie, McConville, & Ormston, 2010; Chowdhury, & Ceder, 2013; Cheyne, & Imran, 2010; Worku, 2013; Borhan, Syamsunu, Akhi, Yazid, Ismail, & Rahmat, 2014; Diab, van Lierop, & El-Geneidy, 2017).

Impacts of Transportation on Access to Health Care and Economic Benefits

Lack of transportation can be a major barrier to health care access and therefore to the prevention of diseases and mortalities. This is a particular challenge for residents of rural Doña Ana County. The following discussion is an attempt to analyze some of the health care challenges, impacts of transportation, and potential costs of lack of transportation. There are different methods available to model the health costs, including cost-benefit and cost-effectiveness studies, methods approached by other HIA practitioners (James, et al., 2014; Kavage, et al., 2010), methods adopted by leading health and environmental governmental agencies like the CDC, EPA, and WHO, and transportation and planning agencies (U.S. DOT; U.S. Department of Health and Human Services). However, we did not attempt to monetize health care costs as we did not have access to the data that would allow us to do such an analysis.

Key health conditions for which access to more specialized health care is needed and which are common in our study include (in no certain order):

- All cancers
- Nutritional anemias
- Diabetes mellitus
- Malnutrition
- Suicide
- Diseases of the circulatory system
- Diseases of the respiratory system
- Traffic related injuries
- Alcohol consumption/abuse
- Drug overdose
- Mental, behavioral and neurodevelopmental disorders

In Table 11, we estimate the prevalence of these conditions in the study area of our HIA from state of New Mexico statistics and the population of our study area or the percentage of the population of Doña Ana County that is represented by our study area (15%).

The most prevalent chronic conditions include hypertension, diabetes, depression, and asthma. Work absenteeism is also particularly high for these chronic conditions. The consequences of not treating these conditions can lead to more serious respiratory, cardiovascular, and mental

Table 11 . Prevalence of Selected Chronic Diseases in Study Area and Related Absenteeism from Work (from 2010)

Disease	Percent Treated from Total Population of NM	# of Treated Cases in Study Area	Missed Person-Work Days*
Asthma	4.7%	1410	1658
Cancer	4.2%	1260	323
Cardiovascular			
Congestive Heart Failure	0.5%	150	88
Coronary Heart Disease	3.5%	1050	1175
Hypertension	15.7%	4710	1912
Stroke	1.3%	390	1590
Other Heart Diseases	2.1%	630	2712
Depression	6.1%	1800	3320
Diabetes	6.6%	1980	1857
Emergency Department Visits	N/A (70,099 for DA County)	10,515	N/A

*(# cases x % employment x # days missed per case)

conditions. It is hard to estimate the economic value of treatment of these chronic conditions before they become more serious life-threatening illnesses, but it is clear that access to health care is a crucial determinant in the prevention of more serious illnesses. For our study area, the average travel distance for specialized health care access is about 20 miles (to either Las Cruces, NM or to El Paso, TX). Reliable transportation becomes a major determinant in accessing needed facilities.

Economic Benefit of Preventive Health Care

The economic benefit of improved access to health care is very difficult to quantify for a rural area like southern Doña Ana County. Preventive health care can reduce the significant economic burden of disease in addition to improving the length and quality of people's lives. For example, regular preventive care can lead to early detection of cancer, reducing the cost of treatment and the mortality rate. Treatment, lost productivity, and health care costs are significant burdens to the economy, families, and businesses. Prevention policies and programs often are cost-effective, reduce health care costs, and improve productivity. Accepting that public transportation would improve access to preventive health care, we provide several examples below of economic benefits that could be at least partially realized by improving access to preventive health care through public transportation. These examples from the National Prevention Strategy of the U.S. Department of Health and Human Services (2011) show why prevention is the best buy in health.

- A proven program that prevents diabetes may save costs within three years. One of every five U.S. health care dollars is spent on caring for people with diagnosed diabetes. People who increased physical activity (2½ hours a week) and had 5 to 7 percent weight loss reduced their risk of developing type 2 diabetes by 58 percent regardless of race, ethnicity, or gender.
- A 5 percent reduction in the prevalence of hypertension would save $25 billion nationally in 5 years. We estimate this to translate to about $250,000 for southern Doña Ana County.
- A 1 percent reduction in weight, blood pressure, glucose, and cholesterol risk factors would save $83 to $103 annually in medical costs per person.

- Increasing use of preventive services, including tobacco cessation screening, alcohol abuse screening and aspirin use, to 90 percent of the recommended levels could save $3.7 billion annually nationwide in medical costs or about $350,000 in southern Doña Ana County.
- Indirect costs to employers of employee poor health—lower productivity, higher rates of disability, higher rates of injury, and more workers' compensation claims—can be two to three times the costs of direct medical expenses.
- Asthma, high blood pressure, smoking, and obesity each reduce annual productivity by between $200 and $440 per person.
- Workers with diabetes average two more work days absent per year than workers without diabetes.
- Absenteeism costs are reduced by approximately $2.73 for every dollar spent on workplace wellness programs, according to a recent study.

Commuting Time and the Benefits of Public Transportation

In Doña Ana County, the average commuting time in 2015 was 23 minutes (PDNHF, 2015). An estimated personal cost of using personal vehicle vs. SCRTD system was calculated using the starting point of Anthony, NM transfer station and a final destination of the Mesilla Valley Intermodal Transfer Station in Las Cruces. Then this scenario was broken down into 2 sub scenarios by mode of transportation, private car vs. public transportation. The amount of time spent getting to and utilizing public transportation services was multiplied by the minimum hourly ($7.50/hr. or 0.125/min.) wage of the county in order to place a monetary value on time spent on travelling. Commuting 27.9 miles would take approximately 30 minutes assuming good traffic flow, and on SCRTD service the same distance is travelled in 55 minutes. Then the value from the U.S. General Services Administration (GSA) reimbursement rate for personal vehicle travel ($0.54/mile in 2016) was multiply by the number of miles travelled. The U. S. GSA rate accounts for maintenance, insurance, and gas prices to operate a personal vehicle. An estimated cost of a person commuting to work was also calculated considering the counties average commuting time and using same factors. Adjusted for each scenario, costs associated with service, commuting time (on bus and walking), and bus fares were calculated, see Table 12 and 13. The costs were calculated based on current bus fares, July 2016.

Table 12. Commuting cost to the traveller associated with travelling by personal vehicle.

Commuting	Miles Travelled	Total Costs*
One-way	27.9	$18.82
Round trip	55.8	$37.63
Doña Ana County Average (one-way)	23	$15.30

*No costs associated with parking was applied.

In summary, this analysis shows a substantial savings to the traveler by using the bus service compared to a private car, even when considering the extra time required for travelling by bus. This should provide an incentive for residents of southern Doña Ana County to use public transportation.

The Costs of Public Transportation

The operating budget for the SCRTD to provide the public transportation services in southern Doña Ana County is currently $735,714 per year. The most recent ridership numbers show 206

Table 13. Commuting cost to the traveler associated with travelling by SCRTD service.

Commuting	Miles Travelled	Total Costs
One-way	27.9	$11.63 (Discounted $11.13)*
Round trip	55.8	$23.25 (Discounted $22.25)*

**Reflects discounted bus fare for seniors and students. The regular fare is $1.00 and the discounted fare is $0.50.*

riders per week. This amounts to a cost per rider of about $69 ($735,714/52 weeks/206 riders). The cost for a single round trip ride from Vado (about midpoint between El Paso and Las Cruces, about 20 miles) using Uber ranges from $38-51. Thus, at the current ridership levels the public transportation system is not cost effective compared to other commercial rates for transportation. To make public transportation competitive with commercial rates (about $45/rider), the ridership would need to go up by about 50% on a weekly basis (a total of about 300 riders per week).

III.E. Predicted Impacts

For each scoping category, we summarize in Table 14 our predictions for each health determinant/outcome and the populations likely to be most impacted if the decision is made to provide public transportation in southern Doña Ana County. To characterize the effects of the decision to provide bus service, we used the following descriptors in the table:

Direction of Impact

- Positive – changes that improve health
- Negative – changes that may detract from health

Magnitude of Impact

- Low – causes impacts to no or few people (<10% of the population)
- Medium – causes impacts to a wider number of people (10-50% of the population)
- High – causes impacts to many people (>50% of the population)

Severity of Impact

- Low – causes impacts that can be quickly and easily managed or do not require treatment
- Medium – causes impacts that necessitate treatment or medical management and are reversible
- High – Causes impacts that are chronic, irreversible, or fatal

Likelihood of Impact

- Likely - it is likely that impacts will occur as a result of the proposal
- Possible – it is possible that impacts will occur as a result of the proposal
- Uncertain – it is unclear if impacts will occur as a result of the proposal

Table 14. Transportation Matters HIA Predicted Impacts

SCOPING CATEGORY	DIRECT OR INDIRECT IMPACTS	HEALTH DETERMINANT/ OUTCOME	CHARACTERIZATION OF EFFECTS				
			Direction	Magnitude	Severity	Likelihood	Distribution/Populations Most Impacted
ACCESS TO HEALTHCARE AND HEALTHY CONDITIONS	**Direct**	Improved nutrition from access to fresh fruits & vegetables	+	M	M	P	Everyone impacted; Children most impacted
		Improved preventive, short- and long-term care due to access to physicians	+	H	H	P	Everyone impacted; Elderly most impacted
		Improved access to pharmaceuticals	+	H	H	P	Everyone impacted; Elderly most impacted
		Improved access to other health related goods (health aids, equipment) and services (therapy, rehab, specialized treatment, and other services like family planning and immunizations)	+	M	H	P	People with serious illnesses and the elderly most impacted
	Indirect	Physical activity from walking to bus stop	+	H	L	P	Everyone impacted
		Less pollution exposure due to less cars on the road	+	H	H	P	Everyone impacted; Children and the elderly most impacted

		Improved road safety	+	M	M	L	Everyone impacted
		Less stress resulting from convenience and flexibility of bus system	+	M	L	L	Everyone impacted
		Reduced risky behaviors	+	M	M	P	Youth and young adults
ACCESS TO EDUCATION	**Indirect**	Access to formal education (university and/or comm college)	+	M	M	P	Young adults most impacted
		Access to job training	+	M	L	P	Young people
		Access to life skills/ informal education	+	M	M	P	Everyone impacted
		Access to social & recreational activities	+	M	L	P	Everyone impacted
		Improve communication and engagement	+	M	M	P	Everyone impacted
ACCESS TO JOBS/ ECONOMIC ACTIVITY/ ECONOMIC IMPACTS	**Indirect**	Access to jobs	+	M	M	P	All adults
		Access to shopping	+	M	L	P	All adults
		Paying bills	+	M	M	P	All adults
		Cost of the system	-	H	M	L	All adults
		Road damage from buses	-	M	L	P	All adults
		Reduce household costs for a car	+	M	M	P	All adults

We elaborate on the predicted impacts below for each scoping category.

Access to healthcare and healthy conditions. Both direct and indirect predicted impacts were identified. With respect to direct impacts, the most significant predicted impacts relate to improved preventive, short- and long-term care due to improved access to physicians; improved access to pharmaceuticals; and improved access to other health related goods and services. The most impacted populations will be seniors who have greater demand for health care goods and services and less mobility due to either a lack of a personal vehicle or inability to drive. Health care providers in the area informed us that missing appointments was a major problem for residents from our study area. Seeing specialists in the Las Cruces area is a particular challenge because of the distance.

Indirect impacts include more physical activity to walk or bike to the bus stop and less pollution from the number of cars on the road. Improved road safety is also an important indirect impact. For young people, reducing risky behaviors is a significant indirect impact.

Access to education. Access to educational opportunities is a significant indirect impact for young adults. Many young people in the area live with their parents. They cannot afford their own car, and are dependent on their parents' car or a friend. Access to the NMSU Community College campuses are especially important. This was an unanticipated result. Improved access to formal education could also have a major impact on the economic development of the region since a college education would improve job opportunities for young people from this area.

Improved access to adult learning, especially life skills training and English language training, is also an important outcome for older adults. Parents of school children could also benefit from public transportation that would improve access to the public schools to meet with teachers or attend school related meetings (like the School Board).

Access to jobs/economic activity/economic impacts. The most significant positive impacts related to the economy are improved access to jobs and job training. This should mostly impact families living in the area. The improved access to shopping should also bring economic opportunity to retail businesses in Las Cruces. Significant negative impacts include the cost of the system, which must be borne mostly by taxpayers in Doña Ana County. A lesser negative impact is the potential wear and tear on the rural roads stemming from the buses.

III.F. Recommendations

Based on the summary of findings presented in Table 10, we propose the following recommendations.

1. Based on the preponderance of residents in rural Doña Ana County that are in need of public transportation and who said that they would use public transportation if it were available, the SCRTD should implement the bus system for rural Doña Ana County.
2. In order to maintain the operations of the bus system, SCRTD should seek additional funding, including federal and state grants, local government funding, private funding, and any other source that might be available.
3. The routes should include stops at Doña Ana Community College campuses, clinics, hospitals, La Semilla, Women's Intercultural Center, and senior centers, as these were the most common preferred destinations.

4. Schedules need to be extended into the early evenings, as people need to board a bus to return home at or near 5:00 pm. There also needs to be service on Saturdays.
5. SCRTD needs to develop and implement a communications plan that would include: a) education of the potential users on how to access and use the bus system, b) education of the taxpayers about the benefits of the bus system; c) development of an "identity" that would improve awareness of the system; this could include a clever motto or slogan, brightly painted buses, a "mascot", improved logo, etc. d) identifying with the Livability Principles of Viva Doña Ana; e) improving the visibility and conditions at bus stops to include better signage, advertising, benches, and shade; and f) marketing the bus system using flyers, posters, mailings, NMSU (for young people), and others.
6. SCRTD and the county should improve walking conditions around bus stops to include more pedestrian and biking paths to and around the bus stops.
7. Consider buses that use natural gas for fuel; emissions are much reduced compared to gasoline or diesel.
8. More paved roads are necessary for the bus system to fully serve the communities, to provide safer travel of residents to the bus system and to reduce air borne dust in the rural communities. This is the responsibility of the county.
9. Develop an evaluation plan that will document the ridership and overall customer satisfaction with the bus system.
10. Document the benefits of the bus system by collecting data related to health, educational, and economic outcomes, using important indicators that have already been identified for public transportation systems by agencies such as the U.S. Department of Transportation, the U.S. Centers for Disease Control and Prevention, and other agencies. Additional information about important indicators and resources for monitoring outcomes is provided in the Monitoring section of this report (Section III.G.).

III.G. Monitoring

Goals

We identified the following two broad-based goals for monitoring the implementation of HIA recommendations (refer to Section III. E). The following actions by SCRTD should be monitored:

1. providing and maintaining public transportation to rural communities in Doña Ana County, and obtaining sustained funding to operate and even expand the service on a long-term basis; and
2. developing and implementing processes to track health and transportation outcomes related to the three HIA scoping categories: a) healthcare and healthy conditions; b) education; and c) jobs/economic activity/economic impacts.

Monitoring Outcomes

A number of direct and indirect impacts on health were identified in this HIA resulting from improved access to health care services, healthy environments, educational opportunities, jobs, economic activity, and social and recreational opportunities. Benefits from public transportation were recognized through improved preventive care practices, improved air quality and commuter safety, and reduced stress related to isolation from resources. Rather than monitoring illnesses or public health directly, we recommend to SCRTD to monitor indicators related to both health and transportation that have been established and monitored by leading public health and

transportation agencies to reduce morbidities, premature mortalities, and improve quality of life. These are summarized below in Table 12. Indicators that can be categorized to measure 1) accessibility of resources, 2) air quality and commuter safety, and 3) community socioeconomic factors. Monitoring already established indicators would help SCRTD review outcomes from their public transportation service but also contribute to local, state, and federal monitoring.

Access to healthy conditions, jobs, and economic opportunities are monitored indirectly by the U.S. and New Mexico Departments of Transportation through a rating system on *accessibility*, considering commuting modes and times to work, ownership of personal vehicle, and access to public transportation within a distance radius from home, while at the same time analyzing land use mix and complete streets policies rating to create active transportation opportunities. The same indicators are recognized by Centers for Disease Control and Prevention (CDC) as impacting morbidity and mortality outcomes, a health and transportation relationship that led to the development of the Transportation and Health Tool. The information from this tool represents state level data, but Healthy Paso Del Norte and local transportation systems monitor the same indicators at regional and county level. As for access to food, the U.S. Department of Agriculture (USDA) monitors at small community level households with no car, distance from a grocery store, and availability of public transportation to determine *accessibility*. Specific access to healthcare services and education opportunities are not monitored by other agencies that would facilitate the monitoring of outcomes for SCRTD, but community *socioeconomic factors* such as education attainment, household income, and employment rate are indicators for having such access to health care services, education and economic opportunities. Other health impacts related to *air quality and commuter safety* are monitored by regional transportation planning committees such as Las Cruces Metropolitan Planning Organization and El Paso Metropolitan Organization, while traffic related injuries and premature deaths are monitored by New Mexico Public Health Department.

We recommend that SCRTD identify important outcome indicators from the following important resources:

Accessibility of resources:

- State level data on transportation infrastructure, and commuting factors through the U.S. Department of Transportation in the Transportation and Health Tool https://www.transportation.gov/transportation-health-tool/indicators
- Regional and county data on commuting factors by Healthy Paso Del Norte http://www.healthypasodelnorte.org/modules.php?op=modload&name=Resources&file=index&topic=9
- County and small community data access to food through the Food Access Research Atlas http://www.ers.usda.gov/data-products/food-access-research-atlas/go-to-the-atlas.aspx

Air quality and commuter safety:

- Regional air quality monitoring through New Mexico Environment Department http://drdasnm1.alink.com/
- State and county data traffic related injuries and deaths through New Mexico's Indicator-Based Information System (NM-IBIS) https://ibis.health.state.nm.us/

- State DWI and crash reports through The University of New Mexico Traffic Crash Data http://tru.unm.edu/

Community socioeconomic factors:

- State and county data on education attainment, household income, and employment rate through New Mexico's Indicator-Based Information System (NM-IBIS) https://ibis.health.state.nm.us/

- County and small community data on housing and transportation costs through The Center of Neighborhood Technology http://htaindex.cnt.org/

Table 15. Summary of Monitoring Plan

Recom-mendation	*Responsible Entity*	*Monitoring Indicator*	*Monitoring Agency*	*Timing*
1	SCRTD	Vote to provide services	HIA leadership team	Immediate
2	A. SCRTD B. SCRTD	A. Applications for financial support for services B. HIA findings reported	A. SCRTD B. HIA leadership team	Immediate to Medium
3	SCRTD	Routes match the preferred destinations	SCRTD	Immediate
4	SCRTD	Schedules match preferred days and hours of service	SCRTD	Medium
5	SCRTD	• Development of education plan • Service branding • # of venues where bus schedules are available • # of bus stops with recommended conditions	SCRTD	Immediate to Medium
6	SCRTD	• # of bike paths • # of footpaths	SCRTD	Medium to Long
7	SCRTD	# of natural gas buses	SCRTD	Long
8	SCRTD	# of paved roads	SCRTD	Long
9	SCRTD	• Passenger ridership • Development of customer satisfaction survey	SCDTD	Immediate
10	A. SCRTD B. SCRTD	A. Development of benefit tracking plan B. Tracking of outcome indicators	A. HIA leadership team B. SCRTD	Immediate, Medium, and Long

Timing parameters: Immediate= 0 to 1 year; Medium= 1 to 3 years; Long= more than 3 years

III.H. Conclusions

Conclusions from the Findings of the Assessment

We conclude that public transportation would have major impacts in rural southern Doña Ana County on: 1) health through improved access to health care and fresh fruits and vegetables; 2) education through improved access to community colleges, university, and adult learning

opportunities; and 3) economic development through better access to jobs and job training and goods and services. Over 80% of residents responded that they would use public transportation to help improve their health, education, and/or economic status. Some of the priority purposes for accessing public transportation included: doctor appointments, obtaining pharmaceuticals, regular medical treatments, shopping at supermarkets or farmers markets, attending college, visiting a public library, getting a job, attending job training, and paying bills. Preferred destinations included Las Cruces, Anthony, and Sunland Park.

Predicted impacts include: 1) improved health, especially for seniors; 2) improved education, especially for young adults; and 3) improved economic status, especially for families, due to better jobs and better access to goods and services. A major negative impact is the cost of the bus system to the taxpayers.

We identified a number of recommendations (see Section III.E.), chief of which is that the SCRTD should implement and maintain the bus system for rural Doña Ana County.

Conclusions from the Process of the Assessment

Designing, implementing, and funding public transportation systems in rural areas is very challenging. By definition, they serve a relatively small population over a large geographic area. Though it seems that rural citizens should have access to public transportation similar to urban citizens, the expense is not shared proportionately over the population and must be principally borne by urban residents, if financed through tax revenues. This is because there are many more urban residents compared to rural ones. In the case of southern Doña Ana County, the benefits would be significant to an underserved, disproportionately impoverished, racial minority community. Such communities as those prevalent in southern Doña Ana County are lacking in resources, economic opportunity, and political voice. An unexpected result was that young people could benefit significantly from improved access to higher education.

III.I. Dissemination Plan

Our plan for disseminating results from our HIA is summarized below in Table 16.

Table 16. Summary of Dissemination Plan

General Target Audiences	Specific Audiences	Priority and Language	Communication Methods
Decision Makers	• DA County Commission • City Council • NMDOT • SCRTD	High Priority English	• Executive Summary • Brief Summary • HIA Report • Presentations during public meetings
Community Members/Groups	• Residents • Students • Community health workers • Business owners • Empowerment Congress • Churches • Community centers	Medium to High Priority English and Spanish	• One page summary • Infographics • Community forums • Press release/editorials • Social Media posts • Website insert • Brochures • Posters

	• Farmers markets/youth farms • NGAGE • Women's Intercultural Center		• Training on riding buses • Television or radio • Presentations
Stakeholder Groups/Service Providers	• Clinics, hospitals • NMSU/DACC campuses • Public libraries • Community of Hope • Food banks • Las Cruces MPO • Chambers of Commerce • Colonias Development Council • Health Department	Medium to Low Priority English and Spanish	• Brief report • One page summary • Presentations to management • Infographics • Posters

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One of the communities served by SCRTD

La Clinica de Familia


Conducting ridership survey


Presenting to DA County Commisione**rs**

SECTION IV. "WATER MATTERS" HIA

"…There is no future. Death is the future. We are going to die waiting for water to come. Water is life. There is sadness, people lose hope, and people get tired…from hauling water."
- Resident of Las Pampas

IV.A. Introduction

The Context

We conducted an HIA around a proposed expansion of water infrastructure in Presidio, TX. This HIA served two important purposes. First, it informed the decision regarding extension of the water system from Presidio to businesses and residents outside the city limits and extending to the Las Pampas Colonia just north of the city. Second, it was used to pilot test a Health Impact Index and a streamlined system of assessing health impacts of infrastructure projects for BECC. This Health Impact Index and the streamlined HIA is described in Section V of this report.

Presidio is located in Presidio County, TX, about 250 miles southeast of El Paso on the U.S. Mexico border. Las Pampas Colonia is located along the east and west sides of U.S. Highway 67 gong north from Presidio towards Marfa, TX. See map in Fig. 12. The extension of the city's water system would provide water for the first time to residents north of the city along Hwy 67 up to the airport. A planned second phase would provide water to the remaining residents in Las Pampas Colonia. Originally we estimated that the decision would impact about 20 residents and 4 businesses. The planned project includes construction of a ground storage tank at the existing water treatment plant, one elevated storage tank, booster pumps, main lines, and piping for 24 connections.

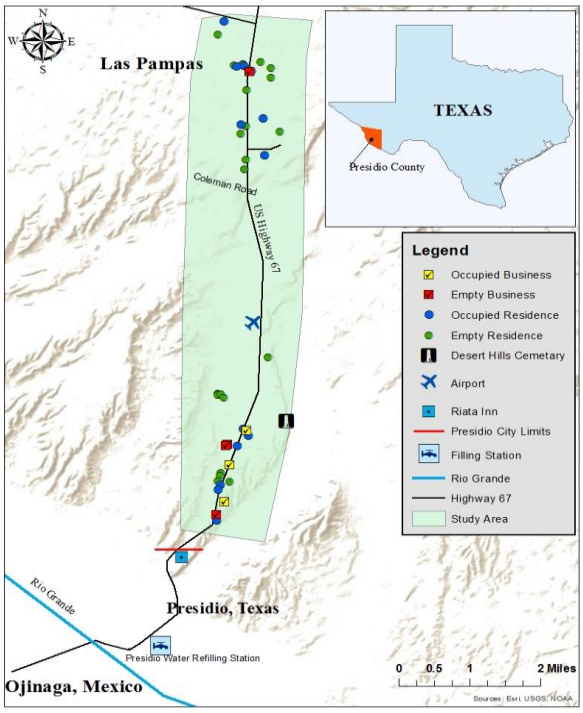

Fig. 12. Map of potential service area for extension of Presidio's water system.

Residents currently haul water from the City of Presidio in portable hauling tanks. See photos below in Fig. 6. The source water is treated water from the City that meets drinking water standards, but the transfer and hauling of the water introduces opportunity for contamination by disease causing organisms and other sources of contamination. We provide a literature review focused on water and sanitation and its impacts on health in border region *colonias* in Appendix B.1.

Fig. 13. Photos of water hauling equipment.

The Decision

There are actually a number of decisions to be taken regarding the expansion of water service to Las Pampas. A revised project plan was to be developed in the summer of 2015, but is still under development. Actions to adopt the proposed plan could be taken by end of the year in 2016, when decisions concerning funding would also be made. Potential funders include BECC, Texas Water Development Board, and USDA-Rural Development Agency. The principle questions to be addressed include:

1. Should the city expand service north along Hwy 67 and to Las Pampas and if so, how far north along Highway 67?
2. How will this expansion be funded?

In addition to these questions, there are decisions about improving service within the city of Presidio and improving existing infrastructure. Our HIA will be crucial to providing information on the impacts of the expansion.

The Affected Population

The residents along Hwy 67 and in the *colonia* Las Pampas can be characterized as a relatively older population who are mostly retired. Thus, these older adults can be characterized as a vulnerable population because they live on a low fixed income and/or suffer from chronic health

conditions such as asthma, diabetes, hypertension, and others. We did not find any children living in the study area with the exception of one family who also owns and operates a trucking business. The family lives on site adjacent to their business establishment. There are three other businesses in the study area including trucking businesses, an automobile body shop, and a repair shop. We assessed changes in health and quality of life indicators with special emphasis on these population groups.

The Stakeholders

A stakeholder analysis was conducted and is included as part of our Stakeholder Engagement Plan, presented in Appendix B.2.

HIA Methodology

Health Impact Assessment (HIA) is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population (National Research Council, 2011). In addition, HIA provides recommendations on monitoring and managing those effects. Our HIA followed the six recommended steps of:

- Screening
- Scoping
- Assessment
- Recommendations
- Reporting
- Monitoring

Our Screening and Scoping reports are included in the Appendix (B.3. and B.4.) We summarize our findings from Screening and Scoping here and then focus on the Assessment, Recommendations, and plans for Monitoring in the body of the report.

Screening. We engaged a number of stakeholders in the screening process through small group meetings, electronic communication, and one-on-one interviews over several weeks. We made a presentation to the Mayor and City Council and visited with them about the project and our HIA. We interviewed a number of key informants who are also stakeholders to collect preliminary information that was used in screening. The groups that we met with or interviewed include:

- City Manager
- Economic Development Officer
- City Utilities Manager
- State Health Department Offices in Presidio
- Santa Teresa Catholic Church Office in Presidio
- Local residents of Presidio
- Personnel with BECC

Through the screening process we determined that an HIA could inform the decision by the City of Presidio to provide extended water service. Potential funders for this project include BECC, Texas Water Development Board, and USDA-Rural Development Agency. The principle questions to be addressed include:

1. Should the city expand service to Las Pampas and if so, how far north along Highway 67?
2. How should it be paid for?

In addition to these big questions, there are decisions about improving service within the city of Presidio and improving existing infrastructure. We found that our HIA would be crucial to providing information on the impacts of the expansion and would inform the decisions about both the expanded service and the internal infrastructure improvements.

Scoping. Through the scoping phase we identified a focus and the important health determinants for our HIA. The geographic focus is on the *colonia* Las Pampas plus all the residents and businesses located outside the city limits of Presidio and along Highway 67 north of Presidio. The quality of hauled water and the related economic and quality of life factors associated with hauled water are the chief health determinants of interest. The source water that is used by residents of Las Pampas is municipal water from city of Presidio. We checked their water quality reports and found that their water meets all drinking water standards. However, contamination can occur in the hauling process. We suspected that hauled water could be contaminated by bacteria or other biological agents as a result of contamination from hoses or tanks or by soil and blowing dust. Additional direct health impacts could include injuries from accidents during the filling and hauling process. Most tanks are 250-1000 gallons and require crawling up on the tank to open and insert filling hose. The distance traveled in Las Pampas is about 10 miles one way to fill tanks.

Some of the other issues that we addressed include economic factors, such as individual household costs for one-time hook-up plus ongoing costs for water. Some of the community benefits include increased housing and property values, improved fire protection, and quality of life improvements resulting from the inconvenience of hauling water.

IV.B. The Assessment

The key research questions that guided our assessment work and a brief description of the methodology used to address the research questions are included in the Scoping Summary in Appendix B.4. Below we provide more detail on our methodology for the key informant interviews, community survey, and focus groups. All protocols were approved by the Institutional Review Board for Human subjects Research at the University of Texas at El Paso (#637598-7). All subjects gave their informed consent for inclusion before they participated in interviews, focus groups, or surveys.

Key Informant Interviews. We interviewed 10 key informants. A list of the agencies , organizations, or businesses that they represent is provided in Appendix B.5. The key informants represented professionals from a range of sectors including health, education, business or economic development, and local government. We used a standard list of 14 open-ended questions to interview each individual. The questions focused on water issues and the health and economic impacts of lack of access to water. Key informants were also asked about their concerns and recommendations for the proposed expansion of water service from Presidio. The list of questions is provided in Appendix B.6. Each interview required about 45 minutes. The interviews were audio recorded, transcribed, and analyzed for qualitative codes. The results were organized into key themes, subthemes, and magnitude of impacts.

Water Survey. We conducted a water quality survey by sampling tap water from eight households and four businesses in spring/summer, 2015. One business entity was a combined household and business; the owner and his family lived adjacent to the business and used the same hauled water for household and business use. Another business had their own domestic well on their property which was used as their water source. Eight households, three businesses, and the one combined household/business relied on hauled water. The samples were placed on ice until transported to the El Paso Water Utilities (EPWU) Certified Lab within 24 hours of collection. EPWU Certified Lab analyzed the samples for arsenic, total dissolved solids, chloride, nitrate and sodium, coliform bacteria and E.coli. These results provided us with data on the quality of water after hauling. We also sampled water at the filling point in Presidio. We delivered the results in person to each household and business that we sampled.

Household Survey. For the household survey, we developed and administered a 64-question survey (in English and Spanish) for community members. The survey focused on water use, management, health, economics, and sanitation. We obtained informed consent from each participant. There was only one household with children. We surveyed only adults in each household. The survey instrument is presented in Appendix B.7.

We obtained ten household and five business surveys. The ten household surveys included eight residences that were permanently occupied at the time and two who did not reside on the property full time. We estimate that there are at least 21 empty/abandoned residences in the area, and four abandoned businesses. We went door to door to every residence and returned if no one answered the door until we found someone at home to answer the survey. The demographics of survey respondents and their source of water are summarized below in Table 14.

Table 14. Demographics of survey respondents and their source of water

Variable	**Study Area - Residential**	**Study Area - Business**	**Presidio County**
# of surveys	10	5	NA
Median age, yrs	68	45	40
Mean years of formal education	6	14	NA
% completed high school	20	100	78
Household or business income			
# <$15,000/yr	8	0	
# $15,000 – 30,000/yr	1	0	
# >$80,000/yr	0	1	
# Not willing to share	0	4	
Median household income			$29,634
Mean household or business size # of residents or # of employees	1.8	6.3	2.9 residents/ household
Mean years of residence	13.5	NA	NA
Preferred household language			NA
English	1	4	
Spanish	9	1	
Source of water	10 hauled	4 hauled 1 well	NA

Persons living in the study area, compared to Presidio County as a whole, tended to be older, had lower levels of education and income, and answered our survey in Spanish. Most of the residents were retired (all but one household). Nine of the ten households said that they had no intention of moving from their residence.

Focus Group. We conducted two focus groups, one comprised of the residents of the study area, and the second comprised of businessmen from the study area. Ten individuals (8 women, two men) attended the residents focus group, and nine businessmen attended the business focus group. The script/discussion questions that were used for each focus group are presented in Appendix B.8. In each case, the results from the water survey and household/business survey were shared and discussed, followed by questions and discussion from the participants.

IV.C. Assessment Findings

Key Informant Interviews. The majority of key informants anticipated that water contamination resulting from hauling would result in some illnesses among the residents. Reported results from *colonias* in other areas have shown contamination from *E.coli* after hauling (Redlinger et al., 1999; and Dutton et al., 2000). Another potential health impact that was identified by key informants was the mental stress associated with the fear of running out of water and the inconvenience of hauling water.

Key informants identified not only significant health benefits from the proposed water service extension from Presidio, but also significant economic benefits, including: 1) economic development stemming from the expansion of new businesses; 2) construction of new homes; and 3) increased property values, estimated at about 20% increase after five years (Hargrove et al., 2015). Several of the business owners said that they would like to live on or near their business establishment but would not build a home without piped water. Several residents of Presidio own land in the study area and said that they would build a home on their property if it had piped water.

Key informants identified several barriers or challenges to overcome in order to provide piped water to the residents and businesses in the study area. The cost to the city of extending service is one major barrier. The cost is especially high to provide service to only twelve current residences and five businesses. Several key informants raised the issue of developing a local community water supply similar to the nearby community of Candelaria. A local citizens group, the Las Pampas Water Corporation, attempted to find a suitable site to drill a well. They were funded by the USDA Rural Development Agency, but, they did not find water. Reports of key informants from professional geologists and previous attempts to drill wells in the area show that finding a good supply of good quality water is difficult in the area due to very "spotty" shallow aquifers. The City of Presidio water supply derives from a much deeper West Texas Bolson of high quality water. Some key informants also mentioned the possibility of piping water from the nearby mining community of Shafter, which is about seven miles north of Las Pampas. But this proposition would be costly, and the water from the mining operations has water quality challenges.

Water Survey. Results from the water survey are shown below in Table 15. Presidio has very good quality water. We analyzed one sample from the filling station provided by the city for the

residents and businesses from the study area (results shown in Table 15). We also examined records provided by the city on the quality of their water. Results show that the City of Presidio provides high quality water with relatively low salt concentrations and arsenic concentrations that are common challenges in the region.

Table 15. Results of the water survey

Parameter	EPA Standard	Presidio Filling Point	Hauled Water	Delivered Water*	Private Well
Number of samples		1	10	1	1
Arsenic, ppb SD**=0.5	10	4.4	4.4	3.8	1.6
Dissolved Solids, ppm SD**=45	500 1000 (TX)	352	367	788	1220
E. coli, cfu***	0	0	0	0	0

*** from a non-potable source**
**** SD = standard deviation**
***** cfu = colony forming units**

The results for hauled water from a non-potable source (labelled "Delivered Water" in Table 15), and the one private well showed no problems with respect to arsenic (a common naturally occurring contaminant in the area) or *E.coli*. The delivered water from a non-potable source exceeded the EPA- recommended secondary standard for total dissolved solids (788 ppm vs. 500 ppm secondary standard). And, the one private well exceeded the TX standard for total dissolved solids (1220 ppm vs. 1000 ppm secondary standard). Both of those sources were at businesses that provide bottled water for their employees and customers. In this limited one time sampling, there was no apparent contamination resulting from hauling and storage on site for household use.

Household Survey. For the majority of survey respondents (70%), the quality of water from the City of Presidio is trusted, and 50% of respondents believed it is safe to drink even after hauling. However, only two residents out of the ten interviewed actually drinks the hauled water; all others prefer bottled water to drink. The residents and businesses who haul water themselves seem to do a reasonable job in terms of sanitation and hygiene. Sixty percent of respondents wash their containers/tanks every time before filling, and 90% wash their containers/tanks at least once every one to six months.

Residents haul water on average, two times per week for most of the year, but in the summer, up to three times per week. Several residents have gardens, livestock, trees, and other landscaping that require water in addition to their household use. The businesses haul water on average one time per month.

The most common health impacts reported by survey respondents were related to stress associated with the fear of running out of water and the risk of accidents associated with hauling water. Several residents reported injuries from accidents such as falling off the hauling tank while filling. One resident had an automobile accident when the tank filled with water that he was hauling fell off the trailer and onto the highway. Luckily no one was seriously injured. No illnesses associated with contaminated water were reported by respondents.

The costs of water to residents and businesses are significant. Estimates of total costs of water, including the direct costs of municipal water and bottled water, and the indirect costs associated with hauling are presented below in Table 16. Residents spend about $20/month on municipal water from the city (hauled) and about the same for bottled water for a total direct cost of about $40/month per household. We estimated the indirect costs of hauling water using the distance hauled and an average cost of $0.51/mile, which is the state mileage reimbursement rate in TX. This added, on the average, another $30.81/month to the cost of water for residents. Thus, the total average cost per month for residents is $70.47/month and for businesses is $46.04/month. For households whose total income is less than $15,000/yr (the majority of residents in the study area) this is a very significant monthly cost. By comparison, the average water bill for residents of Presidio was $17/month in 2012 (BECC, see reference list), and estimated to be not more than $20/month now.

Table 16. Costs of water from community survey

Cost Element	Residential Costs, $/mo		Business Costs, $/mo	
	Mean	Range	Mean	Range
Direct Costs				
Municipal water	$20.00	-	$10.00	$0 – 20.00
Bottled water	$19.66	$0 - 39.50	$30.63	$22.50 – 50.00
Subtotal Direct Costs	$39.66	$20.00 - 59.50	$40.63	$25.00 – 70.00
Indirect Costs				
Hauling	$30.81	$5.41 – 43.24	$5.41	$0 – 10.81
Total	$70.47	$40.00 - 102.74	$46.04	$25.00 - 80.81

Focus Groups. For the community residents focus group (the same individuals who were surveyed), all but one of the occupied households were represented. We shared the results of the water and household surveys with participants. Participants expressed much confidence in the quality of water from the City of Presidio, but nevertheless expressed fear about contamination through the process of hauling and storing. Residents were relieved to learn that there was no contamination resulting from hauling. The biggest health concerns on the part of residents is the stress and the risk of accidents associated with hauling water. Several residents have had minor accidents related to hauling water including falling off the hauling tanks. Residents believe that a positive benefit of having piped water would be increased property values and the potential for economic development through business expansion. Residents claim that their water use would not substantially change if they had piped water; rather they would use the same amount. Ninety percent of residents were willing to pay the cost of monthly water bills and even the cost of household connection if the main water line was not too far from their home.

In general, the residents are very discouraged and disheartened by the lack of piped water. Piped water was promised to most of the residents within five years of the purchase of their property by the sellers of the property. However, 10-15 years have passed and still there are no signs of piped water connections. The quotes below, gathered during the survey and the focus group, effectively convey the frustration and sense of hopelessness felt by most residents.

> *"There is no future. Death is the future. We are going to die waiting for water to come. Water is life. There is sadness, people lose hope, and people get tired…from hauling water."*
>
> *"When I haul water, I come praying to all the saints possible to avoid an accident and that I arrive safely."*
>
> *"…taxes are increasing anyway, at least bring water."*
>
> *"There is too much work involved…most of us are old."*
>
> *"…when we bought property here, we were told water is coming, only 5 years. That was 15 years ago."*

For the business focus group, all five active businesses were represented, plus several property owners who would like to establish businesses in the area also participated. Like the residents, the businessmen expressed concern about water quality after hauling and storage and were relieved to see our results that did not indicate contamination from hauling. For them, hauling water is a huge inconvenience; most are willing to pay "almost anything" to get piped water. Their biggest concerns include the time lost in hauling water and the risk of accidents. Some expressed concern that they were unable to provide showers or eyewash stations for their employees as a worker safety precaution. Also since most of them are in truck transport businesses, the ability to wash trucks is limited, which is a detriment for their business. Connection to Presidio water would allow for expansion of business (estimated to be as much as 50%) and expansion of residential areas. Most business owners and some of the employees want to live nearby their business. One participant said "…you can't have economic development without water. If there was water, I would build my house here right now". The businesses who participated are interested in trying to find their own solution to the lack of piped water. There

was discussion of developing a privately owned water supply that could also become a profit center for one of the businesses, or a community water supply. They expressed the sentiment that they are "tired of waiting on the city". One businessman said that he was moving to El Paso County; it was "just too much hassle to haul water".

A summary of the findings of our assessment is presented below in Table 17.

IV.D. Predicted Impacts

For each scoping category, we summarize in Table 18 our predictions for each health determinant/outcome and the populations likely to be most impacted if the decision is made to extend water service from Presidio. To characterize the effects of the decision to provide bus service, we used the following descriptors in the table:

Direction of Impact

- Positive – changes that improve health
- Negative – changes that may detract from health

Magnitude of Impact

- Low – causes impacts to no or few people (<10% of the population)
- Medium – causes impacts to a wider number of people (10-50% of the population)
- High – causes impacts to many people (>50% of the population)

Severity of Impact

- Low – causes impacts that can be quickly and easily managed or do not require treatment
- Medium – causes impacts that necessitate treatment or medical management and are reversible
- High – Causes impacts that are chronic, irreversible, or fatal

Likelihood of Impact

- Likely - it is likely that impacts will occur as a result of the proposal
- Possible – it is possible that impacts will occur as a result of the proposal
- Uncertain – it is unclear if impacts will occur as a result of the proposal

We elaborate on the predicted impacts in each scoping category below.

Water Quality. Our findings indicate no contamination of water from hauling and overall good water quality for all the residents and businesses who haul water; therefore there were no predicted adverse health outcomes. The only exception is the one business who relies on a domestic well which had high salt content. But, this business provides bottled water for their employees and customers to drink.

Convenience, Safety, and Cost of Hauled Water. The greatest negative predicted impacts arise from the quality of life factors associated with *water insecurity*. By *water insecurity,* we mean inadequate supplies of potable drinking water to meet the needs of the household, including not only all the indoor needs but also the landscaping, gardening, and animal production needs.

Table 17. Summary of Findings

SCOPING CATEGORY	DIRECT OR INDIRECT IMPACTS	HEALTH DETERMINANT/ OUTCOME	EVIDENCE	
			INDICATORS	**RESULTS**
WATER QUALITY/ AVAILABILITY	**DIRECT**	Gastrointestinal disease	Frequent stomach and/or intestinal ailments by at least one family member in the past 6 months	No reports of gastrointestinal disease
		Parasites	Frequent stomach and/or intestinal ailments by at least one family member in the past 6 months; diagnosis by a physician	No reports of gastrointestinal disease
		Methemoglobinemia	Blue skin coloration especially among infants, due to high nitrates	No infants in the project areas at this time; no reports of gastrointestinal disease
		Kidney disease	Kidney stones or other kidney ailments due to high salt content of water	No reports of kidney disease
		Skin irritation	Skin infections or rash, redness, itchiness due to drying and irritation from bathing in high salt content water	No reports of skin irritation
	INDIRECT	Stress	Mental stress due to anxiety about running out of water, inconvenience of having to haul water, inability to haul water	All residents and all businesses report mental stress associated with the anxieties about running out of water, the inconvenience of hauling water, the time requirement for hauling water on a regular basis, and the anxiety about road safety in hauling water
		Injuries	Injuries during filling and hauling or accidents on the road in hauling water	At least two residents had experienced multiple injuries in the filling and hauling process; most commonly falling off the tank; one road accident
		Quality of life	*Water security* – do households have sufficient good quality water	Residents were fearful about running out of water; most businesses and residents bought bottled water to drink because they did not trust the hauled water or well water; residents would like to have more plants and animals but feel limited by the lack of water
		Fire safety	Ability to fight a household fire	There are no fire hydrants in the area; a house fire would have to be fought by the city fire department using tank trucks
ECONOMICS	**INDIRECT**	Cost of connection	Willingness and ability to pay for household connections	All residents and businesses were willing to pay the cost of connection if piped water were provided
		Monthly cost of water	Willingness and ability to pay for monthly costs of water	All residents and businesses were willing to pay the monthly cost of water
		Property values	Appraised property values	Most residents and businesses thought that their property values would go up with piped water
		Property taxes	Tax bills	Businesses and residents recognize that property taxes would go up with higher property values but are willing to pay higher taxes (up to 20% higher) if they get piped water.

Table 18. HIA Predicted Impacts – Water Matters

SCOPING CATEGORY	HEALTH DETERMINANT/ OUTCOME		CHARACTERIZATION OF EFFECTS				
			Direction	Magnitude	Severity	Likelihood	Distribution: Populations Most Impacted
WATER QUALITY	Gastrointestinal Diseases		+	L	L	U	All residents
	Parasites		+	L	L	U	All residents
	Methemoglobinemia		+	L	L	U	Families of childbearing age
	Kidney disease/skin irritation from high salt content		+	L	L	U	All residents
CONVENIENCE, SAFETY, & COST OF HAULED WATER	Quality of Life		+	H	H	L	All residents & businesses
	Injuries		+	M	H	L	All residents & businesses
	Costs		+	H	H	L	All residents & businesses
ECONOMIC	Economic Development/ New businesses		+	M	M	L	Business community
	Residential development		+	H	M	L	Residential areas
	Household Costs	Costs to Connect to Water	-	H	M	L	All property owners
		Property values	+	H	M	L	All property owners
		Costs of Property Taxes	-	H	M	L	All property owners

Households buy bottled water to drink and have insufficient water through hauling to have all the plants and animals that they would like to have. This results in a lessened quality of life for residents. The personal injuries and road safety associated with hauling water are also factors that contribute to negative health outcomes. The cost of bottled water and the indirect costs of hauling water are also negative predicted impacts on household income.

Economic Impact. The impact of providing piped water to households and businesses could have both positive and negative consequences for disposable income for households or profits/assets for businesses. Positive consequences include the increase of property values resulting from having piped water. Results from *colonias* in El Paso County show that property values increase from 10-15% during the first few years (3-5 years) after piped water is provided in communities that have not had connections previously (Hargrove et al. 2014). Potential for economic development also increases significantly. Since the area includes the airport and is on a major north-south highway, there is potential for development of new businesses along the highway, stemming from the port of entry in Presidio, and especially near the airport. Also

water infrastructure could result in the area being considered more desirable for residential development and more homes being built in the area. Negative consequences include the upfront cost of a meter and the connection and monthly cost of water, plus the potential for higher property taxes due to the increased property values.

IV.E. Recommendations

Based on the summary of findings presented in Section IV.C., we propose the following recommendations.

1. Providing piped water to residents and businesses north of Presidio along Hwy 67, including the *colonia* Las Pampas, will improve health related to stress, risk of accidents, and worker safety at businesses. It would also improve quality of life, highway safety, and employee safety, and increase the potential for economic growth and development in the area. Piped water could be achieved by several different ways, including a) extension of city water services; b) developing a community water supply based on one or more wells in the area; c) delivery of water from Shafter. All of these options are costly relative to the number of residents and businesses served. The most economical solution might be development of a community water supply if a reliable water source could be found. One attempt was made but failed to identify a reliable source of water. Identifying reliable groundwater sources is very "spotty" in this region.
2. Residents could reduce the amount of water that they have to haul by implementing rainwater harvesting to at least capture enough water for gardens, trees, and other landscaping.
3. The city of Presidio could consider a water delivery service using certified haulers; it might be cheaper than extending the main water line.
4. The city could improve the filling station by moving it to a more accessible location near the city limits and raising the filling point so that haulers drive under or parallel to the filling point, making it easier for clients to fill their tanks and avoiding falls from having to run a hose from the ground to the filling tank.
5. Residents and businesses could reduce their cost by having two tanks, one for potable water and one for non-potable water that could be used for landscaping and gardening.
6. The City of Presidio and/or the County should seek financial assistance from state and federal sources to provide water to residents and businesses who lack water.

IV.F. Monitoring

Goals

We identified two broad areas for monitoring into the future the implementation of HIA recommendations (refer to Section IV.F):

1. City of Presidio's decision and BECC's planning to provide water services to businesses and residents outside the city limits along Hwy 67, and their application for project funding.
2. To monitor water infrastructure and health outcomes related to the three scoping HIA categories: a) water quality; b) convenience, safety, and cost of hauled water; c) economic.

Monitoring Outcomes

Providing piped water to residents and businesses north of Presidio along Hwy 67, including the *colonia* Las Pampas, will improve health related to stress, risk of accidents, and worker safety, but also provide quality and quantity of water that this type of infrastructure has to offer. While there are different water improvement recommendations made in this HIA, monitoring *water*

security based on quality and quantity on each circumstance monitors health outcomes indirectly. We summarize a monitoring plan below in Table 19.

There are different indicators for measuring water security when there is hauled water and piped water services. Reducing trips for hauling water in turn reduces opportunities for accidents on the road and injuries during the process of filling and hauling tanks, and at the same time reduces the stress related to water availability, and the inconvenience and effort of hauling water. For these health outcomes, monitoring and ultimately eliminating the *number of hauling water trips* made by residents and business owners is a key indicator for reducing stress and risk of accidents. Worker safety concerns were raised by business owners as they do not have reliable running sinks for employees to wash food items or cook, and eye wash stations and showers in case of a chemical splash. To improve worker safety, employers should be able to provide quantity, quality, and pressurized water and this can be delivered by having constant good quality water source and a running pump in the business. Monitoring *water availability and functionality of water pump in businesses* is a key indicator to improving worker safety, but also *water availability and functionality of water pump at home* reduces stress. For piped water, assuming water quality and pressure requirements are met, the *number of homes connected to the service* is an indirect monitoring indicator to the identified health outcomes in this HIA.

Table 19. Summary of Monitoring Plan

Recommendation	*Responsible Entity*	*Monitor Indicator*	*Monitoring Agency*	*Timing*
1	City of Presidio and BECC	Plan option selection	HIA leadership team	Immediate
2	BECC and HIA leadership team	# homes with rain harvesting systems	BECC & HIA leadership team	Immediate to Medium
3	City of Presidio	Water delivery service offered	City of Presidio & HIA leadership team	Immediate
4	City of Presidio	Filling station with recommended conditions	City of Presidio & HIA leadership team	Medium
5	Residents and businesses along Hwy 67	2 designated tanks for potable and non-potable uses	Residents and businesses along Hwy 67	Immediate to Medium
6	City of Presidio	Applications to funding resources to expand water services	City of Presidio & HIA leadership team	Medium to Long

Timing parameters: Immediate= 0 to 1 year; Medium= 1 to 3 years; Long= more than 3 years

We were not able to identify indicators that would be of low resource to monitor, therefore we recommend allocation of resources such as personnel and funding to track indicators. Monitoring water security will indirectly monitor highway safety, employee safety, potential for economic growth and development in the area, and ultimately an improvement in the overall quality of life.

IV.G. Conclusions

The quality of water from the City of Presidio, even after hauling and storing, is very good. Although we sampled residences and businesses only once, we found no instances of contamination. Residents and businesses were relieved to see this result.

The biggest health impacts related to hauled water include stress from fear of running out of water; the inconvenience, time, and stress associated with hauling water; the risk of accidents; and for businesses, worker safety. If the City of Presidio would extend their service, there are potentially significant positive benefits for economic growth and development, including not only businesses but also residential areas as well. Both residents and businesses are willing to pay the cost of connection and the monthly cost of piped water. In sum, the residents and businesses in the study area, including the *colonia* Las Pampas, are disillusioned and harbor dashed hopes from the past. They see no future for their community without water. As residents of the richest country in the world, they deserve better.

IV.H. Dissemination Plan

The results of the Water Matters HIA have been presented orally in the following venues: 1) a public meeting of the Presidio City Council, 2) a meeting of community members in which all but one household participated, and 3) a meeting of the businesses in the community in which all participated. We will provide a copy of the final written report to these same stakeholders when approved by the funders.

IV.I. References

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SECTION V. HEALTH IMPACT INDEX AND OTHER MONITORING AND ASSESSMENT TOOLS

V.A. Health Impact Index

Methodology. We tested a "health impact index" (HII) to help "score" proposed projects with respect to their health impacts. We calculated an index using both an arithmetic mean and a geometric mean. The approach that we used was similar to the Water Poverty Index developed for *colonias* by Korc and Ford (2013)[1] . Using the arithmetic mean, the HII is defined as:

$$HII_j = [\sum_{i=1}^{i=n} D_{ij} M_{ij} S_{ij} L_{ij}] w/n$$

Where HII_j is the Health Impact Index at location *j*; *i* is a selected health determinant or outcome; D_{ij} is the direction of the impact for health determinant *i*, positive or negative; M_{ij} is the magnitude of the impact of health determinant *i*; S_{ij} is the severity of the impact of health determinant *i*; and L_{ij} is the likelihood of impact of health determinant *i*. *M, S,* and *L* are rated low, medium, or high and assigned a numerical value of 1, 2, or 3 respectively. Thus the minimum value of HII_j is theoretically -27 but more likely to be near 0, and the maximum value is *27*.

Using the geometric mean, the HII is defined as:

$$HII_j = \prod_{i=1}^{i=n} w_i x_{ij}$$

Where HII_j is the Health Impact Index at location *j*; *i* is a selected health determinant or outcome; *n* is the number of health determinants being considered; x_{ij} is the product of the magnitude, severity, and likelihood of health determinant *i*, divided by 27 (the maximum possible); and w_i is the weighting factor for health determinant *i*, which equals one for all direct impacts and 0.5 for all indirect impacts.

To calculate the HII, for an individual proposed project, whether by arithmetic mean or geometric mean, a table of predicted impacts would have to be developed. This would require enough work to develop a scoping summary for the proposed project. A predicted impacts table could be developed using the scoping categories, the health determinants or outcomes and the related direction, magnitude, severity and likelihood using the following standard criteria.

Direction of Impact

- Positive – changes that improve health
- Negative – changes that may detract from health

Magnitude of Impact

- Low – causes impacts to no or few people
- Medium – causes impacts to a wider number of people
- High – causes impacts to many people

[1] Korc, Marcelo E., and Paula B. Ford. 2013. Application of the Water Poverty Index in border *colonias* of west Texas. Water Policy 15:79-97.

Severity of Impact

- Low – causes impacts that can be quickly and easily managed or do not require treatment
- Medium – causes impacts that necessitate treatment or medical management and are reversible
- High – Causes impacts that are chronic, irreversible, or fatal

Likelihood of Impact

- Likely – it is likely that impacts will occur as a result of the proposal
- Possible – it is possible that impacts will occur as a result of the proposal
- Uncertain – it is unclear if impacts will occur as a result of the proposal

The HII can then be calculated using the completed table and the process described above for assigning numerical values to each criterion. The HII was pilot-tested using three proposed projects: 1) our HIA conducted in Vinton, TX related water and sanitation infrastructure; 2) our HIA in southern Doña Ana County, NM related to public transportation; and 3) the HIA for the Presidio water service extension project. For each the HII was calculated using both the arithmetic and geometric mean. Through our experience and case studies, we established some health impact categories based on ranges of the HII that could be useful in comparing and categorizing projects that BECC and other agencies wish to evaluate in terms of their health impact.

Mean Score Categories for Arithmetic Mean
0-2 Low Impact
3-10 Low Medium Impact
10-17 High Medium Impact
18-27 High Impact

Mean Score Categories for Geometric Mean
0-.1 Low Impact
.1-.3 Low Medium Impact
.3-.6 High Medium Impact
.6-1.0 High Impact

It is anticipated that the result can be used as a tool by BECC and/or EPA for proposed projects.

Results. The predicted impact tables and the scores for the three projects that we tested are given below in Tables 20, 21, and 22, for the water and sanitation project in Vinton, the public transportation project in southern Doña Ana County, NM, and the water project in Las Pampas, respectively. For all three cases, the resulting HII score was either low or low-medium, indicating a modest overall impact on health for the proposed infrastructure projects. We first attempted these calculations without any weighting factors but considered all factors equally. This also resulted in even lower numbers because of the large negative indirect impacts. For the Water Poverty Index described by Korc et al., weighting factors were identified by the stakeholders. We decided on a simple way to use weighting factors by weighting direct impacts and indirect impacts differently, in this case 1 for direct impacts and 0.5 for indirect impacts.

Table 20. HII score sheet for Vinton HIA

SCOPING CATEGORY	HEALTH DETERMINANT/ OUTCOME		CHARACTERIZATION OF EFFECTS				
			Direction	Magnitude	Severity	Likelihood	Total Points
WATER QUALITY	Gastrointestinal Diseases		POSITIVE	MEDIUM 2	MEDIUM 2	LIKELY 3	+12
	Neurological Disorders		POSTIVE	MEDIUM 2	LOW 1	POSSIBLE 2	+4
	Skin Irritation from arsenic in Drinking Wáter (top row) and Salt in Bathing/Wash Wáter (bottom row)		POSITIVE	LOW 1	LOW 1	LIKELY 3	+3
			POSITIVE	LOW 1	LOW 1	POSSIBLE 2	+2
SANITATION	Gastrointestinal Diseases		POSITIVE	MEDIUM 2	MEDIUM 2	LIKELY 3	+12
	Skin Irritation		POSITIVE	MEDIUM 2	LOW 1	POSSIBLE 2	+4
COMMUNITY	Fire Control Public Safety		POSITIVE	LOW 1	HIGH 3	POSSIBLE 2	+6
	Health Care Access		POSITIVE	MEDIUM 2	LOW 1	POSSIBLE 2	+4
	Recreation Space		POSITIVE	MEDIUM 2	LOW 1	POSSIBLE 2	+4
ECONOMIC	Fire Liability Insurance		POSITIVE	MEDIUM 2	LOW 1	POSSIBLE 2	+4
	Net Worth of Households		POSITIVE	HIGH 3	LOW 1	POSSIBLE 2	+6
	Economic Growth In Community		POSITIVE	MEDIUM 2	LOW 1	UNCERTAIN 1	+2
	Household Costs	Costs to Connect to Water	NEGATIVE	HIGH 3	MEDIUM 2	LIKELY 3	-18
		Costs to Connect to Sanitation	NEGATIVE	HIGH 3	MEDIUM 2	LIKELY 3	-18
		Costs of Property Taxes	NEGATIVE	HIGH 3	MEDIUM 2	LIKELY 3	-18

Key
Low or Uncertain =1
Medium or Possible =2
High or Likely =3

Total Direct Impacts (w=1)	= 37
Total Indirect Impacts (w=0.5)	= -14
Total Weighted Score	= 23
Arithmetic Mean (23/15)	= 1.5 L
Geometric Mean (0-1)	= .024 L

Table 21. HII Score sheet for Transportation Matters HIA

SCOPING CATEGORY	DIRECT OR INDIRECT IMPACTS	HEALTH DETERMINANT/ OUTCOME	CHARACTERIZATION OF EFFECTS				
			Direction	Magnitude	Severity	Likelihood	Score
ACCESS TO HEALTH CARE AND HEALTHY CONDITIONS	Direct	Improved access to fresh foods	+	M 2	M 2	P 2	+8
		Improved access to physicians	+	H 3	H 3	P 2	+18
		Improved access to pharmaceuticals	+	H 3	H 3	P 2	+18
		Improved access to other health related goods and services	+	M 2	H 3	P 2	+12
	Indirect	Physical activity from walking to bus stop	+	H 3	L 1	P 2	+6
		Less pollution exposure due to less cars on the road	+	H 3	H 3	P 2	+18
		Improved road safety	+	M 2	M 2	L 3	+12
		Less stress resulting from convenience and flexibility of bus	+	M 2	L 1	L 3	+6
		Reduce risky behaviors	+	M 2	M 2	P 2	+8
ACCESS TO EDUCATION	Indirect	Access to formal education	+	M 2	M 2	P 2	+8
		Access to job training	+	M 2	L 1	P 2	+4
		Access to life skills/ informal education	+	M 2	M 2	P 2	+8
		Access to social & recreational activities	+	M 2	L 1	P 2	+4
		Improve communication and engagement	+	M 2	M 2	P 2	+8
ACCESS TO JOBS/ ECONOMIC ACTIVITY/ ECONOMIC IMPACTS	Indirect	Access to jobs	+	M 2	M 2	P 2	+8
		Access to shopping	+	M 2	L 1	P 2	+4
		Paying bills	+	M 2	M 2	P 2	+8
		Cost of the system	-	H 3	M 2	L 3	-18
		Road damage from buses	-	M 2	L 1	P 2	-4
		Reduce household costs for a car	+	M 2	M 2	P 2	+8

Key
Low or Uncertain =1
Medium or Possible =2
High or Likely =3

Total Direct Impacts (w=1)	=	56
Total Indirect Impacts (w=0.5)	=	44
Total Weighted Score	=	100
Arithmetic Mean (100/20)	=	5 LM
Geometric Mean (0-1)	=	.152 LM

Table 22. HII Score sheet for Water Matters HIA (after completion of the assessment)

SCOPING CATEGORY	HEALTH DETERMINANT/ OUTCOME		CHARACTERIZATION OF EFFECTS				
			Direction	Magnitude	Severity	Likelihood	Score
WATER QUALITY	Gastrointestinal Diseases		+	L 1	L 1	U 1	1
	Parasites		+	L 1	L 1	U 1	1
	Methemoglobinemia		+	L 1	L 1	U 1	1
	Kidney disease/skin irritation From high salt content		+	L 1	L 1	U 1	1
CONVENIENCE SAFETY COST OF HAULED WATER	Quality of Life		+	H 3	H 3	L 3	27
	Injuries		+	M 2	H 3	L 3	18
	Costs		+	H 3	H 3	L 3	27
ECONOMIC	Economic Development/ New businesses		+	M 2	M 2	L 3	12
	Residential development		+	H 3	M 2	L 3	18
	Household Costs	Costs to Connect to Water	-	H 3	M 2	L 3	-18
		Property values	+	H 3	M 2	L 3	18
		Costs of Property Taxes	-	H 3	M 2	L 3	-18

Key
Low or Uncertain =1
Medium or Possible =2
High or Likely =3

Total Direct Impacts (w=1)	=	49
Total Indirect Impacts (w=0.5)	=	19
Total Weighted Score	=	68
Arithmetic Mean (68/12)	=	6 LM
Geometric Mean (0-1)	=	.107 LM

We intend to continue to work with BECC to test these approaches to find one that is reliable and practical for BECC's use; however since these first tests resulted in all relatively low values, we question the usefulness of calculating a single value as an index. However, the construction of the predicted impacts table is very useful in identifying all the direct and indirect determinants of health and placing some value on them by assessing the magnitude, severity, and likelihood. In the cases that we evaluated, all represent rural case studies where impacts can be large on individuals but because of small rural populations, the collective impact is small relative to urban populations. The costs are also high for infrastructure improvements. This illustrates the disparities for rural populations compared to urban populations in terms of assessing the benefit/ cost ratio for infrastructure improvements.

V.B. Streamlined HIA Approach

Description. Using the HII described above we propose a streamlined HIA process for BECC to use in considering health impacts of proposed infrastructure projects without having to do a full HIA on every project. Our streamlined process includes: 1) screening, 2) scoping, 3)streamlined assessment and predictions based on available data and information, 4) recommendations, and 5) report. For each scoping category, direct and indirect determinants of health can be identified. For each determinant of health or outcome, a matrix of predicted impacts in terms of direction, magnitude, severity, and likelihood can be developed, as for the HII. The calculated HII replaces the full assessment of an HIA.

Pilot Test. This streamlined process was pilot tested by completing the scoping summary for the Water Matters HIA and then calculating the HII as described above. The results for the HII before completing the HIA are presented below in Table 23. Subsequently, we completed a full assessment as in a traditional HIA and completed the predicted impacts table using the information collected in the HIA. We then calculated the HII again (shown above in Table 22) and compared the value post-HIA to that which we calculated for the pre-HIA (in Table 23) below).

The resulting HII parameters for the pre- and post-HIA analysis are summarized below in Table 24. Results for pre-assessment compared with results for post-assessment were similar. Both resulted in an overall impact assessment of Low Medium (mean total score of 6.75 vs 7.3, respectively).

V.C. Conclusions and Recommendations

We developed a "health impact index" (HII) to help "score" proposed projects with respect to their health impacts, utilizing a table of predicted impacts. This would require enough work to develop a scoping summary for the proposed project. A predicted impacts table could be developed using the scoping categories, the health determinants or outcomes and the related direction, magnitude, severity and likelihood of health impacts. The preliminary tests used weighting factors for direct and indirect impacts and both arithmetic and geometric means. Resulting values showed low to low medium impact. Further work needs to be done to evaluate the use of the predicted impacts table and the resulting index. We plan to continue to refine the HII through collaboration with BECC. Using the predicted impacts, we propose a streamlined HIA process that BECC could use in considering health impacts of proposed infrastructure projects without having to do a full HIA on every project.

Table 23. HIA Predicted Impacts for Water Matters, Pre-HIA (April 22, 2015)

SCOPING CATEGORY	HEALTH DETERMINANT/ OUTCOME		CHARACTERIZATION OF EFFECTS				
			Direction	Magnitude	Severity	Likelihood	Total Points
WATER QUALITY	Gastrointestinal Diseases		+	H 3	M 2	L 3	+18
	Parasites		+	M 2	H 3	L 3	+18
	Methemoglobinemia		+	L 1	H 3	U 1	+3
	Kidney disease/skin irritation From high salt content		+	L 1	L 1	P 2	+2
CONVENIENCE SAFETY COST OF HAULED WATER	Quality of Life		+	M 2	M 2	P 2	+8
	Injuries		+	L 1	M 2	P 2	+4
	Costs		+	H 3	L 1	P 2	+6
ECONOMIC	Economic Development/ New businesses		+	M 2	M 2	L 3	+12
	Residential development		+	H 3	M 2	L 3	+18
	Household Costs	Costs to Connect to Water	-	M 2	M 2	L 3	-12
		Property values	+	M 2	M 2	L 3	+12
		Costs of Property Taxes	-	M 2	M 2	P 2	-8

Key

Low or Uncertain =1
Medium or Possible =2
High or Likely =3

Total Direct Impacts = 53
Total Indirect Impacts = 14
Total Weighted Score **= 67**
Arithmetic Mean(67/12) **= 6 LM**
Geometric Mean (0-1) = .15 LM

Table 24. Comparison of the HII parameters pre- and post-HIA

HII Parameter	Pre-HIA	Post-HIA
Total Direct Impacts	53	49
Total Indirect Impacts	14	19
Total Weighted Score	67	68
Arithmetic Mean	6	6
Geometric Mean	0.15	0.107

Our streamlined process includes: 1) screening, 2) scoping, 3) stream-lined assessment and predictions based on available data and information, 4) recommendations, and 5) report. For each scoping category, direct and indirect determinants of health can be identified. For each determinant of health or outcome, a matrix of predicted impacts in terms of direction, magnitude, severity, and likelihood can be developed, as for the HII. The calculated HII replaces the full assessment of an HIA. Thus, the stream-lined process keeps most of the elements of a full HIA, but includes a much shortened and less expensive assessment. However, we recognize the importance and valuable input that is obtained through stakeholder engagement. It is difficult to make a valid health impact assessment without stakeholder input. There needs to be some compromise between the cost of a full HIA and the valuable information obtained through stakeholder engagement. This process needs to be more fully tested by BECC. Stemming from a contract that we implemented with BECC, we will be working closely with them during the period of September 1, 2016 – March 1, 2017 to identify processes to improve their monitoring and evaluation and their assessment of impacts. Unfortunately most of this time falls outside the timeframe of our current HIA Program Grant.

V.D. Monitoring Indicators for BECC

During most of the timeframe of our HIA Capacity Building Grant, the work schedule of BECC was such that they were not able to actively participate in the project. But as of August 1, 2016, they have become more interested in the streamlined HIA process, monitoring and evaluation approaches, and identifying indicators for their infrastructure projects. We will be working more closely with them during the period of September 1, 2016 – March 1, 2017 to identify processes to improve their monitoring and evaluation and their assessment of impacts. We will use a project that they planned and partially funded in the border communities of Socorro and San Elizario, which are in El Paso County, to do a retrospective HIA and further refine their monitoring and evaluation process. A brief scope of work for this project is provided in Appendix C.1. Unfortunately most of the time required for this scope of work falls outside the timeframe of our current HIA Program Grant, but further updates and reports will be provided to the Health Impact Project as they become available.

Narrow streets in rural community

SECTION VI. INSTITUTIONALIZING HIA

VI.A. HIA Course

We developed an interdisciplinary HIA course aimed at undergraduate and graduate students at UTEP in order to train our students in HIA concepts and practice. Such a course is sorely needed due to the limited expertise and experience in the border region to conduct HIAs and the projected demand for trained HIA professionals who are bilingual and culturally competent. We developed a logic model for the course, shown in Appendix C.1. The course syllabus, shown in Appendix C.2., was developed based on the logic model, and included basic elements of HIA process and practice as outlined by Pollack et al. (2014).

The course was pilot tested in the summer of 2016. The HIA course was offered through the Public Health Sciences Department in the College of Health Sciences during the extended summer session. Michelle Del Rio, our HIA Coordinator, was the Instructor. Class met twice a week, for 2 hours each day, for two months. Registration was open for undergraduate and graduate students of all majors, with initial capacity for 18 students.

Eighteen students pre-registered for the course, but seven students dropped before the session started. The remaining eleven students who started the course remained for the entire semester. The demographics of the students were 10 females and 1 male, and ranged in age from 23-60 years. The majority were Hispanic (10 students), and 1 student was African-American. All but 1 were fluent in Spanish and English. All were undergraduate students, classified as seniors (9) and juniors (2). The majority (10 students) were pursuing a Bachelor of Science degree (B.S.) in Health Promotion; one student was pursuing a B.S. in Social Work. When asked about career goals after completing their degree, the responses included epidemiologist, professional nurse, medicine, health education, and social work. Many of them were first in their family to go to college, were parents already, and had experienced something related to health disparities that motivated them to explore HIA.

At the end of the course, the students completed the standard course evaluation as required by UTEP. Plus the Instructor led a brief reflection session on HIA and what they learned, and Dr. Maria Duarte led a focus group discussion with some of the students about their response to the course. Some of these results are summarized below.

Standard Course Evaluation. The complete course evaluation results are presented in Appendix C.3. Ten of the eleven students rated the course as “excellent”; one student rated it “good”. Eighty-two percent of the students estimated how much they learned in the course was well above average (the highest choice), and 18% above average. Sixty-four percent estimated that the amount the course challenged them intellectually was also well above average; 36% estimated the amount that they felt challenged intellectually as above average.

Student Reflections. Results from an Instructor led reflection on the last day of class, and a survey and focus group led by an independent evaluator conducted at the end of the course are presented in Appendix C.4., C.5., and C.6., respectively. All students agreed that they found value in HIA and that they would see themselves using it in their future careers. They also thought that while it might be a costly process, it could be justified by the value of the results.

They provided positive feedback on the content of the course; in particular, the in-class activities were helpful in supporting and learning more about the HIA process. They really thought that having examples of complete HIAs was very helpful for them.

In terms of potential improvements, they wanted more "hands on" activities or stakeholder engagement experience. They would have benefitted from actually visiting an area in which a HIA was done, or interacting with decision makers who found value in HIA. They very much appreciated the experience from the guest key informant (each group had a chance to interview one) as this was the first time they had ever had an encounter like that. Conducting a mock interview made them realize the process of engaging stakeholders in the HIA process and at the same time how to obtain and record their valuable information. They also thought that it would have been helpful to have developed a survey and done primary data collection and/or maybe more depth in secondary data analyses.

For several of the students, this course was their first introduction to HIA. After the course, they felt that HIA is of great value and they were pleased to have learned the process. One student suggested that this course should be among the three courses to choose among for the Health Promotion degree plan in the College of Health Sciences.

In terms of the process of the course, several students expressed that the most valuable lesson learned was the importance of teamwork through their class projects. They were able to see how collaborative teamwork can help in engaging stakeholders in the HIA process and in engaging other participants in the HIA process, such as the leadership team, steering committee, and key informants.

Finally, the course improved their understanding and appreciation for social determinants of health, and how public decision making is done often times without consideration for the adverse impacts on public health.

Next steps. The pilot course was a success. UTEP College of Health Sciences plans to offer the course again next year. NMSU College of Health Sciences is also interested in offering the course in their MPH curriculum. It is possible that Ms. Del Rio will teach the course at NMSU in spring, 2017.

VI.B. New Partners

We expanded our network of institutional partners by conducting one full HIA in New Mexico, engaging New Mexico State University as a new institutional partner. Their Southwest Center for Survey Research in the College of Health Science and Social Services made a major contribution to our HIA effort by designing the surveys that we used, helping to administer the surveys, and analyzing the survey results. We engaged other state and local agencies in New Mexico related to the public transportation HIA that are listed below in Table 25, including the lead agency, the South Central Regional Transit District of New Mexico.

This not only expanded our institutional partners but also provided an opportunity for these local and state agencies to learn about HIA and its utility. The NM DOT used our results in

conducting their own transportation infrastructure assessment in the Santa Teresa area including the new port of entry on the U.S./Mexico border.

Table 25. New Mexico Partners in Transportation Matters

AGENCY OR ORGANIZATION	ORGANIZATION TYPE	CONTACT
South Central New Mexico Regional Transit District	State/regional	Wayne Hancock, Board Chairman
South Central New Mexico Regional Transit District Advisory Board	Local citizens group	Sharon Thomas, Chair
Doña Ana Community College	State/local	Jackie Kiefer
Empowerment Congress	Local NGO	Amanda Formica
New Mexico State University College of Health Sciences	State	Joe Tomaka
New Mexico State University Department of Geography	State	Chris Brown
La Clinica de la Familia	Community health clinic	Virgil Medina
Memorial Medical Center	Regional hospital	Steven Runwoldt
New Mexico State University Cooperative Extension	State/local	Karim Martinez
Ngage	Local NGO	Frank Lopez
University of New Mexico Health Extension	State	Marnie Nixon
NM Department of Transportation	State	

VI.C. New Approaches

Our chief new contribution was to develop and pilot test a streamlined process for BECC that will promote a HIAP approach along the U.S./Mexico border. What we developed is described above in Section VI.A. This tool could be used not only by BECC but also EPA and USDA-RDA who also fund infrastructure projects on the border. Unfortunately the work schedule of BECC was such that they were not able to actively participate in the project over the past 22 months. But as of August 1, 2016, they have become more interested in the streamlined HIA process, monitoring and evaluation approaches, and identifying indicators for their infrastructure projects. We will be working more closely with them during the period of September 1, 2016 – March 1, 2017 to identify processes to improve their monitoring and evaluation and their assessment of impacts. Unfortunately most of this time falls outside the timeframe of our current HIA Program Grant.

Another new contribution of our project is the HIA course that was developed and taught at UTEP. This is the first HIA course taught at an institution on the Border. There is a major need for HIA professionals and practitioners who are bilingual in the U.S./Mexico border region and beyond. The course that we taught helps to fill this gap. We will also try to spread the use of this course and disseminate information on the course to other institutions along the border.

VI.D. References

Pollack, Keshia M., Andrew L. Dannenberg, Nisha D. Botchwey, Cynthia L. Stone and Edmund Seto. 2014. Developing a model curriculum for a university course in health impact assessment in the USA. *Impact Assessment and Project Appraisal* http://dx.doi.org/10.1080/14615517.2014.960213

Bus service

Bus stop in Chamberino

SECTION VII. LESSONS LEARNED

We identify the following lessons learned for the HIAs and other major activities that we conducted.

VII.A. Transportation Matters HIA

1. A "culture" of public transportation use is lacking/missing in the region. In other regions of the U.S. a culture of public transportation use has developed that does not exist in the desert Southwest.
2. There is a very large lack of agreement between survey results for respondents' interest in using the bus system and the actual ridership. Whereas at least 80% of respondents said that they would use the bus, ridership is only around 150/week.
3. Public transportation in rural areas has the potential to remove a physical barrier that prevents residents from accessing goods and services that are available in urban areas.
4. There is a "structural bias" in more urban areas with regards to rural areas. Urban residents ask "why should we bear the cost of providing services to rural areas? Rural residents cannot expect the same services as urban residents."
5. Lack of access to health care in rural areas contributes to health disparities.
6. Individual stakeholders have "hidden agendas". Triangulation among stakeholders and key informants can shed light on some of those hidden agendas.

VII.B. Water Matters HIA

1. The community verified a longstanding struggle to obtain piped water in the area, having been promised when they purchased their land that piped water was coming but then after 15 years there is no piped water. For the first time, community members felt heard through the HIA process. They do not feel heard by the city of Presidio or other local government officials. Thus, there was an intangible benefit to the community, just in terms of feeling heard for the first time.
2. Our study area around Hwy 67 and Las Pampas included only about 20 residents in 12 households and four businesses. Obtaining access to water would certainly provide opportunities for the area to grow, but over the past 15 years it has been constantly shrinking. The amount of time, money, and resources spent on the HIA has to be questioned in terms of the number of people who will directly benefit. Yet without the HIA, the community had no voice.
3. There is a lot of potential to grow the international bridge traffic and that could impact businesses on the Hwy 67 corridor.
4. Presidio is a small town in a rural, relatively isolated area; it was difficult to find key informants for the purpose of the HIA.

VII.C. General Lessons Learned from Conducting HIAs in Rural Areas

1. Conducting HIAs in rural areas reveals the complexity of rural areas compared to urban areas, including the political context of local control by locally powerful individuals and how it changes over time and the structural bias of urban residents against rural areas.
2. HIA provides validation and gives voice to marginalized rural residents.

VII.D. The Health Impact Index

1. We are confident that an appropriate Health Impact Index (HII) can be developed and used in a stream-line HIA process. The HII needs further testing and development but this must be done by potential users like BECC. The stream-lined process that we propose maintains the basic HIA structure with stakeholder input, but shortens the assessment process by using predicted impacts based on the literature, professional experience, and stakeholder knowledge.

VII.E. Institutionalizing HIA

1. HIA Course

Our pilot course attempted to include both theory and practice in one semester and turned out to be a bit overwhelming. In the duration of eight weeks, we were able to hit all learning objectives, but in very little depth. If we continue to offer the course, we recommend to divide the learning objectives into two courses, one for theory and the second for practice. Conducting an HIA would allow for students to practice the theory and build their confidence in conducting HIA.

In general, our students had a keen interest in health disparities which are prevalent in the border region. This interest, in turn, fueled their interest in HIA methods and tools. It was helpful that the students had been exposed to health program evaluation, epidemiology, and environmental health courses prior to the HIA course. This experience and background supported the HIA learning experience.

This first pilot course in HIA at UTEP proved to be both challenging and rewarding. A major challenge was how to simplify the goals and practice of HIA. In the end, the students felt empowered and saw great value in the HIA methodology. They envisioned using the tools of HIA, if not actually conducting HIA in their future careers. From this standpoint, the course trained and inspired new HIA practitioners. UTEP plans to offer the course again and NMSU is thinking of offering the course as well.

2. New Partners

NMSU became involved in HIA for the first time. They are considering offering the HIA course and now have the capacity to conduct HIA on their own. The value of HIA was also demonstrated to a number of new partners in New Mexico, which is one more step in institutionalizing HIA and "health in all policies".

3. BECC

BECC is not able to conduct a complete HIA for every project that they plan and certify. However, they are interested in using the tools of HIA and in implementing a stream-lined process focused on assessing, monitoring, and evaluating the health impacts of projects. This also involves identifying a set of key indicators that they can monitor. The identification of these key indicators and the institutionalization of a streamlined process is still to come but intentional work is in process and progress is being made.