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Potential Health Effects of Proposed Public Transit Concepts in Wichita, Kansas

Kansas Health Impact Assessment Project

September 2013

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The Kansas Health Institute is a nonprofit, nonpartisan, independent health policy and research organization based in Topeka, Kansas. Established in 1995 with a multi-year grant from the Kansas Health Foundation, the Kansas Health Institute conducts research and policy analysis on issues that affect the health of Kansans.

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ABOUT THE REPORT

The report is intended to be an accessible, informative resource for Wichita policymakers as they assess potential positive and negative health effects associated with each of the proposed transit concepts in Wichita. The report is also intended to present the scope of the Kansas Health Impact Assessment Project to a diverse audience, including Wichita policymakers, local and state transportation-related agencies, organizations that serve vulnerable populations and community stakeholders.

Acknowledgements

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Over the course of the project, the Kansas Health Impact Assessment Project Research Team, further referred to as the HIA team, received valuable input and participation from a variety of stakeholders, including city and county officials, state legislators, and representatives of transit-related organizations, academia, faith-based organizations, social service organizations and others. We thank them for dedicating their time, energy and expertise to the project. We also extend a special thanks to members of the Kansas HIA Transit Advisory Panel for their important involvement throughout the project.

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EXECUTIVE SUMMARY

Overview of Concepts

As the Wichita City Council prepares for a vote on proposed changes to the city's transit system, the Kansas Health Institute (KHI), in collaboration with the University of Kansas School of Medicine – Wichita, and with assistance from the Hugo Wall School of Urban and Public Affairs at Wichita State University, conducted a Health Impact Assessment (HIA) to examine how those changes might affect the well-being of Wichita area residents (Table 1).

HIA is a practical tool that assesses the health impact of policies, strategies and initiatives in sectors that indirectly affect health, such as transportation, employment and the environment. The overall goal of HIA is to inform decision-makers of potential health benefits and adverse health effects of proposed actions and to support identification of appropriate policy options.

Table 1. Potential Health Impacts of Wichita Transit Concepts

TRANSIT SYSTEM	DESCRIPTION	MARGINAL INCREASE IN LEVEL OF ANNUAL RIDERSHIP	POTENTIAL POSITIVE HEALTH IMPACTS
Current	Hub-and-spoke system with the most geographic coverage out of all proposed concepts, but no night or Sunday service.	N/A	N/A
Concept A (Grid)	Grid system with increased frequency, night and weekend service and routes traveling north and south, although slightly less geographic coverage than the current system.	+1,040,000 rides	●●●
Concept B (Optimization)	Optimization of current hub-and-spoke system with greater frequency for higher ridership routes and elimination of lower ridership routes.	+991,000 rides	●●
Concept C (Reduction)	Reductions from the current hub-and-spoke system, including elimination of Saturday service, fewer routes and reduced hours of operation, but provides coverage to transit-dependent populations.	-331,000 rides	●
Concept D1 (Extension)	Extension of current routes to surrounding Wichita communities such as Andover, Derby, Goddard and Valley Center, with hourly service.	+425,000 rides	●
Concept D2 (Commuter)	Extension of current routes to surrounding communities such as Andover, Derby, Goddard and Valley Center, with morning and evening trips for commuters.	+39,000 to +185,000 rides	●

Note: Symbols represent expected potential positive health impacts, on a scale of 1 to 3, where 3 represents the greatest number of positive health impacts. Concept D1 or D2 can be combined with one of the other concepts presented (e.g., A+D1). The concept description and marginal increase in level of annual ridership were developed by the Kansas Health Institute based on the review of the *Wichita Transit Community Outreach* study prepared by Olsson Associates, March 27, 2012.

Source: KHI HIA Transit Project, 2013.

Over the past year, Olsson Associates developed three new concepts (A-C) and two add-on concepts (D1 Extension and D2 Commuter) that include transit system changes based on community recommendations but do not directly take health into consideration. The proposed concepts differ in service coverage, frequency, hours of operation and annual cost. Additional funding will be required to initiate and sustain these changes.

The HIA details how each of the proposed public transit concepts could affect the health of Wichita residents. Specifically, the HIA explored transit-related factors that influence health including air quality, injury, exposure to secondhand smoke, access to employment, health care, food sources and educational and recreational resources.

Key Questions

The HIA considered three key research questions related to the proposed transit changes in Wichita:

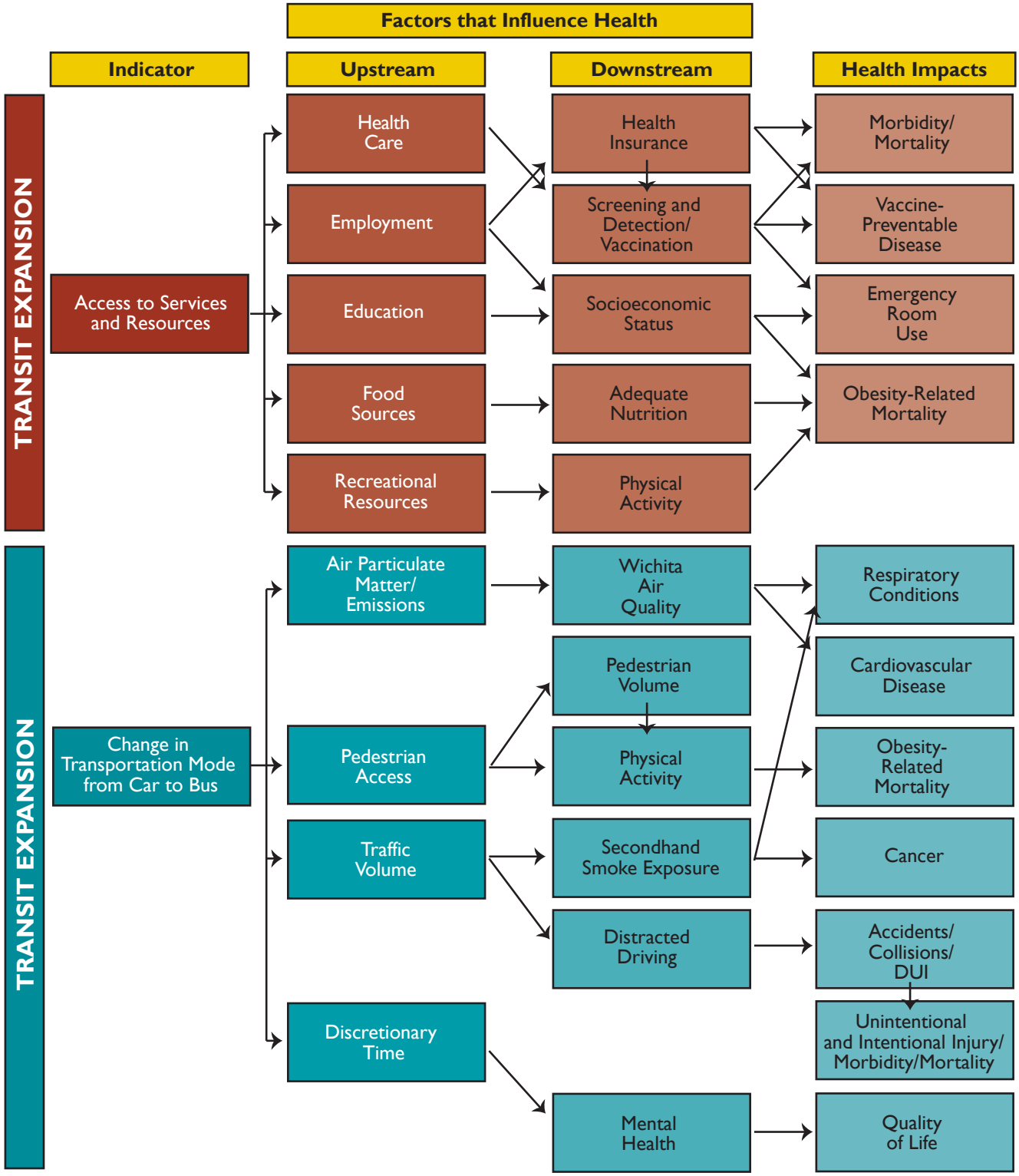
- Will the proposed transit changes affect access to employment, health care, food sources and educational and recreational facilities?
- Will changes in access to these services improve the health of Wichita residents?
- How will a change in transportation mode from car to bus affect the health of Wichita residents?

Key Findings

The HIA uncovered potential positive and negative health impacts associated with each of the proposed transit concepts (Figure 1). In addition, the HIA assessed the relative extent of these impacts on vulnerable populations. Access to services can have a greater effect on vulnerable populations because they may have less access to transportation outside of public transit. This could affect their ability to access services and goods such as healthy foods. Low-income populations are six times less likely than other Americans to own a car.[1]

Overall, the HIA found that the potential health impacts of each transit concept are determined largely by two variables: the relative access to key health-supportive services provided by each concept and the relative ability of each concept to shift people from their cars to public transit for some of their transportation needs. In order to increase access to services and maximize potential health benefits associated with this increase, the HIA developed the recommendations described in Tables 2–12. For a full list of findings and recommendations, please see Appendix D.

Figure 1. Pathway Diagram: How Transit May Affect Health



Note: The pathway diagram illustrates potential relationships between transit and health. The pathway diagram doesn't describe direction of the projected impacts (increase or decrease) or the nature of these impacts (negative or positive) due to the multiple transit concepts (A, B, C, D1 and D2) and their differential effects on health.

Source: KHI HIA Transit Project, 2013.

Health Impacts Related to Changes in Access to Services

Access to services is one factor that can influence health and quality of life. The degree to which people have access to food sources, employment, health care and recreational and educational facilities influences the quantity and quality of food choices they can make, the timeliness of screening, diagnosis and treatment of health issues, as well as the amount of physical activity they achieve.

According to the HIA, the health of people who do not have a reliable car or social network will be most affected by changes in the transit system. In general, Concept A (Grid) will increase access to all services, especially for low-income residents who live in the southeast part of Wichita. All other concepts will affect access to services differently. For example, Concept B (Optimization) will increase access to employment and educational services while decreasing access to health care facilities. Concept C (Reduction) will decrease or limit access to services across the board. This is especially true for people who do not have access to reliable transportation.

The findings were developed based on a literature review, community input and secondary data analyses. The recommendations are intended to inform relevant decision-makers as they consider Wichita Transit changes. The recommendations are drawn from the findings and are intended to maximize health benefits while minimizing risks.

Wichita, 2012.

Table 2. Key Findings and Recommendations: Access to Health Care

ACCESS TO HEALTH CARE	
OVERVIEW	**FINDINGS**
Two of the primary reasons for disparities in access to health care are lack of health insurance and cost of services. However, the availability of transportation options can improve or decrease access to health care. Findings from the literature review and stakeholder input indicate that improved access to transit will help link Wichita residents to health care services. In general, data analyses show that Concept A is more likely to increase access to health care and result in positive health impacts (e.g., reduction in vaccine-preventable disease).	• Access to reliable transit increases the likelihood of primary care and chronic care visits and decreases the number of emergency room visits. • All three concepts (A, B and C) would limit access to at least six hospitals and several health care facilities. • Concept A is most likely to increase access to health care and result in positive health impacts (e.g., reduction in vaccine-preventable disease). • Increasing access to health care depends on timeliness and frequency of transit services and increased access for vulnerable populations. Concepts A and B would increase timeliness and frequency of transit services.
	RECOMMENDATIONS
	Wichita Transit should consider: • Locating bus stops near health care offices and specialty clinics, especially those that serve children.* • Encouraging health care organizations to inform and link their patients to available transit services.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table 3. Key Findings and Recommendations: Access to Employment

ACCESS TO EMPLOYMENT	
OVERVIEW	**FINDINGS**
The research and stakeholders suggest that a lack of access to transit can be a barrier to employment for workers without a stable form of transportation. Some characteristics that make transit more attractive for workers are wide geographic coverage, timeliness and frequency. Given that only Concept A meets these characteristics, it is likely to result in increased access to employment and associated positive health impacts (e.g., increased life expectancy).	• Typically one of the most predominant uses of transit is to get to work, but Wichita may not follow this trend. • Concepts A and B increase timeliness and frequency of services, which improve access to transit, especially for shift workers, while C does not. • The hub-and-spoke system doesn't provide easy access to jobs outside downtown Wichita. However many of the jobs in Wichita are located elsewhere. • The impact on the Wichita economy resulting from additional Wichita area resident payroll earnings would be $6.1 million annually for Concept A, $3.1 million annually for Concept B and $1.2 million annually for Concept D1.
	RECOMMENDATIONS
	Wichita Transit should consider: • Exploring the reasons for low ridership in the southeast part of Wichita. • Increasing frequency of bus routes and availability of routes at night or on weekends to align the transit schedule with shift workers' needs.* • Exploring the viability of a grid system.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table 4. Key Findings and Recommendations: Access to Food Sources

ACCESS TO FOOD SOURCES	
OVERVIEW	**FINDINGS**
Food choices affect the health and well-being of individuals. Food and dietary choices are influenced by many factors (e.g., economic, social, physical). Although improved access to stores with healthy options doesn't necessarily mean that individuals will change their food choices, it provides the opportunity to make healthy dietary choices. Stakeholders noted that Wichita residents could benefit from increased access to grocery stores. The analysis shows that Concept A would increase access to food sources through wider geographical coverage and increased timeliness and frequency. Similar to access to employment, transit characteristics such as timeliness and frequency as well as direct routes are more likely to affect shoppers' choice of food sources. Additionally, the extent of positive health impacts associated with increased access to grocery stores will largely depend on residents' food choices.	• In general, people who are more likely to use bus service for grocery shopping do not have access to alternative modes of transportation. • The use of a bus for grocery shopping also depends on available places on the bus to store groceries. • The use of transit for grocery shopping is dependent on convenience (e.g., proximity, timeliness). **RECOMMENDATIONS** **The Metropolitan Area Planning Department should consider:** • Locating future grocery stores near transit routes. This can be achieved through zoning changes or other incentives. **Wichita Transit should consider:** • Using buses with a low floor area for rolling carts on the routes that have the most grocery stores. • Reviewing and changing the two-bag limit on buses to a higher number, such as six.*

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Wichita, 2012.

Table 5. Key Findings and Recommendations: Access to Education

ACCESS TO EDUCATION	
OVERVIEW	**FINDINGS**
There is a strong correlation between an individual's level of education and their health status. For example, research shows that greater educational attainment has been associated with eating healthier, getting exercise and avoiding risk factors such as drinking excessively and smoking. However, the association between access to transit and educational attainment is less clear. The literature review didn't identify the lack of public transportation among commonly cited barriers to education. On the other hand, stakeholders suggested that reliable transit services could benefit students who don't have cars or don't know how to drive, or that have working parents. Stakeholders also noted that access to transit could provide students with opportunities to participate in after-school activities. According to data analyses, Concept A is more likely to increase access to educational facilities.	• Concepts A and B provide more frequent and timely access to K-12 school programs and university classes held later in the evening, while Concept C does not. • Unlimited access transit passes purchased by local universities for all students may be beneficial for the university, students and transit agency. • Easy access to a university does not increase higher education participation, but it can affect institutional choice and student retention. **RECOMMENDATIONS** **Wichita USD 259 should consider:** • Identifying the need for transit services to access after-school activities and classes. • Collaborating with Wichita Transit to address any identified needs for education sector employees and students, including available public transportation during off-peak hours for activities and evening classes.* **Universities in Wichita should consider:** • Working with Wichita Transit to develop a universal pass for students.*

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

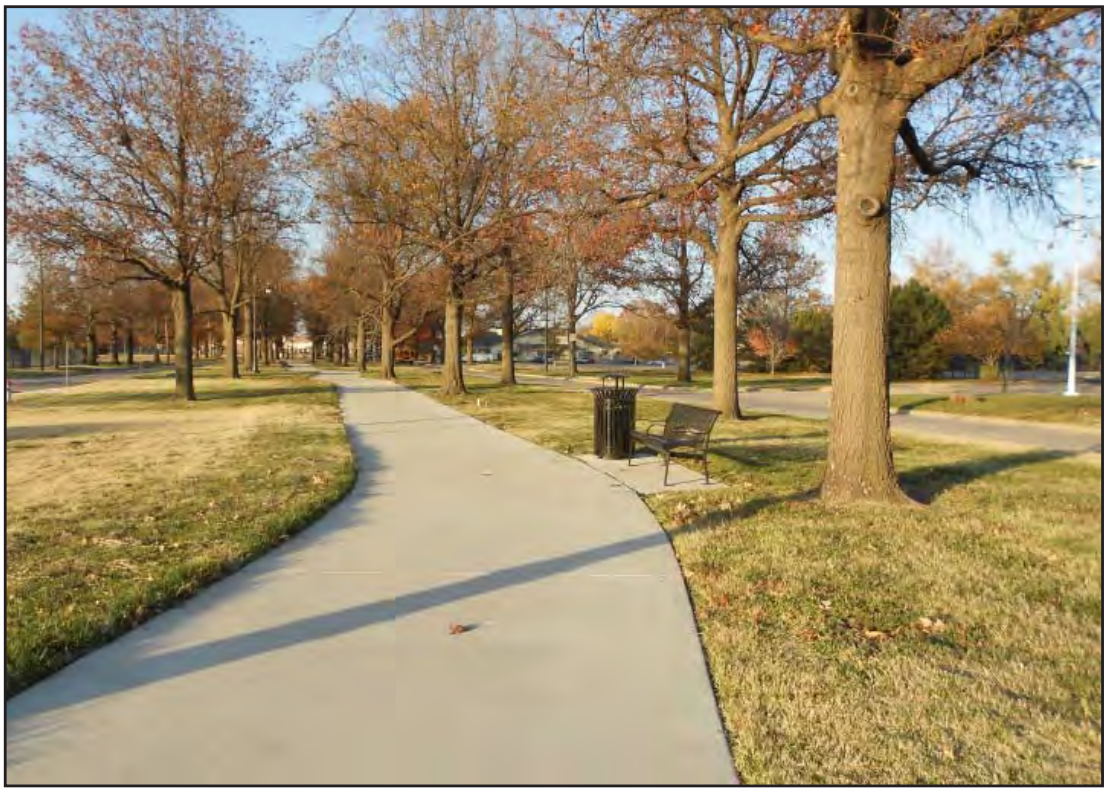
Source: KHI HIA Transit Project, 2013.

Wichita, 2012.

Table 6. Key Findings and Recommendations: Access to Recreational Resources

ACCESS TO RECREATIONAL RESOURCES	
OVERVIEW	**FINDINGS**
Convenient access to recreational resources could help Wichita residents increase their physical activity levels. Higher levels of regular physical activity are associated with lower mortality rates for both older and younger adults. However, research findings didn't provide a clear picture regarding the association between transit and utilization of recreational resources. Some findings from the literature review suggest that proximity of recreation resources to transit stops increased their utilization. Stakeholder feedback echoed research findings. Although stakeholders noted that increased access to recreational resources will be an asset for the community, they didn't list this issue among their top community priorities.	• Convenience is an important part of getting people to exercise, and it is possible that increasing access to recreational resources through public transit will increase exercise. • The Centers for Disease Control and Prevention (CDC) Community Guide recommends improving access to places for physical activity along with an informational campaign to educate residents about the enhanced service. • Concept A would be more likely to increase access to recreational resources. **RECOMMENDATIONS** **City of Wichita, Park and Recreation in collaboration with Wichita Transit should consider:** • Incorporating questions about recreational-related transit use in future assessments. • Increasing coverage of routes used to access recreational resources. **Wichita schools should consider:** • Establishing shared-use agreements so school grounds can be used as physical activity centers during non-school hours and including transit officials in that planning.

Source: KHI HIA Transit Project, 2013.



Wichita, 2012.

Health Impacts Related to Changes in Transportation Mode from Car to Bus

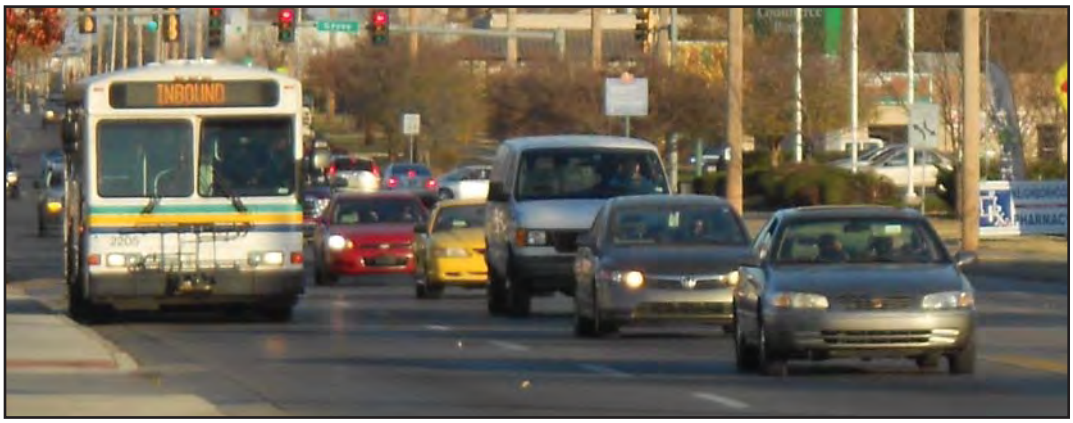
Changes in transportation mode from driving a car to riding the bus can result in a number of positive and negative health impacts. Specifically, Wichita can observe improved air quality due to an increase in transit ridership and a decline in car use. Another potential benefit associated with public transit is increased walking time. Public transportation users potentially achieve up to 30 minutes of physical activity each day. Individuals who take public transit also reduce their risk of being involved in a car accident or being a distracted driver and may experience less exposure to secondhand smoke.

Table 7. Key Findings and Recommendations: Air Quality

AIR QUALITY	
OVERVIEW	**FINDINGS**
According to the research findings, increased transit ridership has been associated with a decline in car use and potential benefits including improved air quality, lower asthma rates and decreases in other respiratory conditions. Stakeholders expressed concerns about local air quality but were divided on whether the proposed changes to the transit system would be sufficient to affect air quality. The data analyses for Wichita suggested that Concepts A and B would likely result in slight decreases of personal car use. However, Concept C would not yield the same benefit. It is important to note that improved air quality also would depend on the type of buses used in Wichita.	• In terms of overall air quality, high ozone levels are the primary concern for Wichita. • Ozone levels depend on many things, including other pollution sources, weather, and type/age of engine and fuels used. • Projected increases in transit ridership under Concepts A and B would improve overall air quality but may not decrease ozone levels. **RECOMMENDATIONS** **Wichita Transit should consider:** • Implementing various strategies, including those suggested in the HIA report (e.g., improve timeliness and frequency of buses, develop a universal pass for students), to increase ridership and thereby improve overall air quality in Wichita.*

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.



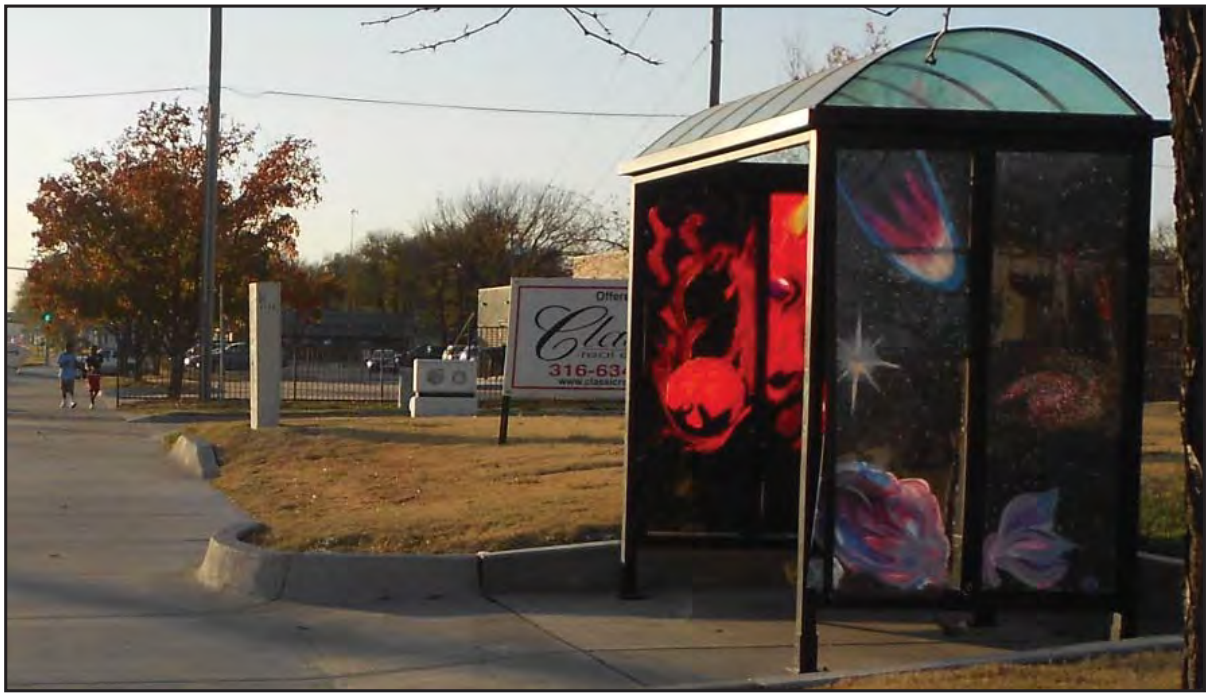
Wichita, 2012.

Table 8. Key Findings and Recommendations: Pedestrian Access and Physical Activity

PEDESTRIAN ACCESS AND PHYSICAL ACTIVITY	
OVERVIEW	**FINDINGS**
Individuals who use public transit are more likely to spend time walking and engaging in other forms of physical activity. Walking to and from transit can help a physically inactive population obtain the recommended level of physical activity, and studies have shown that people who utilize public transit increase physical activity in other parts of their life. Community stakeholders expressed interest in this issue, emphasizing the importance of integrating transit planning with city planning.	• People who receive an employer-sponsored transit pass are more likely to use transit to get to work and meet physical activity recommendations. • When public transportation is easier to access (e.g., bus stops are conveniently located), individuals are more likely to walk to access transit and meet their physical activity recommendations. • Public transportation users potentially achieve up to 30 minutes of physical activity daily. • Increases in ridership under Concept A can be expected to translate into additional community health care savings of $76,141 per year due to walking and receiving the recommended physical activity. Concept B would yield similar savings of $72,528 per year and C would *decrease* the level of current health care savings by $24,231 per year. **RECOMMENDATIONS** **Wichita employers in collaboration with Wichita Transit should consider:** • Subsidizing the cost of bus passes to encourage ridership instead of car use and improve employees' health status.* **Wichita Area Metropolitan Planning Department in collaboration with Wichita Transit should consider:** • Placing bus stops in locations that are connected to sidewalks, crosswalks, and pedestrian and bike paths when possible.* • Integrating and aligning transit plans with city zoning.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.



Wichita, 2012.

Table 9. Key Findings and Recommendations: Traffic Volume

TRAFFIC VOLUME	
OVERVIEW	**FINDINGS**
Utilization of public transit may have several positive health effects associated with decreased traffic volume, including a reduction in vehicle-related injuries. Research suggests that bus occupants have a lesser risk of injury in comparison with other modes of transport. However, the increased use of transit stops has been associated with more pedestrian-motor vehicle collisions. Effective strategies to address this issue include increasing the number of people walking and biking and improving pedestrian and bicycle infrastructure.	• Bus occupants had the least risk of injury compared to car or bike users, pedestrians or motorcycles. • Vulnerable populations, such as the elderly or children, are at a greater risk for motor vehicle-related fatal injuries. • Traffic volume and population density are the main influencers on pedestrian crashes. • A threshold effect shows that as more people walk or bike, the injury rate decreases because drivers are more aware of the cyclists and pedestrians. • Wichita would observe annual savings due to reduced traffic injuries for Concept A ($532,000) and Concept B ($513,000). However, for Concept C, the cost of traffic injuries would *increase* by $172,000. **RECOMMENDATIONS** **Wichita City Council should consider:** • Choosing the concept that will increase ridership most to reduce motor vehicle injuries. **Wichita Area Metropolitan Planning Department should consider:** • Continuing to plan and create an infrastructure conducive to walking and biking in order to meet the threshold for reducing pedestrian-related injuries.*

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table 10. Key Findings and Recommendations: Secondhand Smoke Exposure

SECONDHAND SMOKE EXPOSURE	
OVERVIEW	**FINDINGS**
Changing from driving a car to riding the bus can help reduce exposure to secondhand smoke, as smoking is not permitted on Wichita buses. Potential positive health impacts associated with reduced exposure to secondhand smoke include decreased risk of lung disease, heart disease and respiratory conditions. However, transit users might be exposed to secondhand smoke at the bus stops and experience associated health risks.	• One in five children is exposed to secondhand smoke in cars. Switching from car to bus, where smoking is not allowed, could help decrease children's exposure to secondhand smoke. However, the extent of health impacts will depend on individual's overall exposure to secondhand smoke and the extent of their use of transit versus a car. **RECOMMENDATIONS** **Wichita City Council should consider:** • Restricting smoking in bus stops. **Sedgwick County Health Department and health organizations should consider:** • Increasing efforts (e.g., publications, announcements, media) to inform car users about the potential negative health impacts of secondhand smoke exposure in cars on adults and especially children.* • Utilizing ad spaces on buses and shelters to highlight the benefits of transit as a way to reduce exposure to secondhand smoke.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table 11. Key Findings and Recommendations: Distracted Driving

DISTRACTED DRIVING	
OVERVIEW	**FINDINGS**

Distracted driving encompasses a range of behaviors, such as texting and talking on the phone, that take a driver's attention off the road. Drivers may be distracted visually (eyes off the road), manually (hands off the wheel) and/or cognitively (mind off the road). Everyone on the road is at risk of being involved in an accident involving a distracted driver. However, individuals who ride the bus avoid becoming a distracted driver, even if they text and ride. Therefore, potential negative health impacts may be avoided if a proportion of these individuals choose to ride the bus rather than drive.	• In general, distracted driving causes one in six fatal vehicle collisions.
	• The HIA team estimates that 80 percent of new transit riders will have switched from passenger vehicles to public transit.
	• As a result of switching to public transit under:
	  • Concept A, about 0.19 percent fewer individuals would encounter the risk of distracted driving each year.
	  • Concept B, about 0.18 percent fewer individuals would encounter the risk of distracted driving each year.
	  • Concept C, about 0.06 percent *more* individuals would encounter the risk of distracted driving each year.
	RECOMMENDATIONS
	Sedgwick County Health Department and health advocacy organizations should consider:
	• Increasing efforts (e.g. publications, announcements and/or media) to inform people about the health risks associated with distracted driving.
	• Utilizing ad spaces on buses and shelters to highlight transit as a way to reduce distracted driving.

Source: KHI HIA Transit Project, 2013.

Table 12. Key Findings and Recommendations: Discretionary Time

DISCRETIONARY TIME	
OVERVIEW	**FINDINGS**

Some evidence suggests that discretionary time is associated with better mental health and quality of life. People that have discretionary time might spend it on activities that improve their health. However, the extent of positive health benefits associated with discretionary time would depend upon its use.	• As a result of increased frequency of service and/or optimized routes, annual discretionary time would increase under:
	  • Concept A by 34,887 hours, saving $253,000 ($103 per rider) each year.
	  • Concept B by 141,719 hours, saving $1,027,000 ($424 per rider) each year.
	• There would be no measureable change in discretionary time under Concept C.
	• Based on these findings, Concept B would likely result in more health benefits associated with discretionary time than the other two concepts.
	RECOMMENDATIONS
	Wichita City Council should consider:
	• Choosing or giving priority to a concept that maximizes populations' discretionary time.

Source: KHI HIA Transit Project, 2013.

Table 13. Potential Impact of Transit on Access to Services and Other Factors

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
ACCESS TO SERVICES AND RESOURCES						
Access to Health Care						
A	Increase	Positive	Medium	Likely	Low-income, immigrant, elderly, disabled	***
B	Mixed	Mixed	Medium	Likely		
C	Decrease	Negative	Low	Likely		
D1	Increase	Positive	Low	Uncertain		
Access to Employment						
A	Increase	Positive	Medium	Likely	Shift workers, low socioeconomic, students (day and evening), unemployed	**
B	Mixed	Mixed	Medium	Possible	Shift workers, some low socioeconomic, students, unemployed	
C	Decrease	Negative	Medium	Possible	Low socioeconomic, students (day)	
D1, D2	Increase	Positive	Low	Possible	Residents of outlying communities, commuters	
Access to Food Sources						
A	Increase	Mixed	Medium	Uncertain	Low-income, immigrant, elderly, disabled, individuals without car	***
B	Mixed	Mixed	Medium	Uncertain		
C	Decrease	Negative	Medium	Uncertain		
Access to Education						
A	Increase	Uncertain	Low	Uncertain	K-12 students (and parents) and college students	*
B	Decrease	Uncertain	Low	Uncertain		
C	Decrease	Uncertain	Low	Uncertain	Students and parents	
D1, D2	Increase	Uncertain	Low	Uncertain	College students	
Access to Recreational Resources						
A	Increase	Uncertain	Low	Uncertain	Wichita community members	*
B	Decrease	Uncertain	Low	Uncertain		
C	Decrease	Uncertain	Low	Uncertain		

Note: Only applicable concepts are listed in the table.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

Table 13 (cont.). Potential Impact of Transit on Access to Services and Other Factors

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
CHANGES IN MODE OF TRANSPORTATION FROM CAR TO BUS						
Air Quality						
A	Decrease	Positive	Low	Unlikely	Wichita community members, people with respiratory conditions, children	***
B	Decrease	Mixed	Low	Unlikely		
C	Increase	Negative	Low	Unlikely		
Pedestrian Access						
A	Increase	Positive	Medium	Likely	Wichita community members, employees	***
B	Increase	Positive	Medium	Likely		
C	Decrease	Negative	Medium	Possible		
Traffic Volume						
A	Decrease	Positive	Low	Possible	Wichita community members, elderly, children	***
B	Decrease	Positive	Low	Possible		
C	Increase	Negative	Low	Possible		
Distracted Driving and Secondhand Smoke Exposure						
A	Mixed	Mixed	Low	Possible	Wichita community members, people with respiratory conditions, children	**
B	Mixed	Mixed	Low	Possible		
C	Increase	Negative	Low	Possible		
Discretionary Time						
A	Increase	Positive	Low	Possible	Transit riders (i.e., transit-dependent)	*
B	Increase	Positive	Medium	Possible		
C	No change	Uncertain	Low	Possible		

Note: Only applicable concepts are listed in the table.
Legend is available in Appendix A (page A-1).

Source: KHI HIA Transit Project, 2013.

Conclusion

This HIA explores the potential health impacts of each of the three Wichita Transit concepts — A, B, C — and the two extension routes, D1 (Extension) and D2 (Commuter). In order to develop findings and recommendations and project potential health impacts, the HIA used multiple data sources, including a review of relevant literature, interviews with key local and state leaders, stakeholder engagement meetings with community members and secondary data analyses.

Overall, the HIA team found that Concept A is more likely to produce a larger number of positive health effects. These are associated with increased access to food sources, employment, health care and educational and recreational resources due to broader transit coverage. In particular, the community could experience increased consumption of nutritional food associated with increased access to food sources as well as early detection and treatment of heath conditions associated with increased access to health care facilities (Table 13, pg. xxi). However, the extent to which Concept A will improve access to services and result in positive health effects will depend upon increased frequency and longer hours of operation for the transit system.

Transit's overall impact on the economy is based on the idea that a local industry such as public transit supports others in the community (i.e., workers spend locally). Estimates for the proposed concepts' impact were based on transit industry demand earnings on the Wichita Metropolitan Area. The economic analysis projected that Concept A would likely yield larger economic benefits in comparison to the other concepts. Concept A is projected to provide about $6 million of additional annual payroll earnings to the economy. In addition, Wichita's economy could also benefit from reduced traffic injuries and increased discretionary time. The decrease in traffic injuries due to increased use of public transit could lead to over $500,000 in economic savings per year for Concepts A and B. Concept C, however, yields $172,000 in economic savings due to reduced traffic injuries. When considering the value of discretionary time, Concept A potentially saves each transit rider around $100 per year, but Concept B yields even more savings valued at over $400 per year. For full results, please see Table 14 on page xxiv.

Wichita's transit system provides an essential service for individuals without a car, low-income residents, the elderly and others who depend on it for transportation. Because these people may be disproportionately affected by any changes to the current structure when compared to the general population, routes should be planned and prioritized based on their needs. Recognizing the importance of transit service for these populations, Concepts B and C will not produce similar health

benefits. For example, Concept B will not provide transit coverage to southeast Wichita, decreasing access to services for residents of this lower-income area. Concept C will provide coverage to this area but decrease frequency and hours of operation, making public transit a less reliable and viable means of transportation. In considering the overall impacts of both, Concept B will likely result in more positive health benefits than Concept C, as it would provide access to other parts of Wichita for transit-dependent residents with its increased frequency, longer hours of operation and weekend service, as shown in Table 13, page xxi.

Table 14. Economic Analyses of Selected Indicators

CONCEPT	WICHITA AREA RESIDENTS' ADDITIONAL PROJECTED PAYROLL EARNINGS	TRAFFIC INJURIES		DISCRETIONARY TIME	
		PERCENT OF INJURIES AND FATALITIES	ECONOMIC SAVINGS FROM REDUCED TRAFFIC INJURIES	CHANGES IN DISCRETIONARY TIME (HOURS)	VALUE OF DISCRETIONARY TIME INCREASE
A	$6.1 million	-0.09 traffic fatalities and -5 injuries	$532,000	34,887 hours	$253,000 ($103 per rider)
B	$3.1 million		$513,000	141,719 hours	$1,027,000 ($424 per rider)
C	Not estimated	+ 0.03 traffic fatalities and +1.6 injuries	$172,000	No measureable change	N/A

Note: Only applicable concepts are listed in the table.

Source: McCarthy Snyder, N., & Bannon, C. (2013). Economic Analysis of Health Impact Assessment of Wichita Transit. Wichita, KS: Hugo Wall School of Urban and Public Affairs.

Wichita, 2012.

OLD TOWN


ADVANCE
RUMELY

WHY DO AN HIA FOR A TRANSIT PLAN?

Addressing Health Determinants in Various Sectors

Many policy decisions can have positive and negative health implications. Policymakers might find it challenging to recognize how some of their decisions affect the health of Kansans, particularly when these decisions do not seem to have direct health consequences.

A health impact assessment (HIA) helps fill this gap by giving policymakers more information about how a decision will affect people's health. The community outreach, literature review and data collection that are part of the HIA process provide decision-makers with information on health that may not have been part of the original discussion.

This HIA focuses on the Wichita City Council's decision about contracting or expanding the public transit system and service levels in Wichita. In general, the extent to which policymakers consider the many ways in which transportation systems can affect health — including access to services, exposure to air pollution, residential character and location, safety, aesthetics, economic activity and property values — could improve or diminish the quality of life and health of Wichita residents. According to the U.S. Department of Transportation, the holistic approach to health for transportation planning should include consideration of the following issues:[2]

- Active transportation — A transportation system that encourages walking and bicycling. The health benefits of an active transportation system include physical activity, which could contribute to lower body mass index (BMI) and obesity rates.
- Safety — A transportation system that minimizes risks of injury and fatality (e.g., pedestrian crossings, speed bumps).
- Access to services — A transportation system that integrates with community design and links communities to employment, food sources and medical, recreational and educational services. Access to services could benefit health through several factors, including timely preventive care and treatment.
- Air quality — A transportation system that minimizes air pollution. Particulate matter exposure has been linked to health issues such as asthma and cancer.

An HIA can help transportation planning integrate a holistic approach to health by connecting the dots between policy decisions and their potential health implications. This report will provide the Wichita City Council and other policymakers with the data and information necessary to integrate health into their decision-making process.

OVERVIEW OF WICHITA, KANSAS

Many factors affect the health of individuals and communities. Among other factors, health is shaped by education, employment, income and the built environment. The development and implementation of community improvement strategies require an understanding of a community's socioeconomic, demographic and health status.

Socioeconomic Environment

Population: Wichita, the largest city in, and county seat of, Sedgwick County, is in south-central Kansas. According to 2012 Census estimates, Sedgwick County has 503,889 residents,[3] 76.5 percent of which live in Wichita. Additionally, more than one in six Kansans (17.5 percent) live in Sedgwick County. Compared to the rest of the state, Wichita and Sedgwick County have a larger proportion of residents who are under the age of 18 and smaller proportion who are 65 and older. Both the county and the city are more densely populated, racially diverse and have higher poverty rates and lower median household incomes than the rest of the state.[4]

Race and ethnicity: About 65 percent of Wichita residents are white, non-Hispanic, compared to the state average of 78 percent. Hispanics are the largest minority group, comprising 15.3 percent of Wichita's population. By comparison, non-Hispanic blacks, who are Wichita's second largest minority group, comprise 11.5 percent of Wichita's population.

Education: Both the 2011–2012 Wichita USD 259 graduation rate of 74.1 percent and Sedgwick County graduation rate of 82.0 percent are lower than the statewide rate (85.2 percent).[5] More than 27 percent of Wichita and Sedgwick County adults 25 and older had a bachelor's or higher degree, while the state average was 29.7 percent.[6]

Employment and income: Sixteen percent of Wichita residents live in poverty, compared to 12.6 percent statewide. Wichita residents also tend to have lower household income than their state counterparts. Based on 2007–2011 data, median household income is $45,625 in Wichita, $49,451 in Sedgwick County and $50,594 statewide.[7] The unemployment rate is 7.5 percent in Wichita, 6.9 percent in Sedgwick County and 5.7 percent statewide.

Physical Environment

The physical environment or built environment refers to man-made resources and infrastructure, such as buildings, roads and parks. The design of physical spaces can influence behaviors that contribute to conditions such as diabetes, coronary vascular disease and asthma.

Convenient access to recreational resources is an important strategy for active lifestyles. According to the *2013 County Health Rankings*, Sedgwick County has one recreational facility for every 13,000 residents compared to one such facility for 6,250 residents nationwide. Another factor that affects health is the quality and quantity of food that individuals consume. Limited access to food sources can affect food choices and contribute to poor diet and nutrition. In Sedgwick County, 9 percent of low-income residents live more than one mile from a grocery store.

Additionally, more than 54 percent of restaurants in Wichita are fast food establishments compared to 48 percent statewide and 27 percent nationwide.[8] Typically, fast food restaurants offer food that is high in trans fat, saturated fat, sodium and calories.

Health Status

According to the *2013 County Health Rankings*, Sedgwick County ranks fifth out of the six Kansas urban counties and in the bottom third among the 102 Kansas counties ranked in terms of health outcomes (morbidity and mortality).[9] The Sedgwick County rankings are somewhat better for health factors,[10] where the county ranked third or fourth out of the six urban counties for all but one factor. The rankings for specific health factors were more varied, with Sedgwick County doing relatively well (second out of six) in terms of access to care and not so well in terms of community safety (sixth out of six).[11]

According to the *2010 Community Health Priorities Report* developed by the Visioneering Wichita Health Alliance in collaboration with the Sedgwick County Health Department, the top community priorities included access to medical system, obesity, diabetes, mental health, oral health and health disparities.[12] These priorities are supported by data from the most recent (2013) *County Health Rankings* and *Kansas Health Matters*, (www.kansashealthmatters.org) a website that provides data and information about community health in Kansas.

Access to medical system. The *Priorities Report* highlights access to the medical system as a growing issue. Access to medical system is defined in terms of the patient's ability to obtain medical care. Additionally, the ease of access is determined by such factors as the availability of medical services and their acceptability to the patient, the location of health care facilities, transportation, hours of operation and cost of care.[13] According to the *Priorities Report*, Wichita has experienced growth in the number of uninsured residents, particularly due to layoffs in the aviation manufacturing industry. In 2010, more than 17 percent of Sedgwick County residents younger than 65 were uninsured compared to 16 percent statewide and 11 percent

nationwide.[14] The *Priorities Report* also emphasizes the need for more primary care providers and increased access to these providers. In 2011, there were 1,267 people per primary care physician in Sedgwick Country. The ratio of population to primary physicians is lower than the state average of 1,411 people per primary care physician but higher than the national benchmark of 1,067.[15] It is important to note that Sedgwick County statistics don't make apparent that certain areas in Sedgwick County (e.g., low-income areas) have a shortage of primary care physicians because the population-to-physician ratio doesn't account for distribution, care for the uninsured and location.

Obesity and diabetes. Another health concern the *Priorities Report* highlights is the number of Sedgwick County adults who are overweight or obese. In 2009, more than 28 percent of Sedgwick County adults were obese. Only about one in five adults consumed the recommended amount of fruits and vegetables. Additionally, less than half of Sedgwick County adults participated in the recommended level of physical activity. Obesity increases the risk of many diseases and health conditions, including heart disease, Type 2 diabetes, cancer, hypertension, stroke, liver and gallbladder disease, respiratory problems and osteoarthritis. The 2011 percentage of adults in Sedgwick County diagnosed with diabetes was 8.7 percent, which is slightly higher than the state average of 8.5 percent.[16]

Mental health. According to the *Priorities Report*, Sedgwick County interventions in the area of mental health should focus on improving mental health literacy and promoting early intervention for mental disorders. In 2009, about one in 10 (9.8 percent) adults reported their mental health was not good on 14 or more of the past 30 days.[17] About 18.6 percent of adults in Sedgwick County reported activity limitations due to physical, mental or emotional problems.[18]

Oral health. Access to dental providers and the number of children and adults with dental cavities continued to be areas of concern for Sedgwick County and Wichita. In 2011, about 17 percent of screened K-12 students had dental decay.[19] There were 1,912 people per dentist in Sedgwick County,[20] while the ratio of population to dentists in Kansas ranged from 3,180:1 to 1,096:1.[21] Sedgwick County is among Kansas counties with the lowest percentage of residents (below 30 percent) who have access to fluoridated public water supplies.[22]

Health disparities. Sedgwick County residents that experience economic and social disadvantages often face greater barriers to optimal health. They have poorer oral health status and higher rates of obesity and mortality. For instance, substantial disparities exist in the demographics of children living below poverty level. Between 2007 and 2011, more than 38 percent of non-Hispanic black children and 35 percent

of Hispanic children lived below poverty level compared to 10.7 percent of non-Hispanic white children.[23] Infant mortality rates are also higher among non-Hispanic black and Hispanic infants. Moreover, the infant mortality rate for non-Hispanic black infants (16.9 percent) was three times that of non-Hispanic white infants (5.1 percent) from 2007–2011.[24]

Recent Efforts to Improve Health

Visioneering Wichita Health Alliance

The Visioneering Wichita Health Alliance began in 2004. The Alliance membership and contributors represent multiple sectors, including local government, business, transportation, planning, academia, faith, public health and health care. Since its inception, the alliance has worked to improve the quality of life in the Wichita metropolitan area by focusing on economic development, education, quality of life, infrastructure, government and private sector leadership. As part of its efforts, the alliance created the *2010 Community Health Priorities Report*, which describes regional health priorities and implementation plans.

Wichita Transit

During the last several years, Wichita policymakers and transit-related organizations have explored opportunities to improve transit and connect people to services. As part of these efforts, the consultant group Olsson Associates has developed several concepts focused on transit improvement. The concepts differ in geographical coverage, timeliness and budget. The transit efforts could help to improve the health status of Wichita residents by addressing some of the barriers to services.

Connection Between Health and Public Transit

Based on the literature review, public transit can impact health via its effects on air quality, safety/injury, physical activity and access to health care, recreation, work, education and healthy foods. Table 15 (page 6) summarizes a number of measures and indicators for important health factors and illustrates their connections to public transit.

Specific areas where Sedgwick County is doing poorly compared to relevant benchmark/peers (such as rate of injuries/deaths per 100 vehicle accidents) are highlighted in red. Most measures/indicators are highlighted in yellow, which indicates Sedgwick County isn't doing significantly worse or better than the relevant benchmark/peers. Measures/indicators highlighted in green are those where Sedgwick County excels when compared to the benchmark/peers.

Table 15. Specific Measures/Indicators and How They Are Connected to Public Transit

MEASURES/ INDICATORS	RATING COMPARING WICHITA TO PEERS	CONNECTION(S) TO PUBLIC TRANSIT
Chronic Obstructive Pulmonary Disease (COPD) Hospital Admission Rate Per 100,000 Residents	77.97	Air Quality
Daily Ozone Air Quality	16	Air Quality
Rate of Injuries/Deaths Per 100 Vehicle Accidents[A]	44.3	Safety
Percentage of Vehicle Accidents That Involve Pedestrians	2.2%	Safety
Vehicle Accidents Per 10,000 Residents	181	Safety
Walk Scores (0–100)[B]	41	Physical Activity
Percentage of Adults Consuming Fruits and Vegetables Five or More Times Per Day	18.6%	Access to Food Sources
Percentage of Adults Participating in Recommended Level of Physical Activity	47.9%	Physical Activity
Percentage of Adults Who Are Overweight	35.8%	Physical Activity and Access to Recreation and Food Sources
Grocery Store Density (stores per 1,000 population)	0.23	Access to Food Sources
Percentage of Households Without a Vehicle	6.2%	Access to Health Care, Recreation and Food Sources
Heart Disease Hospital Admission Rate Per 100,000 Residents	389.15	Air Quality, Physical Activity and Access to Health Care, Recreation and Food Sources
Percentage of Adults with High Cholesterol	39.2%	Physical Activity and Access to Health Care, Recreation and Food Sources
Percentage of Adults with Hypertension	27.2%	Air Quality, Physical Activity and Access to Health Care, Recreation and Food Sources
Age-Adjusted Cancer Mortality Rate Per 100,000 Residents	175.3	Air Quality, Physical Activity and Access to Health Care, Recreation and Food Sources
Age-Adjusted Years of Potential Life Lost — Cancer Per 100,000 Residents	1,587.5	Air Quality, Physical Activity and Access to Health Care, Recreation and Food Sources
Percent of Adults Reporting Fair or Poor Health	12.2%	Air Quality, Safety, Physical Activity and Access to Health Care, Recreation and Food Sources
Percentage of Workers Who Drive Alone to Work	84.9%	Physical Activity
Wasted Hours — Mean Travel Time to Work	18.0 minutes	Physical Activity

A. KHI Analysis of Kansas Department of Transportation, Non-Alcohol-Related Motor Vehicle Accident Data, 2011.
B. The walk score (www.walkscore.com) calculates the walkability of an address by locating nearby stores, restaurants, schools and parks.
Dashboard Rating Legend: Red=worse than peers, Yellow=not different than peers, and Green=better than peers

Sources: Kansas Health Matters (www.kansashealthmatters.org), Walk Score (www.walkscore.com), Kansas Department of Transportation Vehicle Accident Data.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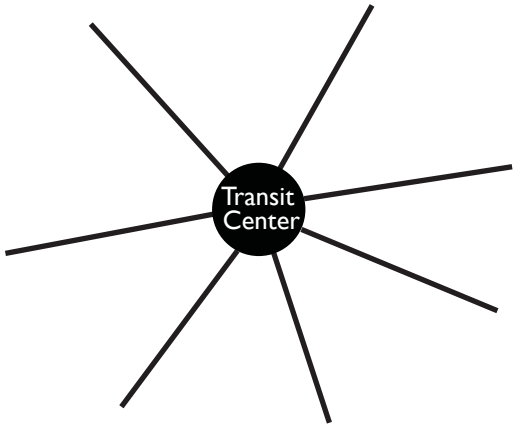
PROPOSED
TRANSIT CONCEPTS

WICHITA TRANSIT SYSTEM AND PROPOSED CONCEPTS

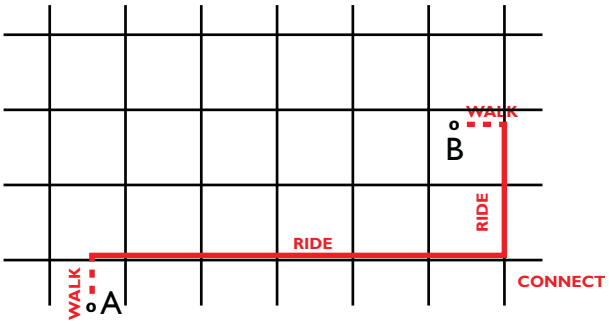
Figure 2. Hub-and-Spoke System



Wichita's current system is a hub-and-spoke, meaning the routes are designed based on the transit hub or center. This system has been in place in Wichita since 1960.

Source: Adapted from Bus Rider's Guide. City of Wausau, Wisconsin.

Figure 3. Grid System



Note: One of the proposed concepts (A) includes a grid system. In a grid system, bus routes are laid out so each major street usually only has one bus route, and bus routes almost always travel north-south or east-west with little, if any, deviation.

Source: Adapted from Walker, J. (2010). The power and pleasure of grids. Human Transit Blog.

Overview of Current Transit System

Wichita Transit

The mission of Wichita Transit is to provide the highest level of support for bus and paratransit services for Wichita area residents.[25] A Transit Advisory Board, appointed by the Wichita City Council, is responsible for making recommendations to the City Council on transit operations.

Wichita Transit currently operates on an approximately $15 million budget and employs 135 people. These positions cover administration, operations and special services, including paratransit. Sixty-four bus drivers operate 48 diesel buses to provide transit service to the city. Wichita Transit is looking into purchasing more environmentally friendly buses in the future. For more information on Wichita Transit's fleet, please see Table 28 on page 59 of this report.

Wichita Transit has a hub-and-spoke system (Figure 2) with 16 fixed bus routes. Hours are 6 a.m. to 7 p.m. weekdays, with most routes operating every 30 minutes during peak periods and hourly during non-peak periods. Buses run on Saturdays from 7 a.m. to 5:30 p.m. and there is no service on Sundays. According to city officials, additional funds are needed for improvements. These improvements include longer operating hours, higher frequencies and change from a hub-and-spoke (Figure 2) to a grid system (Figure 3) that could help travelers reach their destinations in a more efficient way.

Studies Related to Wichita Transit

Two transit-related studies were recently conducted in Wichita. The first, the *Community Outreach Study*, was requested by the City of Wichita and Wichita Transit and conducted by Olsson Associates. The study provided a picture of the transit needs of key stakeholders and the general public and shared stakeholder opinions of characteristics that the transit system should contain.[26] Based on these findings, Olsson Associates developed transit concepts that vary in their geographical coverage, timeliness, frequency and cost, as shown in Table 16. Additionally, Wichita

Table 16. Description of Wichita Transit Concepts by Scope and Cost

CONCEPT	SCOPE	SUNDAY AND EVENING SERVICE	DESCRIPTION AND HOURS OF OPERATION		TOTAL OPERATING COST
Concept A (Figure 5, Page 10)	Change from hub-and-spoke to grid system with expansion of routes and service.	Yes	6 a.m.–9 p.m. weekdays; 7 a.m.–9 p.m. Saturdays; 7 a.m.–6 p.m. Sundays.	30 minutes peak and 60 minutes off-peak frequency.	$21.1 million
Concept B (Figure 6, Page 11)	Refocusing of the current system with increased service for higher-used routes and elimination of low-ridership routes.	Yes	6 a.m.–11 p.m. weekdays; 7 a.m.–11 p.m. Saturdays; 7 a.m.–8 p.m. Sundays.	20 minutes peak and 30 minutes off-peak.	$14.9 million
Concept C (Figure 7, Page 11)	Reduction in services to decrease costs.	No	6 a.m.–7 p.m. weekdays; 7 a.m.–6 p.m. Saturdays with proposed cuts of Saturday service, two routes and a one-hour reduction.	Same as current system. It varies by route and time of day.	$10.4 million
Concept D1 (Extension) (Figure 8, Page 12)	Extensions of bus routes into outlying communities: Andover, Bel Aire, Derby, Haysville, Park City, Valley Center.	No	N/A	60 minute frequency.	$2.5 million
Concept D2 (Commuter) (Figure 9, Page 12)	Creation of express commuter service from outlying communities (e.g., Andover, Augusta, Bel Aire, Derby) directly to downtown Wichita.	No	N/A	Express service: two morning and afternoon trips.	$691,000

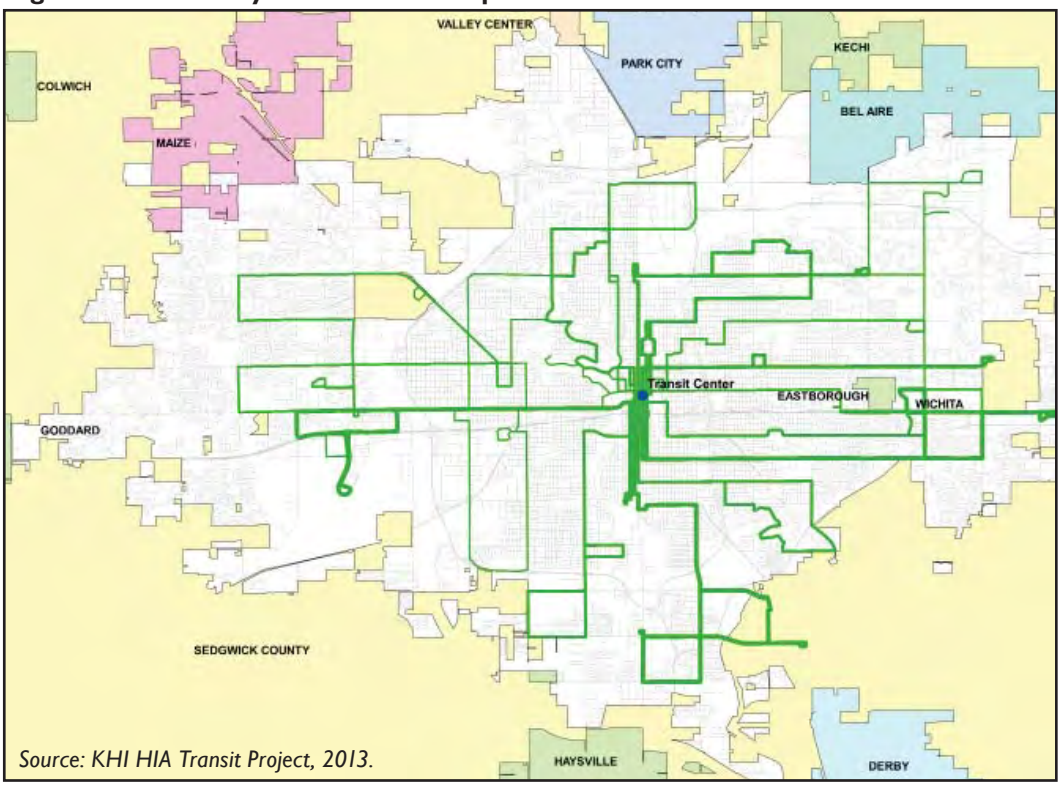
Note: The table was adapted from the *Wichita Transit Community Outreach Study* developed by Olsson Associates in 2011.
Source: KHI HIA Transit Project, 2013.

Transit System indicated that the actual costs associated with implementation of service improvements could vary from the Olsson Associates estimates based on the alternatives selected for implementation and more detailed levels of planning.

The second study, the *Wichita Public Transportation Survey*, was conducted in 2011 by the ETC Institute in collaboration with Olsson Associates. The study was based on a survey administered to 651 households in Wichita and parts of Sedgwick County. The key survey findings were grouped into several categories, including primary reasons and barriers for using transit, primary reasons to provide transit in Wichita and factors that would most encourage public transit use. The survey findings have been used to inform the development of this HIA and are cited throughout this report.

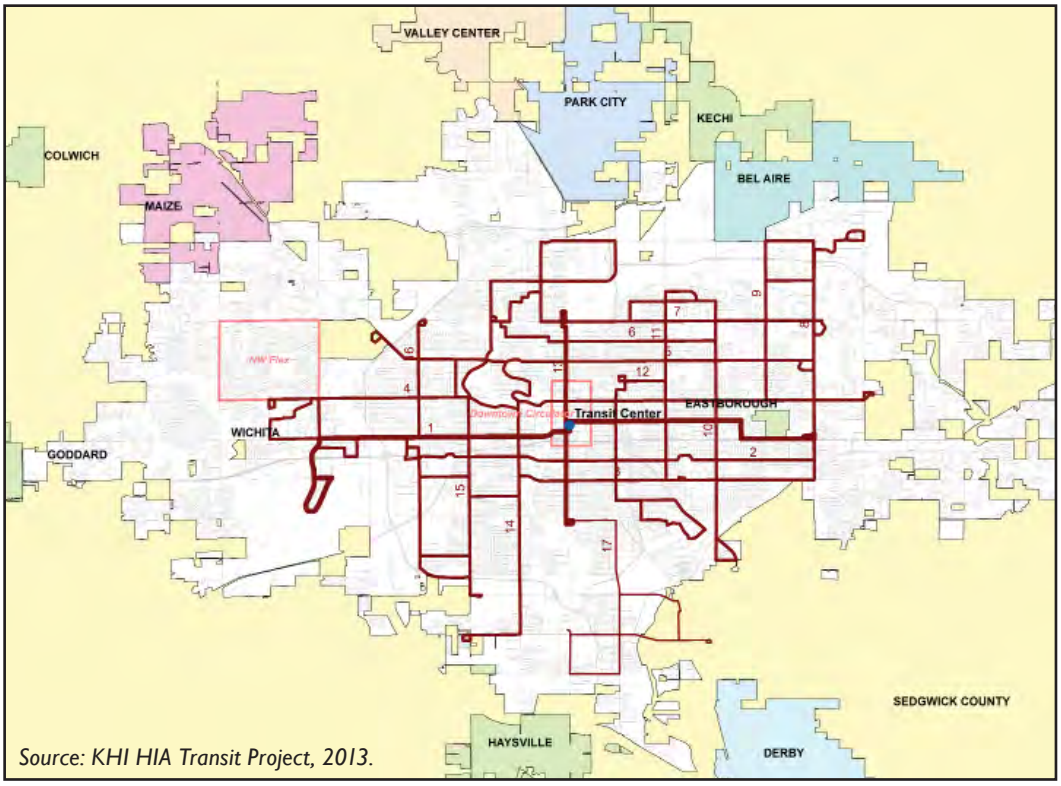
Wichita, 2012.

Figure 4. Current System: Hub-and-Spoke



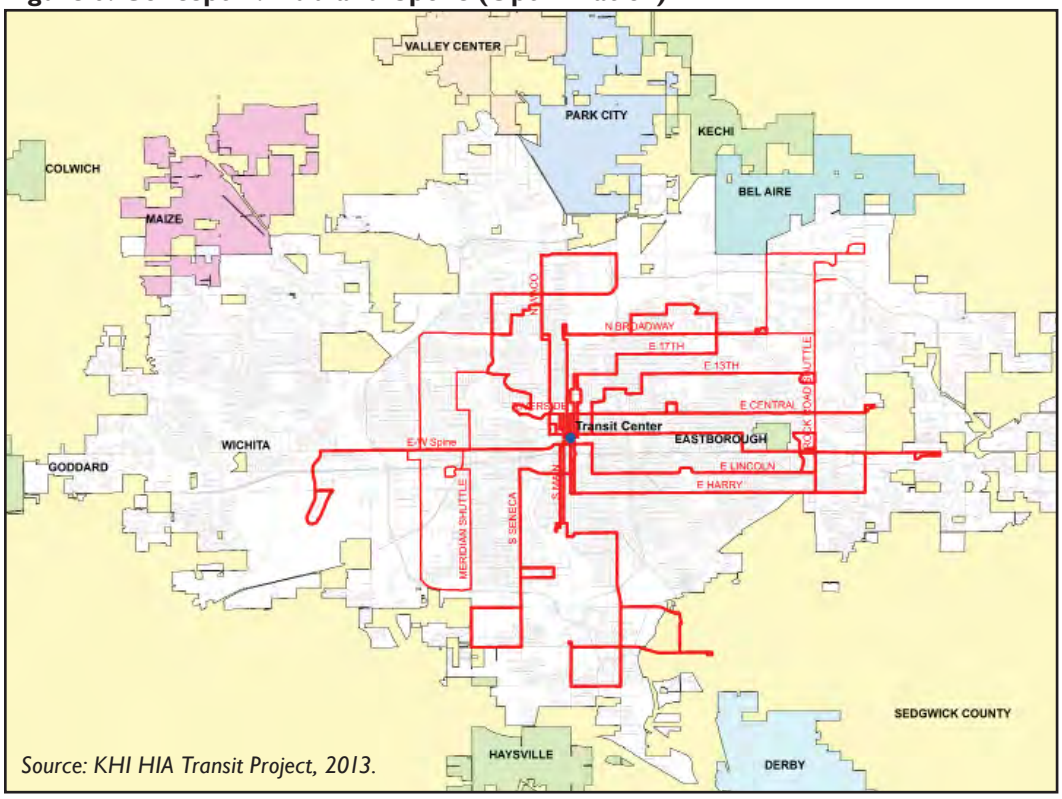
Source: KHI HIA Transit Project, 2013.

Figure 5. Concept A: Grid System



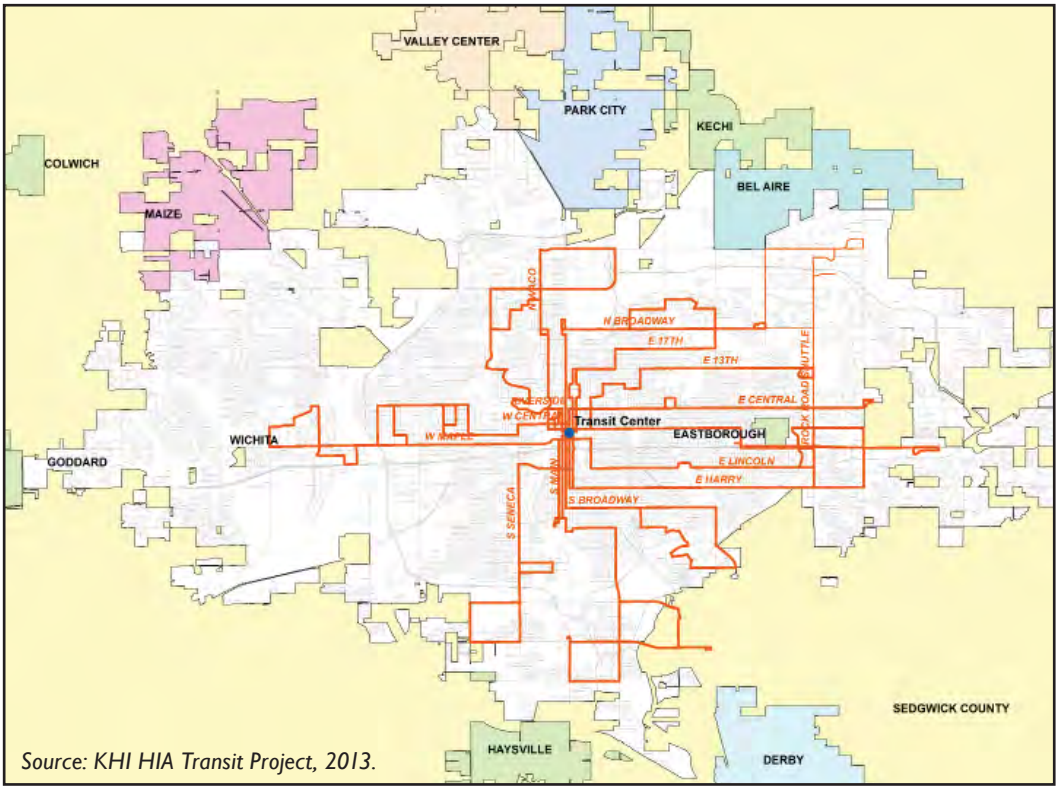
Source: KHI HIA Transit Project, 2013.

Figure 6. Concept B: Hub-and-Spoke (Optimization)



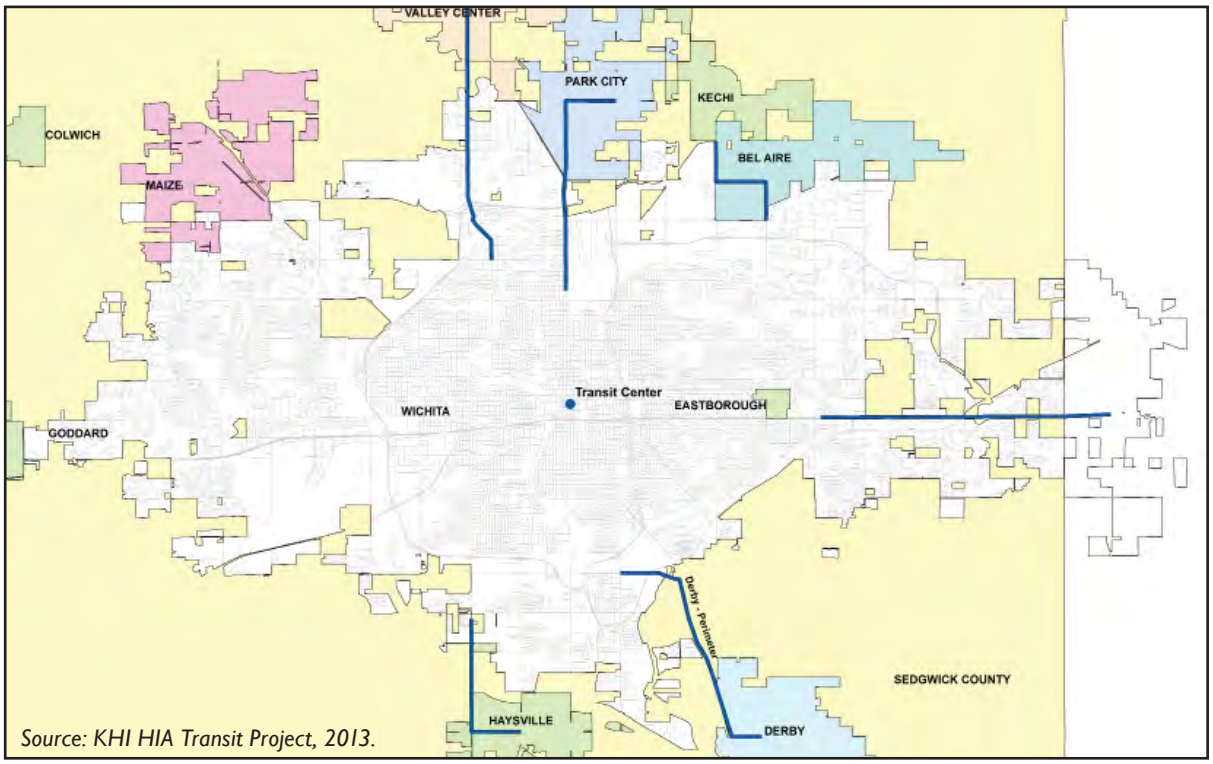
Source: KHI HIA Transit Project, 2013.

Figure 7. Concept C: Hub-and-Spoke (Reduction)



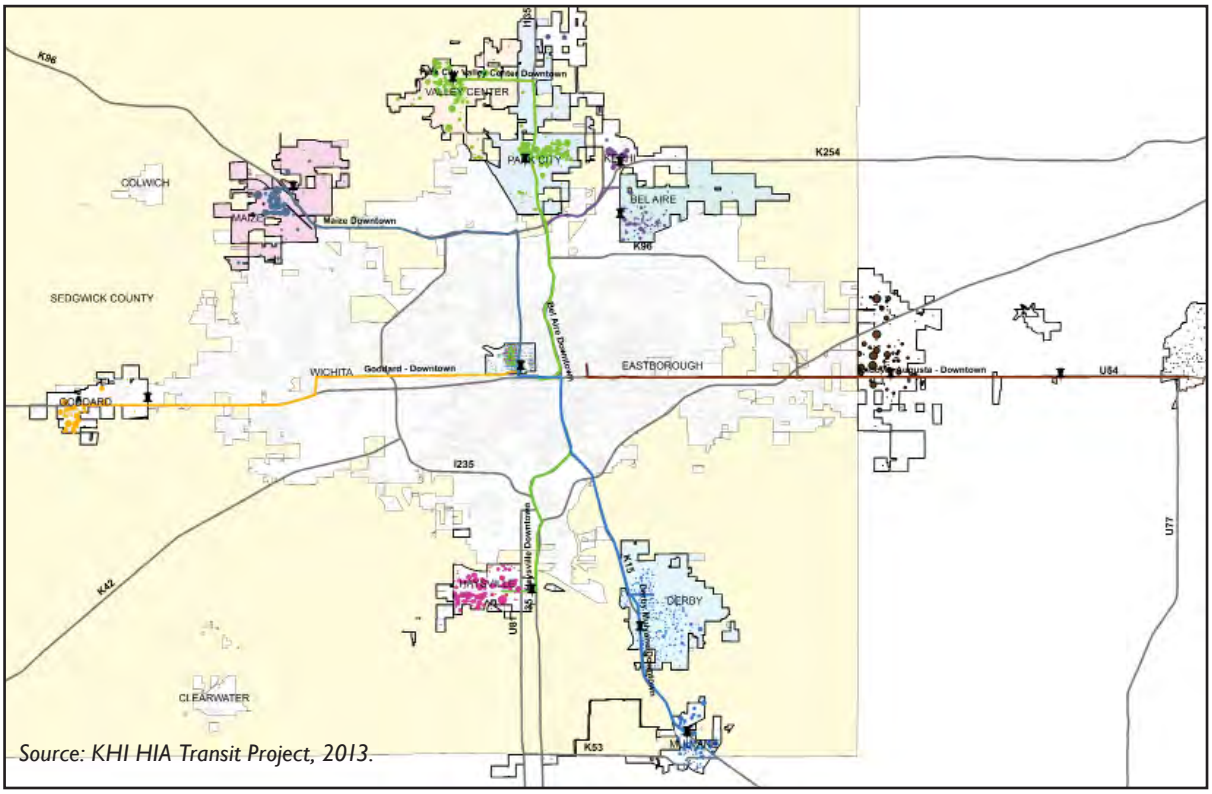
Source: KHI HIA Transit Project, 2013.

Figure 8. Concept D1 (Extension)



Source: KHI HIA Transit Project, 2013.

Figure 9. Concept D2 (Commuter)



Source: KHI HIA Transit Project, 2013.


MUSEUM OF WORLD TREAS

ANALYSIS OF HEALTH IMPACTS

Transit Expansion Pathway Diagram

The HIA team created a pathway diagram, shown in Figure 10, page 14, in order to illustrate the complex interplay among factors that transit affects and the potential health consequences. In addition, the diagram was developed to serve as a focal point for integrating information from multiple qualitative and quantitative sources, including the literature review, data and key informant interviews.

The HIA Transit pathway diagram is designed to:

- Stimulate thinking about potential health impacts of public transit outside recognized or traditional connections.
- Illustrate the various pathways through which transit affects health outcomes.
- Shift from focusing on individual impacts toward a systems-level approach that reflects complex and dynamic connections among the potential health impacts.

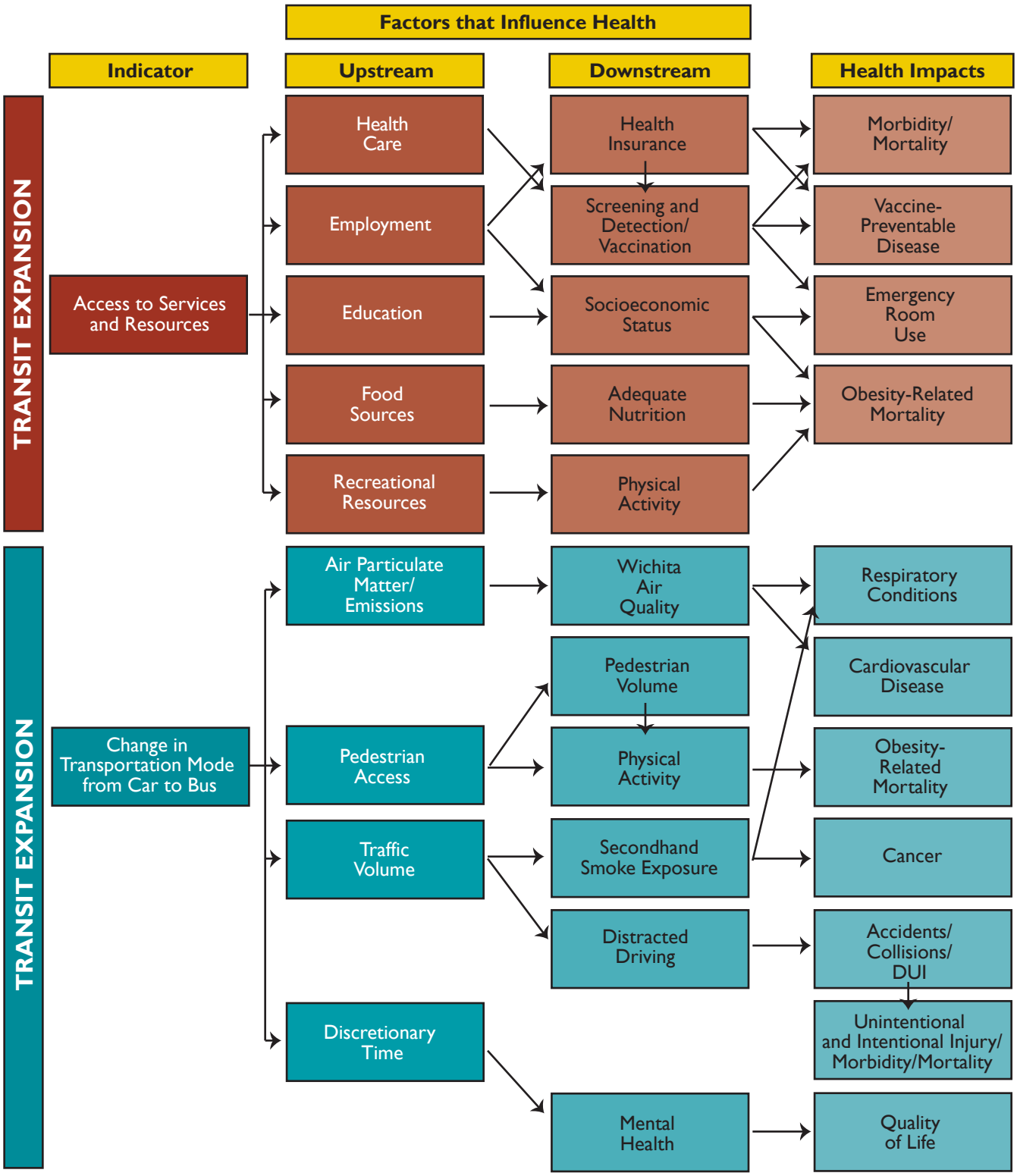
Drawing on the collective knowledge of the HIA stakeholders, a number of pathways were identified. The HIA team reviewed the findings and prioritized them based on the best available evidence and the level of stakeholder concern.

As a result, the pathway diagram was narrowed to two main proximal impacts, as shown in Figure 10:

- Access to Services and Resources
- Change in Transportation Mode from Car to Bus

Each of these proximal impacts also is connected to additional "upstream" and "downstream" impacts as well as health outcomes. Upstream and downstream refer to the sequence of events in order to reach the long-term health outcome. For example, the proximal impact "access to services and resources" is connected to the upstream impact "health care," which in turn is connected to the downstream impact "screening and detection/vaccination" and projected health outcome "morbidity and mortality." The upstream and downstream impacts shown in each of these pathways are determinants of health or factors that can influence health as well as health outcomes. The assessment section (page 21) outlines how transit may affect health through each of these pathways.

Figure 10. Pathway Diagram: How Transit May Affect Health



Note: The pathway diagram illustrates potential relationships between transit and health. The pathway diagram doesn't describe direction of the projected impacts (increase or decrease) or the nature of these impacts (negative or positive) due to the multiple transit concepts (A, B, C, D1 and D2) and their differential effects on health.

Source: KHI HIA Transit Project, 2013.

HIA METHODOLOGY

The HIA process, as defined by the National Research Council,[27] includes six main steps.

- Screening: Identify policy and determine the HIA purpose and value.
- Scoping: Identify potential health issues and research methods.
- Assessment: Analyze identified potential health impacts.
- Recommendations: Determine options to mitigate identified potential negative health impacts and maximize identified potential positive health impacts.
- Reporting: Share findings with stakeholders, including decision-makers.
- Monitoring and Evaluation: Assess results and lessons learned.

The Wichita Transit HIA included all six steps.

Step I: Screening

Screening determines whether an HIA is feasible, timely and likely to add value to the decision-making process.

In 2012, KHI, in collaboration with the KU School of Medicine – Wichita, conducted environmental scanning to identify a local policy that could benefit from an HIA. The environmental scan included a review of proposed local policies and decisions related to healthy foods and the built environment. Based on the results, the Kansas HIA team decided to conduct an HIA to inform proposed transit system changes being considered by the Wichita City Council.

The HIA aimed to broaden the discussion and provide insight on the health benefits and consequences of each of the four proposed transit concepts (A, B, C, D1 and D2) that Olsson Associates developed. Although the consultant study produced important information (e.g., identified community transportation needs and preferences), it didn't assess how the transit changes might affect health. The HIA focused on making health an important policy consideration, as each of the proposed transit concepts may have various health effects. These effects include reduced stress associated with driving in traffic, lower BMI due to walking to and from bus stops, reduced risk of cancer and respiratory problems due to decreased exposure to secondhand smoke, and improved air quality.

The potential areas of focus (health factors and impacts) have been identified in collaboration with key stakeholders such as City Council members, Wichita Transit, Wichita Transit Advisory Board and others.

Because little attention was paid to the potential health effects of the transit system changes during proposal development, this HIA will bring a new perspective, allowing for a better-informed decision-making process when the City Council makes its selection. The original decision timeline has changed from summer 2013 to summer 2014. The City Council also was interested in exploring options for funding transit. The HIA report didn't assess the potential sources of funding for any changes to transit services, as they have been discussed in the section 5.2.1 of the *Wichita Transit Community Outreach Study.*

Step 2: Scoping

Scoping determines what health impacts are going to be studied, which populations will be included in the study and the methods that will be used to conduct the HIA.

At the beginning of the scoping process, the HIA team conducted several engagement activities, including two stakeholder meetings in Wichita. The meeting participants learned about the HIA project, shared their thoughts about potential health effects of Wichita transit and identified populations that are more likely to be affected by the proposed public transit changes.

Using stakeholder input and preliminary literature review findings, the HIA team identified a variety of factors that were grouped into two proximal impacts: Access to Services and Resources and Change in Transportation Mode from Car to Bus. Each of these proximal impacts included a number of social and economic determinants of health that are likely to be affected by the proposed changes to the transit system. Several potential factors such as property values, noise, aesthetics and road quality were excluded from further assessment due to limited available evidence and low stakeholder interest.

Step 3: Assessment

This study used multiple data sources — including a review of relevant literature, interviews with local leaders and community members, stakeholder engagement meetings with community members, an advisory panel of local community members and decision-makers, and secondary data analysis — to identify and estimate potential health impacts of the proposed transit changes. Secondary data analysis was based on information from federal, state and local agencies about vehicle accidents, ridership and the geographic locations of health care, food sources, education, employment and recreation service providers. Estimates for individual concepts were based on data

reported by Olsson Associates, information from the literature and current data on Wichita and the immediate area.

The development of the transit ridership and substitution effect estimates serve as the basis for many of the health impact estimates. To estimate changes in transit ridership, the HIA team calculated an average rate of change in ridership for 10 cities of similar size and population density. For Concepts C and D1, the elasticity was reduced by 20 percent due to differences in frequency of service. After applying these elasticities to the change in annual vehicle revenue miles under each concept, the HIA team estimated how many transit rides would be a substitute for another form of transportation and how many would be new trips. In other words, the estimates include how the transit changes may affect the number of trips made with other modes of travel.

To understand the effects of transit changes on the community, particularly in terms of access to services, the HIA team created a number of maps to illustrate the current and proposed bus routes as well as indicate where people live, work, learn, play and travel to obtain health care services and buy groceries. (These maps were created using ArcMap 10.1 mapping software and are based on data provided by a range of sources such as the City of Wichita, U.S. Census Bureau and Kansas Data Access and Support Center.)

Tables throughout the report summarize the findings. The tables have a full legend in Appendix A, with notes on each concept's expected change to Wichita residents and the quality of evidence of the studies and data. Three stars (***) represent exceptional data or literature, indicating that the literature review included many quality research studies and strong available data. Meta-analysis research studies and systematic reviews received extra weight. Strong available data indicates community-level or, if possible, neighborhood-level information from a non-biased and rigorous source. Two stars (**) indicate sufficient data and literature, meaning that there were methodologically sound research studies but direct links to potential health impacts may be lacking. Expert opinion could move a two-star rating to a three-star rating, although this is rare. A one-star (*) rating indicates insufficient data or literature, reflecting a lack of quality research studies although the information is generally consistent with the principles of public health.

To respond to the decision-makers' needs, the project included economic analysis of a select set of economic indicators important to the community and related to health. An economist from the Hugo Wall School of Urban and Public Affairs at Wichita State University conducted the economic analysis. The analysis used standard economic theory and techniques and incorporated estimates produced by the HIA

team. Indicators selected for the economic analysis included changes in the number of accidents due to changes in traffic volume, changes in wait times for public transit that increase discretionary time, and differences in the cost of car travel versus bus travel. This part of the analysis assigned monetary values to these indicators and projected annual benefits. In addition, the economic analysis evaluated how the transit concepts would affect job creation in Wichita.

Step 4: Recommendations

Recommendations are a way to suggest actions that can enhance positive potential health effects and mitigate potential negative health effects related to the proposed policy or topic of interest.

The HIA recommendations were developed and reviewed in collaboration with the HIA Transit Advisory Panel. The recommendations were prioritized based on the following criteria:

1. *Feasibility*: How realistic is it to implement this recommendation?
2. *Importance*: How important is this recommendation to the community?
3. *Vulnerable population*: Does the recommendation address needs of vulnerable populations?

The final list included 40 recommendations and 16 were given priority. The HIA team aligned each recommendation with relevant finding(s) and indicated if it was a priority to the HIA Advisory Panel members.

Step 5: Reporting

Reporting includes distribution of findings to decision-makers and others involved with the HIA.

The HIA results are summarized in this formal report, which was mainly designed for policymakers, community stakeholders, advisory panel members, transit-related agencies and other relevant audiences.

The report findings and recommendations were shared with City Council members, Wichita Transit and the Wichita Transit Advisory Board.

Step 6: Monitoring/Evaluation

The HIA included both a process and an impact evaluation. The process evaluation assessed the effectiveness of the HIA according to established standards and if the

original plan to report the potential positive and negative health impacts associated with proposed changes to Wichita's Transit System was completed. The impact evaluation measured the extent to which the HIA recommendations were considered by decision-makers. In order to measure the outcomes of the decision, a Monitoring Plan shown in Table 17 (page 20) was developed to track the potential effect(s) of the final decision on health and/or the determinants of health (e.g., income level, education, etc.).

The process evaluation assessed KHI's effective execution of each step of the HIA process (e.g., screening and scoping), the engagement of community stakeholders in a meaningful way, the process of developing the HIA report and recommendations, and the resources expended. The impact evaluation assessed if the HIA achieved its objectives, informed the decision-making process, was useful to decision-makers and built capacity among partners to conduct HIAs. These indicators were assessed utilizing direct observation, personal interviews, pre- and post-HIA surveys and adherence to standard HIA practices.

Limitations

The HIA has several limitations. Because community engagement is one of the core HIA principles, the Transit HIA offered stakeholders multiple venues for discussion and feedback. While the discussions were open to a broad range of organizations and people, some sectors of the community might not have been fully represented. In order to ensure that diverse perspectives are represented, the HIA included many results from previous Wichita Transit public outreach efforts. These results are used throughout the report and complement the information obtained during the HIA process. In addition, HIAs utilize peer-reviewed and grey literature. The literature review focused on providing a broad overview of how transit can affect health, and many perspectives were integrated into the report. To minimize the possibility of missing a seminal article or existing gold-standard research, the HIA team reviewed bibliographies from other transit HIA reports.

Finally, this report analyzed local data and mapped some of the findings. The HIA work was informed by data provided by the Wichita Transit staff and many other sources. It is possible a map didn't include a particular location or entity despite efforts to be as comprehensive and inclusive as possible. Advisory Panel members reviewed the maps and identified some additional health care facilities to include. One request that came up during the process was to study a similar Midwestern city and see how changes to transit affected their community. Unfortunately, no city with fairly recent extensive changes to its bus system, particularly a similarly sized Midwestern city, was found.

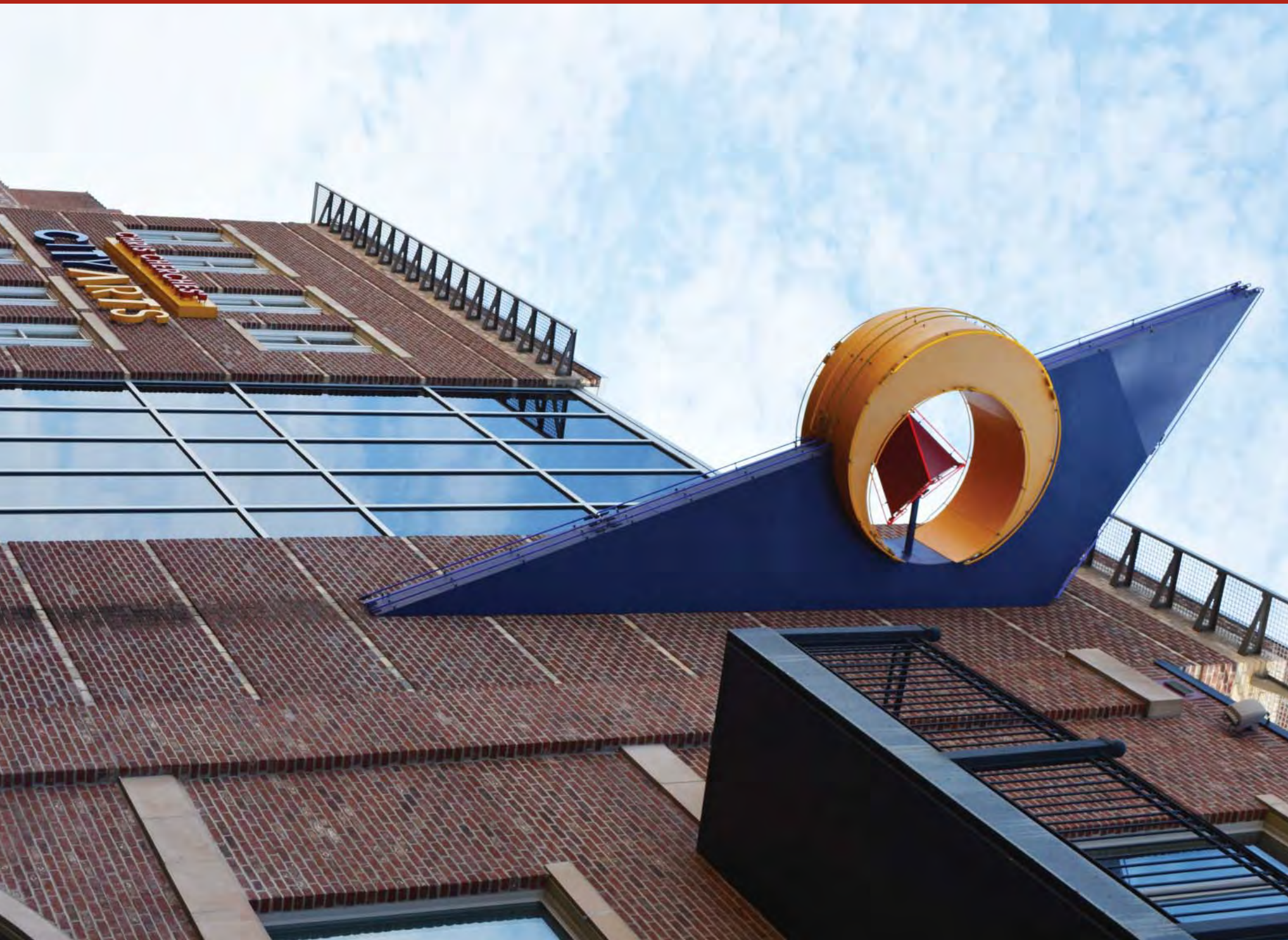
Table 17. Monitoring Plan for Wichita Transit Health Impact Assessment

INDICATOR	MONITORING AGENCY	DATA SOURCE	TIMING
ACCESS TO SERVICES AND RESOURCES			
Transit Ridership	Wichita Transit	Fixed Route Ridership Data	Annual
Percentage of Adults Participating in Recommended Level of Physical Activity	Kansas Health Institute or Sedgwick County LHD	Kansas Health Matters and Behavioral Risk Factor Surveillance System	Biannual
Percentage of Adults Consuming Fruits and Vegetables Five or More Times Per Day	Kansas Health Institute or Sedgwick County LHD	Kansas Health Matters and Behavioral Risk Factor Surveillance System	Biannual
Percentage of Adults Who Are Overweight	Kansas Health Institute or Sedgwick County LHD	Kansas Health Matters and Behavioral Risk Factor Surveillance System	Biannual
Percentage of Adults Who Are Obese	Kansas Health Institute or Sedgwick County LHD	Kansas Health Matters and Behavioral Risk Factor Surveillance System	Biannual
Percent of Diabetic Medicare Enrollees That Receive HbA1c Screening	Kansas Health Institute	County Health Rankings and Dartmouth Atlas Project Medicare Claims Data	Annual
Mammography Screening Rate	Kansas Health Institute or Sedgwick County LHD	County Health Rankings and Dartmouth Atlas Project Medicare Claims Data	Annual
Unemployment Rate	Kansas Health Institute	Bureau of Labor Statistics	Annual
People 25 and Older With a High School Degree or Higher	Kansas Health Institute	U.S. Census Bureau, American Community Survey	Annual
Traffic Congestion Data	Kansas Health Institute	Texas Transportation Institute	Annual
Wichita Air Quality – Ozone	Kansas Health Institute	Wichita's National Ambient Air Quality Data – Kansas Department of Health and Environment	Annual
CHANGES IN TRANSPORTATION MODE FROM CAR TO BUS			
Vehicle Accidents Per 10,000 Residents	Kansas Health Institute	Kansas Department of Transportation Vehicle Accident Data	Annual
Workers Commuting by Public Transportation	Kansas Health Institute	U.S. Census Bureau, American Community Survey	Annual
Workers Who Drive Alone to Work	Kansas Health Institute	U.S. Census Bureau, American Community Survey	Annual
ECONOMIC			
Public Transportation Sector Total Employment	Kansas Health Institute	Bureau of Labor Statistics (BLS)	Annual
Wichita Transit System Operating Revenue	Wichita Transit	Wichita Transit	Annual
Wichita Transit System Operating Costs	Wichita Transit	Wichita Transit	Annual

Note: The timing of monitoring depends on the timing of the transit concept adoption. If one of the transit concepts is adopted in 2014, the monitoring plan could be implemented starting in 2015.

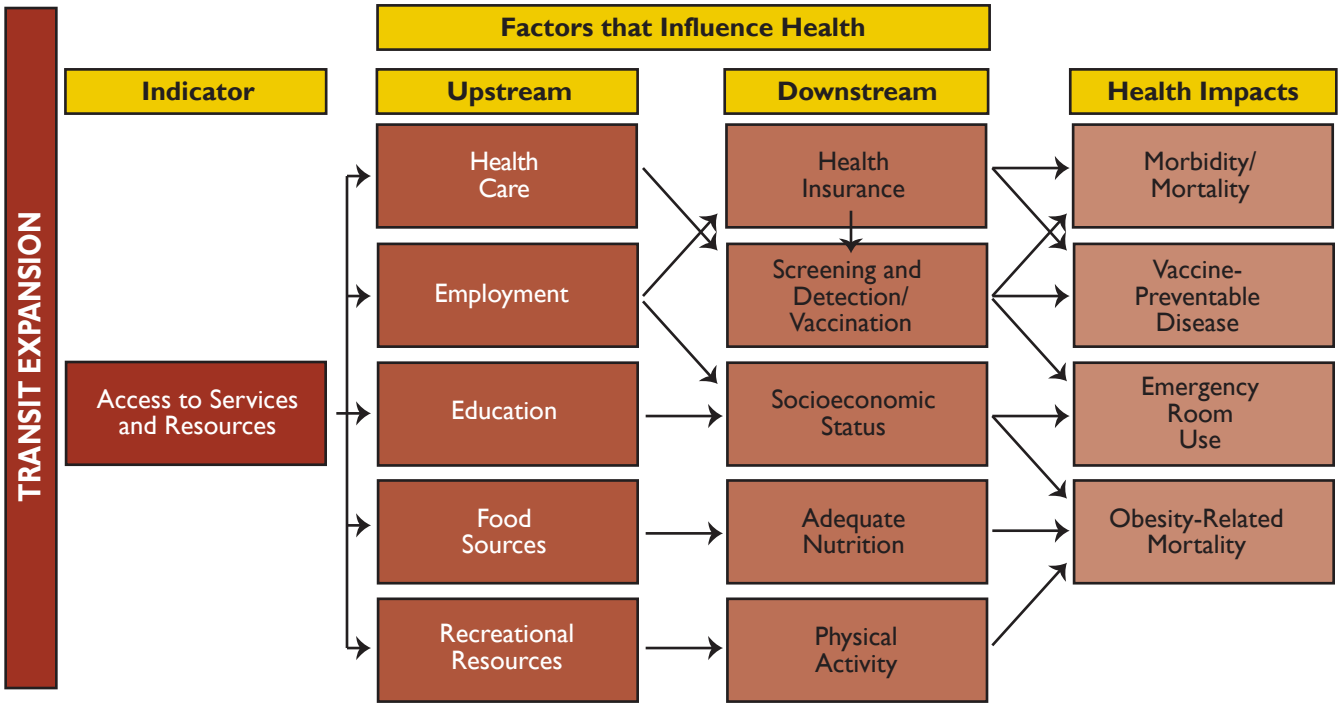
Source: KHI HIA Transit Project, 2013.


$ 1.00
each


CITY ARTS

ACCESS TO SERVICES AND RESOURCES

Figure 11. Pathway Diagram: How Transit May Affect Health



Source: KHI HIA Transit Project, 2013.

Overall Health Impacts

One direct pathway to health is a person's ability to access health services. A person without access to transportation may go without life-saving health care because they cannot get to a health care provider.[28] Public transit can be a way for employees to get to work, especially for low-income or transit-dependent populations. Having a manageable, affordable way to get to work helps workers stay employed and may reduce unemployment assistance at the state level.[29] If a neighborhood does not have a nearby grocery store and public transportation routes do not access a grocery store with healthy food options, it can be difficult for residents — especially those without an alternative form of transportation — to get healthy foods.[30]

Access to services especially affects vulnerable populations because they may have less access to transportation outside public transit, which could affect their ability to access services or goods such as healthy foods.[31] Low-income populations are six times less likely than other Americans to own a car.[32] Rural residents who have access to public transportation are associated with an average of four more chronic care visits a year as compared to those without public transportation.[33] A survey of low-income, largely immigrant participants found that nearly a quarter had problems with transportation that resulted in a missed or rescheduled clinic appointment.[34]

However, not all research shows that transit improves access to services for vulnerable populations. A study of Temporary Assistance for Needy Families (TANF) recipients in major metropolitan areas found that fixed-route transit had no effect on employment outcomes.[35] A study in Alameda County, Calif., found that public transit was not significantly tied to employment.[36] The most beneficial transit routes were located near concentrated housing areas.[37]

Public transit may help bridge transportation gaps, although that may be limited by mobility, cost and location of the transit hubs.[38] Public transit programs often address the first two of these limitations: mobility and cost. Wichita Public Transit offers a half-fare program for the elderly, Medicare recipients and people with a physical or mental disability.[39] This program decreases the cost of a bus pass by half in order to help decrease transportation costs for vulnerable populations.[40] Wichita Transit also complies with the Americans with Disabilities Act which mandates that public transportation be accessible to those with disabilities. Wichita also runs a paratransit route for people with disabilities who are not able to use the fixed-route bus service.[41] These programs should make public transit more accessible, but if the transit routes are not connecting to the services that people need, limitations will remain on the ability of the bus routes to provide equity.

As stated in the *Portland Oregon Transit HIA*, "The ability of transit to improve people's access to resources is based on the routes/locations that are served, and on the level of service that the transit route and system offer."[42] A survey of Wichita residents found they were most likely to use the transit system to go to work, followed by running errands and shopping, going to medical and dental appointments, and accessing downtown Q-line service, a free trolley shuttle service operating during peak evening hours.[43] The main barrier for not using transit was that the service was not available near their home, which reflects research discussed earlier.

What We Learned From Data

Accessing services such as employment, groceries and hospitals through public transit depends upon the system's geographic coverage, proximity to residential areas and the timeliness and frequency of the services. The transit concepts differ in levels of access to services based on analysis of bus routes and their proximity to various services. Table 18 shows a comparison of access issues by concept.

Concept A (Grid) provides the most access to services while being timely and serving vulnerable populations. Although Concept B (Optimization) has more geographic coverage, hours of operation and frequency than Concept C (Reduction), it does not serve the Plainview area of Wichita (the area south of East Harry Street and east of

South Main Street), which has a high concentration of low-income households that might depend on public transportation. Out of the approximately 18,600 residents in this area, about 4,800 live in low-income households.[44] Without service to this area, transit-dependent residents would not have convenient access to health care, grocery stores, employment and other services that could affect health. Figure 12 provides a snapshot of proposed services to Plainview.

Table 18. Effects on Access to Services, Timeliness and Frequency, Access for Vulnerable Populations and Change in Ridership By Transit System Concept

TRANSIT SYSTEM	ACCESS TO SERVICES	TIMELINESS AND FREQUENCY	ACCESS FOR VULNERABLE POPULATIONS	ESTIMATED ANNUAL CHANGE IN RIDERSHIP
Concept A (Grid)	🚌🚌🚌	🕐🕐	🧍🧍	Increase of 1,040,000
Concept B (Optimization)	🚌🚌	🕐🕐	🧍	Increase of 991,000
Concept C (Reduction)	🚌	🕐	🧍🧍	Decrease of 331,000
Concept D1 (Extension)*	🚌	🕐	🧍	Increase of 425,000
Concept D2 (Commuter)*	🚌	🕐	🧍	Increase of 39,000 to 185,000

Note: The greater the number of symbols, the better access, timeliness/frequency and service to vulnerable populations. The assessments were developed by the Kansas Health Institute based on a review of the *Wichita Transit Community Outreach Study* prepared by Olsson Associates, March 27, 2012. The estimated change in ridership represents the change in the number of transit trips.
*Concepts D1 and D2 assessments of access issues can be added to any of the other concepts.

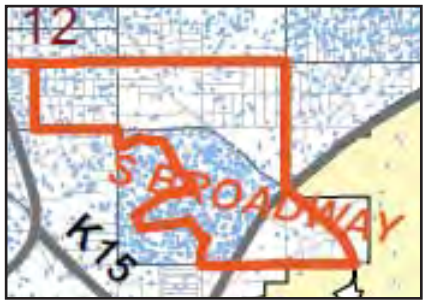
Source: KHI HIA Transit Project, 2013.

Figure 12. Proposed Services to Plainview by Concept

Concept A: (Grid)
Some Access to Services

Concept B: Optimization
No Access to Services

Concept C: Reduction
Broad Access to Services



Notes: The blue dots represent the number of individuals living in low-income households. Estimates are based on Census tract data from the 2007–2011 American Community Survey.

Source: KHI analysis of transit routes. KHI HIA Transit Project, 2013.

Health Implications for Wichita

Table 19. Overview of Transit Concept Potential Impact on Access to Services

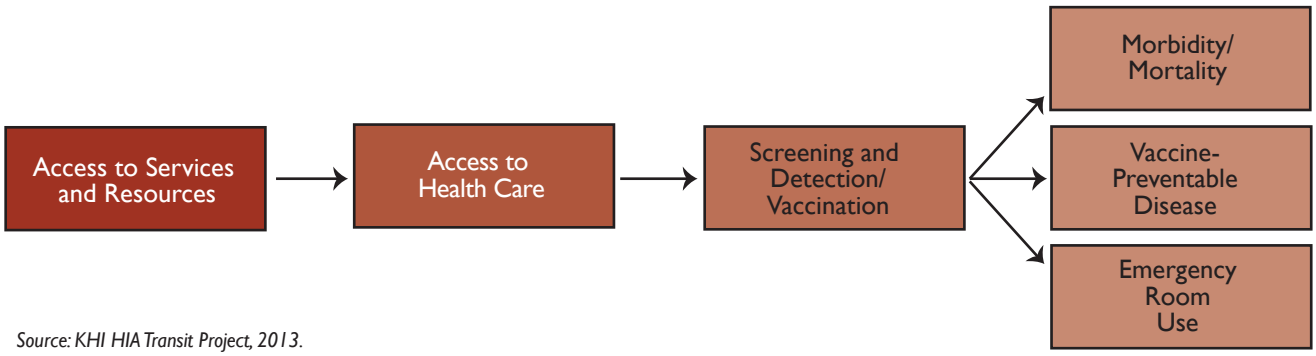
Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
ACCESS TO SERVICES AND RESOURCES						
A (Grid)	Increase	Positive	Medium	Likely	Vulnerable Populations	Health Care*** Employment** Food*** Education* Recreation*
B (Optimization)	Mixed	Mixed	Low	Likely	Users of Current System	
C (Reduction)	Decrease	Negative	Medium	Likely	Vulnerable Population	
D1 (Extension)	Increase	Positive	Low	Uncertain	Residents of Surrounding Cities	
D2 (Commuter)	Increase	Positive	Low	Uncertain	Commuters	

Concept A: Increases access to health care, employment, food sources, educational and recreational resources.
Concept B: Mixed access to health care, employment and food sources; decreases access to educational and recreational resources.
Concept C: Decreases access to health care, employment, food sources, educational and recreational resources.
Concept D1 (Extension): Increases access to employment and health care.
Concept D2 (Commuter): Increases access to employment.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

Wichita, 2012.

Access to Health Care

Figure 13. Pathway Diagram: How Transit May Affect Access to Health Care



Source: KHI HIA Transit Project, 2013.

Key Findings

- Access to reliable transit increases the likelihood of primary care and chronic care visits as well as decreases the number of emergency room visits.
- Concept A (Grid) is more likely to increase access to health care and result in positive health outcomes (e.g., early screening and detection of diseases) as it provides transit services to southeast Wichita (Plainview), an area with large low-income populations, and increases the timeliness and frequency of services.
- Increasing access to health care depends on timeliness and frequency of transit services and increased access for vulnerable populations. Concepts A (Grid) and B (Optimization) would increase timeliness and frequency of transit services.
- Concepts A (Grid), B (Optimization) and C (Reduction) would limit access to at least six hospitals and several health care facilities.

Recommendations

The Wichita City Council should consider:

- Choosing a concept that connects Wichita community members to services. If a concept does not connect populations to all services, consider giving priority to the concept that maximizes access to employment, health care and food sources.

Wichita Transit should consider:

- Locating bus stops near health care offices and specialty clinics, especially those that serve children.*
- Encouraging health care organizations to inform and link their patients to available transit.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

"Medical services are moving to the edge of the city, and that is the hardest to catch. Specialized care is particularly difficult to provide access to via transit."

— *Community Stakeholder*

Overall Health Impacts

An increase in transit services through expanded routes or night and weekend hours would result in an increased ability to get to health care services (e.g., doctors' appointments, tests, hospitals, pharmacies) and reduced use of emergency rooms for care. Increased access to health care services could increase prevention (e.g., vaccinations), screening and detection of illnesses (e.g., cancer), which could reduce morbidity and mortality. Reduced services could result in decreased access to health care services, which could have a negative effect on illness screening and detection as well as morbidity and mortality.

What We Learned from the Community

Stakeholders cited the need for increased access to health care facilities. They indicated that transit could play an important role in connecting residents to health care services. Over 80 percent of respondents to the survey conducted by the University of Kansas School of Medicine – Wichita (KUSM-W) as part of the HIA project indicated that access to health care was "extremely important" or "very important."

In addition, stakeholders said that children, the elderly and people without cars could greatly benefit from increased access to doctors' appointments and other clinical services. Several stakeholders expressed their concerns that the transit concepts would limit access to hospitals. In addition, they mentioned that the newest hospital in the city (Via Christi Hospital on St. Teresa) is not within city limits, so it is difficult to provide transit services to that location. Overall, there was a consensus that the level of connection to health care services should be factored into the concept choice.

These findings echo the *Wichita Public Transportation Survey,* where 25 percent of respondents said that if they were to use public transit in the future, they would likely use it to access medical and dental appointments.

What We Learned from the Literature

"Greater access to health care has been related to better health status, more frequent use of preventative services, and lower hospitalization rates."[45] An important part of access is transportation. Vulnerable populations — such as the elderly, disabled, low-income and others — are the most likely to use the transit system due to their lack of reliable transportation.[46] Low-income and immigrant populations cite transportation problems as the reason for a fourth of their missed or rescheduled clinic appointments.[47] A study of urban poor found that although it was not the most cited reason, transit was one of the barriers to health care; respondents without telephones were more likely to report transportation as an issue.[48] Access to transportation helps increase primary care visits for the general population[49] and children.[50] Transportation access also is linked to increased chronic care visits.[51]

What We Learned From Data

Access to health care is a complex concept. While having health insurance is a crucial step to accessing needed primary care, health care specialists and emergency treatment, health insurance by itself does not ensure access.[52] Access also depends on affordability, physical accessibility and acceptability of services.[53] The HIA assessment primarily focused on the physical accessibility component of access, because it is more likely to be affected by changes to Wichita transit services. A lack of transportation can contribute to barriers to receiving care, such as missed appointments and screenings. This is especially difficult for individuals with low socioeconomic status trying to access care.

In order to assess how transit concepts will affect the physical accessibility of health care services, maps were used to illustrate whether the proposed routes would link to several types of health care facilities, including general hospitals,[54] specialized facilities, community clinics,[55] outpatient facilities[56] and primary care clinics that serve children.[57] Health care facilities were chosen based on the availability of data, range of offered services and type of population served. Although the analysis didn't include all health care facilities in the Wichita area, the data obtained were sufficient to assess how each of the proposed transit concepts would affect access to these facilities and also identify potential gaps in coverage.

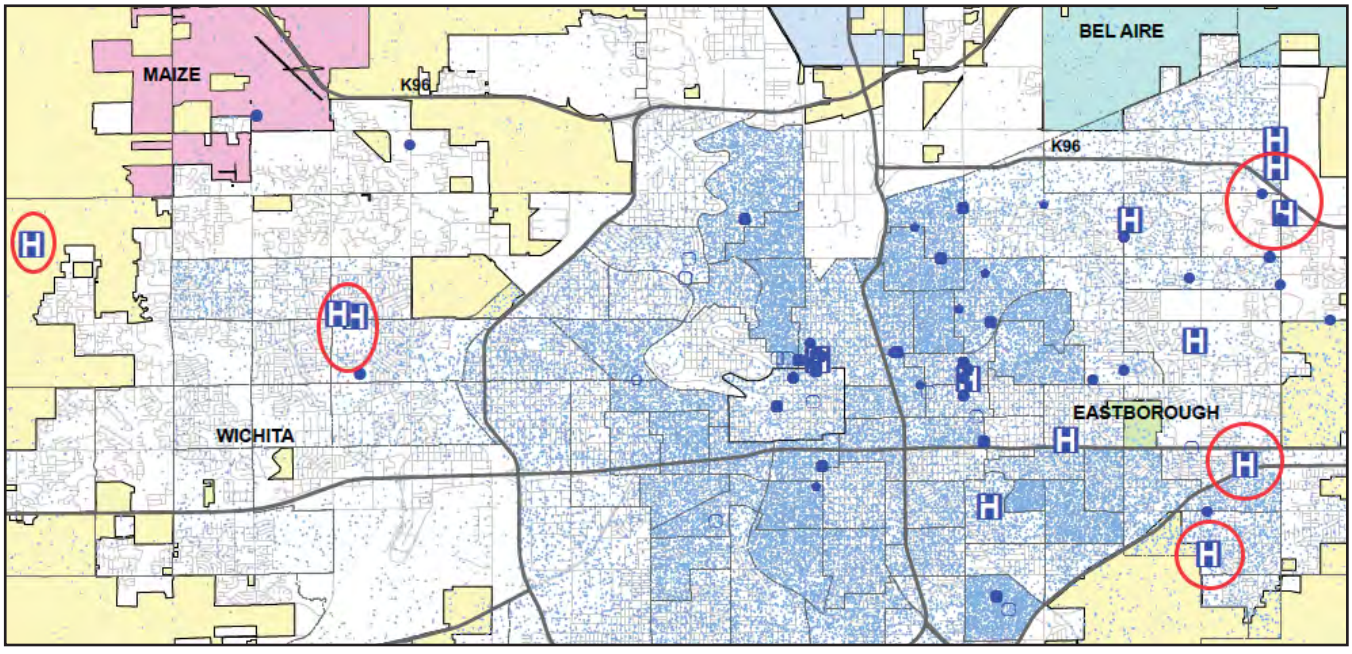
The analysis suggests that the proposed concepts generally cover residents and providers in Wichita. However, Concepts B and C do not have routes in the northwest part of the city, making it difficult for those residents to access facilities throughout Wichita. Concept B also eliminates access to transit for Plainview

residents in southeast Wichita, an area with a high concentration of low-income households. Currently, residents living in outlying cities have no public transportation to access health care facilities in Wichita. This could limit their ability to get care as fewer providers, especially hospitals, are in surrounding communities. Concept D1's proposed extension routes could provide greater access for transit-dependent populations within these communities.

When considering the proximity of transit lines to hospitals and other health care services, the proposed concepts do not differ greatly. The analysis also showed that health care facilities are in close geographical proximity. Overall, the proposed concepts will limit or prevent access to some primary care facilities in west, northeast and southeast Wichita. Access to primary care facilities is especially important because they usually serve as an entry point into the health care system.

In terms of access by type of health care facility, Concept A limits access to seven hospitals, while Concepts B and C limit access to six (Figure 14). Hospitals to the northwest of the city are the least accessible among the proposed concepts, both for residents living in that area and for those needing to obtain services from those

Figure 14. Transit Concepts' Coverage of Health Care Facilities in Wichita



Notes: Red circles are hospitals with either limited or no access via transit across all proposed concepts;
Blue dots are health care facilities (community clinics, outpatient facilities and specialized facilities);
H symbols are hospitals;
Concentrated blue dots represent people living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, 2013.

facilities. Considering that all concepts limit access to a similar number of hospitals, the concept choice should focus on extended frequency, hours of operation and availability of transit to vulnerable populations. Table 20 shows the location of hospitals not accessible through public transit across all proposed concepts.

Health Implications for Wichita

Two of the primary reasons for disparity in access to health care are lack of health insurance and cost of services. However, the availability of transportation options can improve or decrease access to health care. Findings from the literature review and stakeholder input indicate that improved access to transit will help link Wichita residents to health care services. Stakeholders also noted that access to transit is specifically important for many who rely on public transportation to access health care, including low-income individuals, elderly, immigrant populations and individuals who cannot drive or cannot afford a car. Stakeholders expressed concern that the current transportation system does not support these needs.

Table 20. Hospitals Not Accessible By Transit Concept

CONCEPT	HOSPITALS	LOCATION
A (Grid)	Via Christi Hospital on St. Teresa*	NW (outside city limits)
	Wesley Rehabilitation Hospital	NW
	Wesley West E.R. and Diagnostic Center*	NW
	Kansas Spine Hospital	NE
	Kansas Surgery and Recovery Center	NE
	Via Christi Behavioral Health Center - Good Shepherd Campus	SE
	AMG Specialty Hospital – Wichita	SE
B (Optimization)	Via Christi Hospital on St. Teresa*	NW (outside city limits)
	Wesley Rehabilitation Hospital	NW
	Wesley West E.R. and Diagnostic Center*	NW
	Kansas Spine Hospital	NE
	Kansas Surgery and Recovery Center	NE
	AMG Specialty Hospital – Wichita	SE
C (Reduction)	Via Christi Hospital on St. Teresa*	NW (outside city limits)
	Wesley Rehabilitation Hospital	NW
	Wesley West E.R. and Diagnostic Center*	NW
	Kansas Spine Hospital	NE
	Kansas Surgery and Recovery Center	NE
	AMG Specialty Hospital – Wichita	SE

*General hospital.

Note: General hospital means a hospital that provides general acute care services, including emergency services. Specialty hospital means a subclass of hospital that is primarily or exclusively engaged in the care and treatment of one of the following categories: (i) patients with a cardiac condition, (ii) patients with an orthopedic condition (iii) patients receiving a surgical procedure or (iv) any other specialized category of services that the U.S. Department of Health and Human Services designates as a specialty hospital.

Source: KHI Analysis using GIS mapping tools, 2013.

In general, data analyses show that each of the proposed concepts would increase access to health care for some populations while decreasing access for others. According to these findings, Concept A is more likely to increase access to health care and result in positive health outcomes (e.g., early screening and detection of diseases) because it provides transit services to southeast Wichita, an area with large low-income populations, and increases timeliness and frequency of services. Concepts B and C would likely produce fewer health benefits (Table 21) because Concept B doesn't extend transit services to southeast Wichita and Concept C reduces timeliness and frequency.

Table 21. Impact of Transit on Access to Health Care and Potential Health Effects

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
ACCESS TO SERVICES AND RESOURCES						
Access to Health Care						
A (Grid)	Increase	Positive	Medium	Likely	Low-income, immigrant, elderly, disabled	***
B (Optimization)	Mixed	Mixed	Medium	Likely		
C (Reduction)	Decrease	Negative	Low	Likely		
D1 (Extension)	Increase	Positive	Low	Uncertain		

Concept A: Includes southeast corner, prevents access to seven hospitals and increases timeliness and frequency.
Concept B: Doesn't include southeast corner, prevents access to six hospitals and increases timeliness and frequency.
Concept C: Includes southeast corner, prevents access to six hospitals but reduces timeliness and frequency.
Concept D1 (Extension): Would provide access to Wichita health care facilities for transit-dependent individuals in outlying communities.
Concept D2 (Commuter): N/A. Transit system users not likely commute to access health care facilities outside their communities.

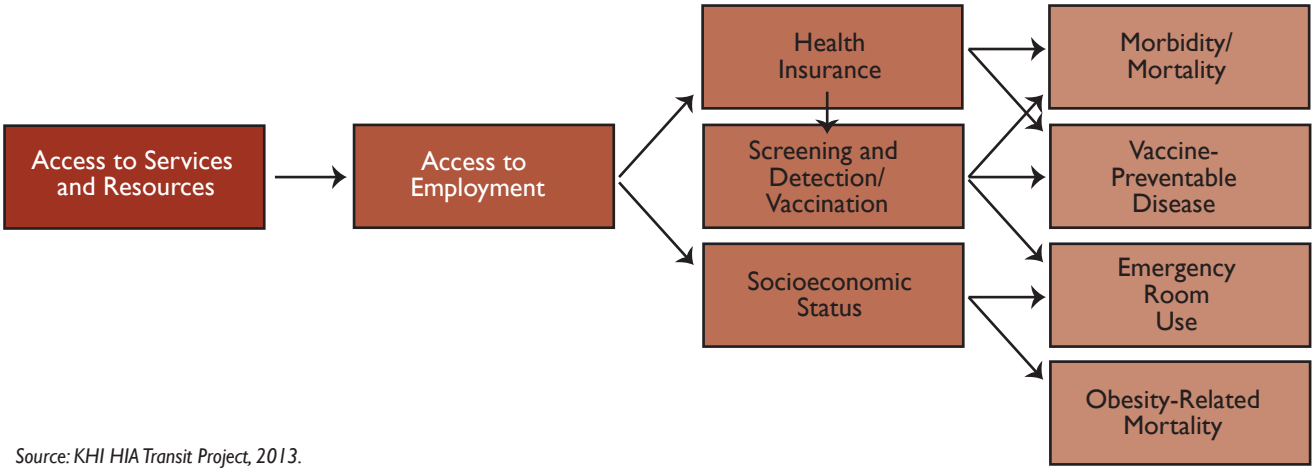
Legend is available in Appendix A (page A-1).

Source: KHI HIA Transit Project, 2013.

Wichita, 2012.

Access to Employment

Figure 15. Pathway Diagram: How Transit May Affect Access to Employment



Source: KHI HIA Transit Project, 2013.

Key Findings

- Typically one of the most predominant uses of transit is to get to work, but Wichita may not follow this trend.
- Concepts A (Grid) and B (Optimization) increase timeliness and frequency of services, thus improving access to transit, especially for shift workers, while Concept C (Reduction) does not.
- The hub-and-spoke system doesn't provide easy access to jobs outside Wichita's central district, although that's where many of the city's jobs are.
- The annual impact on the Wichita economy resulting from additional Wichita area resident payroll earnings would be $6.1 million for Concept A (Grid), $3.1 million for Concept B (Optimization) and $1.2 million for Concept D1 (Extension).

Recommendations

Wichita Transit should consider:

- Exploring the reasons for low ridership in southeast Wichita.
- Increasing frequency of bus routes and availability of routes at night or on weekends in order to align the transit schedule with shift workers' needs.
- Exploring the viability of a grid system.

Overall Health Impacts

An increase in transit services — through expanded routes and new night and weekend service — could increase people's ability to find, obtain and keep jobs. For example, night and weekend routes would increase access to jobs in the service industry. Overall, people who have better access to jobs enjoy better health and have slower declines in health status over time.

"I would like to see more transit for employment. That could be improved as well."

— *Community Stakeholder*

Tangible (e.g., health insurance, income) and intangible (e.g., sense of meaning) benefits of employment may have positive effects on health. Having health insurance increases access to services, which in turn affects a person's health and well-being. Regular and reliable access to health services also can prevent disease and disability, allow early detection and treatment of health conditions, increase life quality, reduce the likelihood of premature death and increase life expectancy.[58] Additionally, an increase in employment could improve economic conditions (personal income, job security). People with higher incomes are more likely to have longer life expectancies and healthier BMI. However, the extent of positive health impacts associated with employment will depend largely on job environment and access to employer-provided benefits (e.g., health insurance).

What We Learned from the Community

"We hear that one of the reasons we should do the expansion is that young professionals want to live in communities where they can ride transit."

— *Community Stakeholder*

Out of all the services described in the HIA, access to employment is the most important to the respondents surveyed. Community members indicated that it is the most significant health issue related to transit, with over 40 percent indicating it is "extremely" important and 100 percent indicating it is "extremely" or "very" important. Community members suggested that it is important to provide access to jobs for vulnerable populations (e.g., shift workers) and young professionals who might not otherwise use transit.

In the *Wichita Public Transportation Survey*, 47.2 percent indicated they would be "very likely" or "likely" to use transit at least once per week if their employer provided incentives to use transit. Additionally, the survey indicated support for commuter and extension routes to outlying cities. When asked, *"Would you support providing a park and ride type of regional service outside the City of Wichita?"* 60.8 percent of all respondents said "yes," and 64.0 percent of those living outside Wichita said they would use this service if it met their transportation needs.

What We Learned from the Literature

There is mixed evidence on how public transit affects employment. A commonly cited advantage of public transportation is that transit helps get people to work,

"The biggest thing I've come across is that expanding hours of operation is very important for people who work late."

— Community Stakeholder

helps employers have a reliable workforce and reduces the reliance on unemployment assistance.[59] Although these advantages seem intuitive, studies have shown that transit is not significantly tied to employment.[60, 61] These studies did not find a correlation between increased access to transit and increased employment rates. With that said, lack of reliable transportation is cited as a barrier to employment success among welfare recipients,[62] and a gold-standard study in the field found that public transit is an important part of determining the average rates of participation in jobs.[63] A recent HIA in Columbia, Mo., found that locals who did not own a car reported missing work more frequently than those with a car.[64] The same survey found that transit riders often looked for employment near their current bus routes.

What We Learned from Data

According to 2011 American Community Survey data, 0.4 percent of Wichita workers used public transportation to commute to work. Although this is a small percentage of the working population in Sedgwick County, the rate is comparable to Kansas as a whole (0.4 percent) and lower than several peer cities, as shown in Table 22.

While a small proportion of individuals take transit to work, literature has shown that public transit can impact job attendance and access to jobs, especially for

Table 22. Percentage of Population Commuting via Public Transit

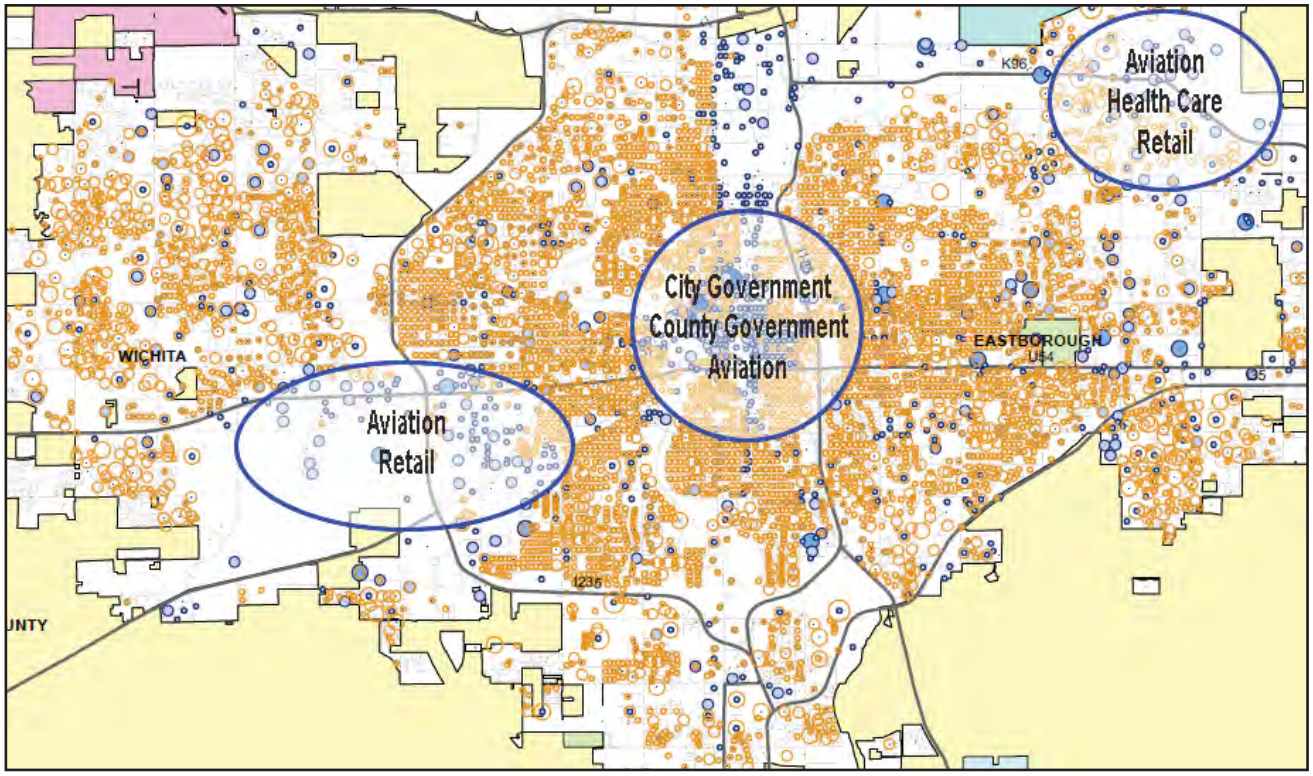
City	Commute via Public Transportation (% of Workers Over 16)	Working Population (Over Age 16)	Zero Available Vehicles (%) Per Household	One Available Vehicle (%) per Household	Two or More Available Vehicles (%) per Household
Wichita, KS	**0.4%**	**176,705**	**2.3%**	**23.8%**	**73.9%**
Oklahoma City, OK	0.5%	273,165	2.2%	22.7%	75.0%
Topeka, KS	0.6%	57,528	3.8%	26.5%	69.7%
Tulsa, OK	0.8%	182,631	2.5%	29.7%	67.8%
Des Moines, IA	1.5%	93,921	3.7%	24.6%	71.7%
Omaha, NE	1.6%	203,625	3.4%	24.2%	72.5%
Chattanooga, TN	2.4%	65,363	3.1%	30.3%	66.6%

Source: U.S. Census Bureau. American Community Survey 2011: One-year estimates. Available online at http://factfinder2.census.gov.

vulnerable populations who are dependent on public transit as their primary means of transportation. As noted earlier, employment, insurance and income have been associated with positive health impacts. Concepts A and C provide transit access to most areas with vulnerable populations, while Concept B does not. However, Concept B provides more frequent service, including during the weekend, which is an important consideration for shift workers' ability to access jobs via transit. The concepts under consideration do not provide transit services to approximately six major Wichita employers, including Spirit AeroSystems, Inc. and Bombardier Aerospace.

Figure 16 shows where people live and work in Wichita. Out of the three major areas of employment, the proposed concepts provide the greatest access to jobs downtown and less access to jobs in the northeast and southwest areas. Geographic coverage is similar among all of the concepts, but Concepts A and B provide greater frequency of service and hours of operation. For example, Concept A provides similar access as current routes, but it is structured as a grid system that runs more frequently. This difference would make it more convenient for transit riders, especially for those traveling from the north or south areas of the city.

Figure 16. Where People Live and Work in Wichita

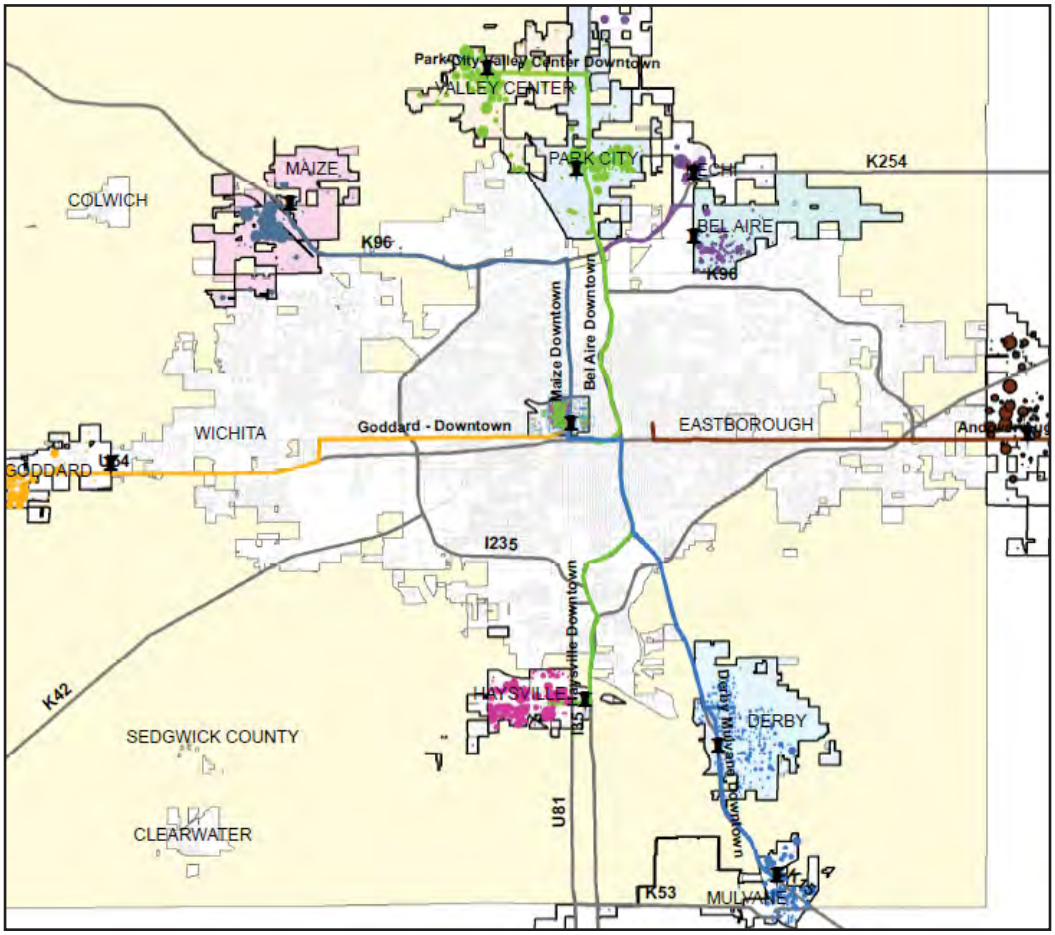


Note: Blue circles show concentration of jobs in the city; orange circles show where Wichitans live.
Source: KHI analysis using OnTheMap from U.S. Census Bureau Center for Economic Studies, 2013.

According to Census data, approximately 3,860 individuals that work in downtown Wichita live in outlying communities. Concepts D1 and D2 propose extension and commuter routes that would serve these cities. Concept D1 (Extension) would provide hourly service from outlying cities to routes inside the city limits, increasing access to jobs. Figure 17 shows the concentration of individuals who could access transit for work if Concept D2 (Commuter) was implemented.

Concept D2 (Commuter) could provide Wichita Transit with additional revenue while expanding employment access to outlying communities. However, Olsson Associates estimated annual operating cost for this concept is approximately $691,000. Table 23 shows the number of workers who might commute on each route. It also predicts the revenue if a commuter pass costs $40 per month. Even when estimating transit ridership at 10 percent of commuters and the cost of the pass at $80 per month, the revenue ($353,280) would not outweigh the projected operating cost ($691,000) for Concept D2. However, it is important to also account for community opinion and the

Figure 17. Residents of Outlying Cities Who Work Downtown



Source: KHI analysis using GIS mapping tools and OnTheMap from U.S. Census Bureau Center for Economic Studies, 2013.

potential positive health effects associated with access to services when deciding on changes to the transit system. For example, a community might be willing to subsidize transit passes if the changes mean better health benefits, improved air quality and reduced traffic and road congestion as describes in the "Transportation Mode" section of the report (page 53).

Table 23. Ridership and Revenue Estimates under Concept D2

Route	Downtown Workers in Outlying City	Estimated Monthly Passes Sold (2% of workers)	Potential Annual Revenue from $40/ month pass (2% of workers)	Estimated Monthly Passes Sold (6% of workers)	Potential Annual Revenue from $40/ month pass (6% of workers)	Estimated Monthly Passes Sold (10% of workers)	Potential Annual Revenue from $40/ month pass (10% of workers)
Augusta–Andover–Downtown Wichita	562	11	$5,280	34	$17,136	56	$26,880
Kechi-Bel Aire–Downtown Wichita	746	15	$7,200	45	$22,680	75	$36,000
Mulvane–Derby–Downtown Wichita	923	18	$8,640	55	$27,720	76	$36,480
Goddard–Downtown Wichita	181	4	$1,920	11	$5,544	18	$8,640
Haysville–Downtown Wichita	390	8	$3,840	23	$11,592	39	$18,720
Park City–Valley Center–Downtown Wichita	778	16	$7,680	47	$23,688	76	$36,480
Maize–Downtown Wichita	280	6	$2,880	17	$8,568	28	$13,440
Totals	3,860	77	$37,440	232	$116,928	368	$176,640

Notes: The table above shows a conservative revenue estimate. Based on current transit ridership for work purposes (0.4 percent), 2 percent ridership for commuter routes (see Table 23, page 36) is the closest expected estimate. Potential commuter estimates were capped at 95 percent of bus occupancy per route.

Source: KHI analysis using OnTheMap from U.S. Census Bureau Center for Economic Studies and operating cost from Olsson Associates.

Health Implications for Wichita

Although the literature review doesn't show a strong association between transit and employment rates, it suggests that lack of access to transit can be a barrier to employment for workers without a stable form of transportation. In contrast to mixed findings from the literature review, stakeholders strongly suggested that Wichita Transit was a key factor for linking residents to employment, specifically individuals who are unemployed, low-income, elderly and students.

Among characteristics that make transit more attractive for employment-based utilization are wide geographic coverage and also timeliness and frequency. Given that only Concept A meets both characteristics — provides access throughout the city and increases timeliness and frequency — it is likely to result in increased access to employment and associated positive health outcomes (e.g., increased life expectancy). However, as noted earlier and in Table 24, the extent of positive health impacts associated with employment will depend largely on job environment and access to employer-provided benefits (e.g., health insurance).

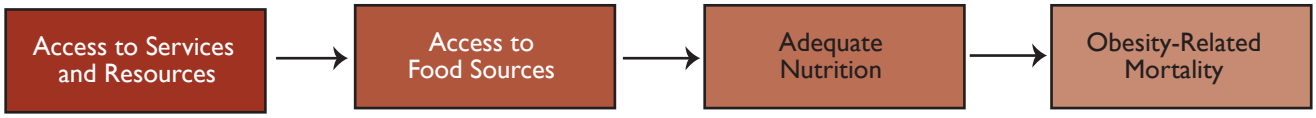
Table 24. Impact of Transit on Access to Employment and Potential Health Impacts

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
ACCESS TO SERVICES AND RESOURCES						
Access to Employment						
A (Grid)	Increase	Positive	Medium	Likely	Shift workers, low socioeconomic, students (day and evening), unemployed	
B (Optimization)	Mixed	Mixed	Medium	Possible	Shift workers, some low socioeconomic, students, unemployed	**
C (Reduction)	Decrease	Negative	Medium	Possible	Low socioeconomic, students (day)	
D1 (Extension)	Increase	Positive	Low	Possible	Residents of outlying communities	
D2 (Commuter)	Increase	Positive	Low	Possible	Commuters	

Concept A: Provides access to jobs throughout city, and west-side connect allows access to downtown jobs for northwest residents and increases timeliness and frequency.
Concept B: Prevents access to downtown jobs for northwest residents, eliminates convenient access for southeast residents but increases frequency and timeliness.
Concept C: Provides access to low-income area in southeast Wichita but does not include access to downtown for northwest and southwest residents; reduces timeliness and frequency.
Concepts D1 (Extension) and D2 (Commuter): Provide access for residents of surrounding communities of Wichita to downtown jobs.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

Access to Food Sources

Figure 18. Pathway Diagram: How Transit May Affect Access to Food Sources



Source: KHI HIA Transit Project, 2013.

Key Findings

- In general, people who are more likely to use bus service for grocery shopping do not have access to alternative modes of transportation.
- Use of transit service for grocery shopping depends on an available place to store groceries.
- The use of transit for grocery shopping also depends on convenience (e.g., proximity, timeliness, pedestrian access, adequate information about transit schedule).
- People who are able to shop at supermarkets that offer healthy choices may be more likely to have lower BMI and less likely to be obese.

Recommendations

The Metropolitan Area Planning Department should consider:

- Locating future grocery stores near transit routes. This can be achieved through zoning changes or other incentives.

Wichita Transit should consider:

- Using buses with a low floor area to accommodate rolling carts on the routes that have the most grocery stores and purchasing new buses with a low floor to support grocery shoppers.
- Reviewing and raising the two-bag limit on buses to a higher number, such as six, to encourage grocery shopping.*
- Making transit-related materials (e.g., maps) and bus passes available in grocery stores.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

"I would like to see increased access to food services, but I'm not sure how to go about doing that."

— Community Stakeholder

Overall Health Impacts

If Wichita officials decide to expand its transit route, offer night and weekend service or a combination of both, it could increase access to food sources such as grocery stores and food pantries. Increased access to healthy food sources could decrease the dependency on convenient food sources (e.g., fast food, convenience stores). There are many positive health outcomes linked to a more nutritious diet, including reduced morbidity and mortality and decreased obesity and BMI. Vulnerable populations would be particularly affected by expanded Wichita Transit routes because of increased access to food pantries. Stagnant or reduced transit services could result in negative health outcomes because residents may rely too heavily on convenient, unhealthy food sources.

What We Learned from the Community

Wichita community members believe it is important that food sources are accessible through public transportation. One hundred percent of respondents in a survey conducted by KUSM–W as part of the HIA project said that access to food sources through transit was at least "somewhat important" and over 60 percent said it was "very" or "extremely" important. According to the *Wichita Public Transportation Survey*, 88.0 percent said that they rarely or never use public transit. However, when asked what they might use transit for in the future, the second most cited use (26.0 percent) was for running errands and shopping. Stakeholders stated that although most residents might not use transit for grocery shopping, there is a strong need for transit-dependent individuals to be able to access food sources, especially healthy ones.

What We Learned from the Literature

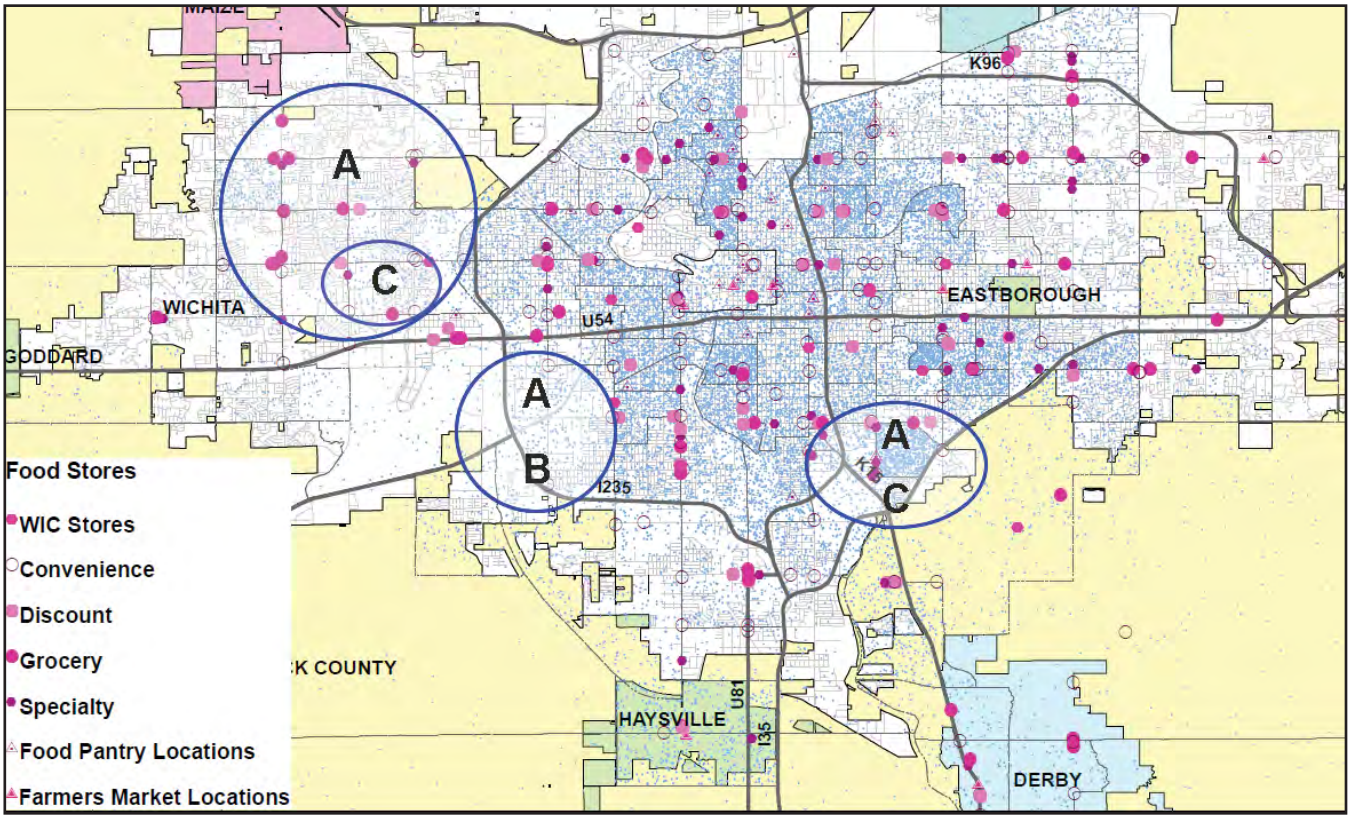
There is very little literature studying the direct link from transit to access to food sources. There is a logical explanation often cited in the literature that if a neighborhood does not have a grocery store and there is no public transit to a local grocery store, the residents will turn to unhealthy food sources.[65, 66] Because there is not a body of evidence to support this statement, the HIA team turned to the robust literature on access to food sources. Unfortunately, this field is conflicted. For a number of years the field seemed to support the idea that having better access to supermarkets reduced obesity and those neighborhoods with greater access to convenience stores would have higher obesity levels.[67, 68, 69] Recent studies examining the relationship between the neighborhood food environment and diet among youth did not find a correlation.[70, 71] A longitudinal study (a type of study known for its

scientific rigor) looking at access to healthy foods found a relationship between low-income respondents who had fast-food restaurants near their home and increased fast-food consumption, but the overall study did not find a relationship between supermarkets with healthy foods and diet.[72] A study looking specifically at populations without cars found that lacking a car and living in a neighborhood with a high density of fast-food restaurants resulted in higher BMI.[73] This research is reflected in other sources.[74, 75]

What We Learned from Data

We know from literature that if a neighborhood does not have a grocery store nearby and public transportation does not include a grocery store with healthy food options on its route, it will be very difficult for residents, especially those without an

Figure 19. Transit Concepts' Coverage of Food Sources in Wichita



Notes: Transit concepts within each circle cover the geographic area within it.
The KHI Team did not map every food source in the City of Wichita, as it was not feasible to collect all the data. By including all SNAP, WIC, and other food locations, food sources (excluding restaurants) available to vulnerable populations and most residents are accounted for.
Concentrated blue dots represent people living in households at or below 100 percent of the federal poverty level.
Definition of terms: Discount locations (e.g., Dollar General); Specialty (e.g., butcher, Asian specialty food store); Convenience (e.g., gas station with grocery items).

Source: KHI analysis using GIS mapping tools, 2013.

alternative form of transportation, to get healthy foods. Not having convenient access to healthy food sources could affect obesity and BMI levels. However, access alone does not account for personal choices made when purchasing food that also could impact health. The concepts vary depending on routes accessible from residents' homes to various food sources, including SNAP and WIC locations, farmers markets and food pantries. Concept B does not have routes to the northwest section of the city and Concept C has limited service to that area, making it difficult for those residents to access stores throughout Wichita and for residents living elsewhere to shop there. Concept B also eliminates access to transit for Plainview residents in southeast Wichita, an area with a high concentration of low-income households. Concept A adds bus lines that run on a grid, giving greater access to food sources and making it more convenient for riders coming from the north and south of Wichita to access healthy foods. Aside from the limitations mentioned regarding access to food sources, the proposed concepts generally cover residents and food sources in the rest of Wichita. Figure 19 (page 40) illustrates food sources in Wichita for concepts that cover various parts of the city.

Wichita, 2012.

Health Implications for Wichita

Food choices affect the health and well-being of individuals. Food and dietary choices are influenced by many factors, including economic (cost and income), social (class and culture), physical (access, education, skills), biological (hunger, taste) and others. Although improved access to stores with healthy options doesn't necessarily mean that individuals will change their food choices, it provides the necessary support for making healthy dietary choices.

Stakeholders noted that Wichita residents could benefit from increased access to grocery stores. The data analyses show that Concept A would increase transit system access to food sources through wider geographical coverage and increased timeliness and frequency (Table 25). Similar to access to employment, such characteristics as timeliness and frequency as well as direct routes are key for affecting shoppers' choice of food sources. Additionally, the extent of positive health effects associated with increased access to grocery stores will largely depend on residents' food choices.

Table 25. Impact of Transit on Access to Food Sources and Potential Health Impacts

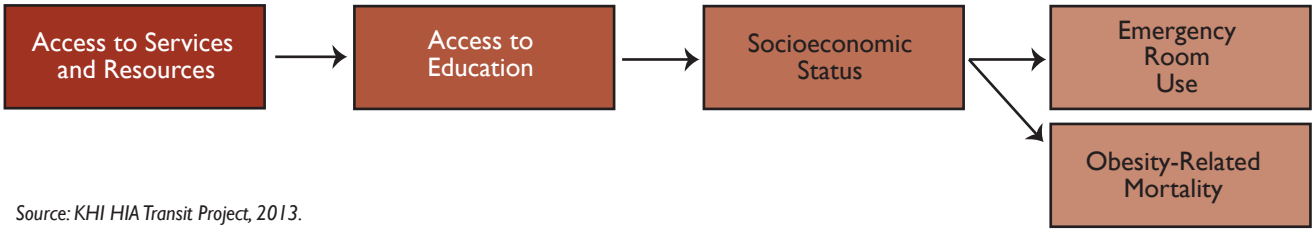
Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
ACCESS TO SERVICES AND RESOURCES						
Access to Food Sources						
A (Grid)	Increase	Mixed	Medium	Uncertain	Low-income, immigrant, elderly, disabled, individuals without car	***
B (Optimization)	Mixed	Mixed	Medium	Uncertain		
C (Reduction)	Decrease	Negative	Medium	Uncertain		

Concept A : Adds bus lines running on a grid, giving greater access to food sources; more convenient for riders coming from the north and south and increases timeliness and frequency.
Concept B: Reduces service to the west where a considerable number of food sources are located, but increases frequency and timeliness.
Concept C: Covers a small part of the west, but does not provide bus routes running north and south in this area as well as reduces timeliness and frequency.
Concepts D1 (Extension) and D2 (Commuter): Not applicable. Commuters would be unlikely to access food resources outside of their communities.
Legend is available in Appendix A (page A-1).

Source: KHI HIA Transit Project, 2013.

Access to Education

Figure 20. Pathway Diagram: How Transit May Affect Access to Education



Source: KHI HIA Transit Project, 2013.

Key Findings

- Concepts A (Grid) and B (Optimization) provide more frequent and timely access to K-12 after-school programs and evening university classes, while Concept C (Reduction) does not.
- Unlimited access transit passes purchased by universities for all students may benefit the university, students and transit agency.
- Easy access to a university does not increase higher education participation, but it can affect institutional choice and student retention.

Recommendations

Wichita USD 259 should consider:

- Identifying the need for transit services that provide access to after-school activities and classes.
- Collaborating with Wichita Transit to address needs for education sector employees and students, including available public transportation during off-peak hours for activities and evening classes.*

Universities in Wichita should consider:

- Working with Wichita Transit to develop a universal pass for students.*

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Overall Health Impacts

Overall, people who have more education enjoy better health and have slower declines in health status over time. The research shows that more-educated people

report having lower morbidity from the most common acute and chronic diseases (heart conditions, stroke, hypertension, cholesterol, emphysema, diabetes, asthma attacks and ulcers). The studies found that "an additional four years of education lowers five-year mortality by 1.8 percentage points; it also reduces the risk of heart disease by 2.16 percentage points, and the risk of diabetes by 1.3 percentage points."[76] These results suggest that there is a link between educational attainment and health literacy, healthy behaviors, work, social standing, social support and sense of control. For example, people who are more educated make better-informed choices among the health-related options and have access to better employment opportunities and higher income.[77] However, the extent of transit impact on education attainment is not clear.

"Access to education would not necessarily be improved. Concept A would have good coverage and Concept B would reduce coverage, but not necessarily to any one university."

— Community Stakeholder

What We Learned from the Community

Community members indicated that there is strong support for providing transit to access schools (K-12 and universities). Over 80 percent of those surveyed as a part of the HIA project stated it was either "very" or "extremely" important. Additionally, according to responses to the *Wichita Public Transportation Survey*, one of the top reasons to provide transit in Wichita was to help those with no access to a car get to school (98.0 percent). When considering access to universities in the area, stakeholders mentioned that it might be beneficial for public transportation to service outlying schools, including Butler County Community College.

What We Learned from the Literature

There is a lack of literature connecting access to public transit with a change in access to higher education. Literature from the United Kingdom did not support the idea that improved transit access will increase higher education participation,[78] although proximity or easy access to a university or college did affect institutional choice.[79] However, there is evidence linking universities that provide unlimited access transit passes to their students with positive outcomes.[80, 81] For instance, universities cite that unlimited passes help reduce parking and increase transportation equity, while the transportation agencies say that the passes increase ridership, especially during off-peak hours.[82]

What We Learned from Data

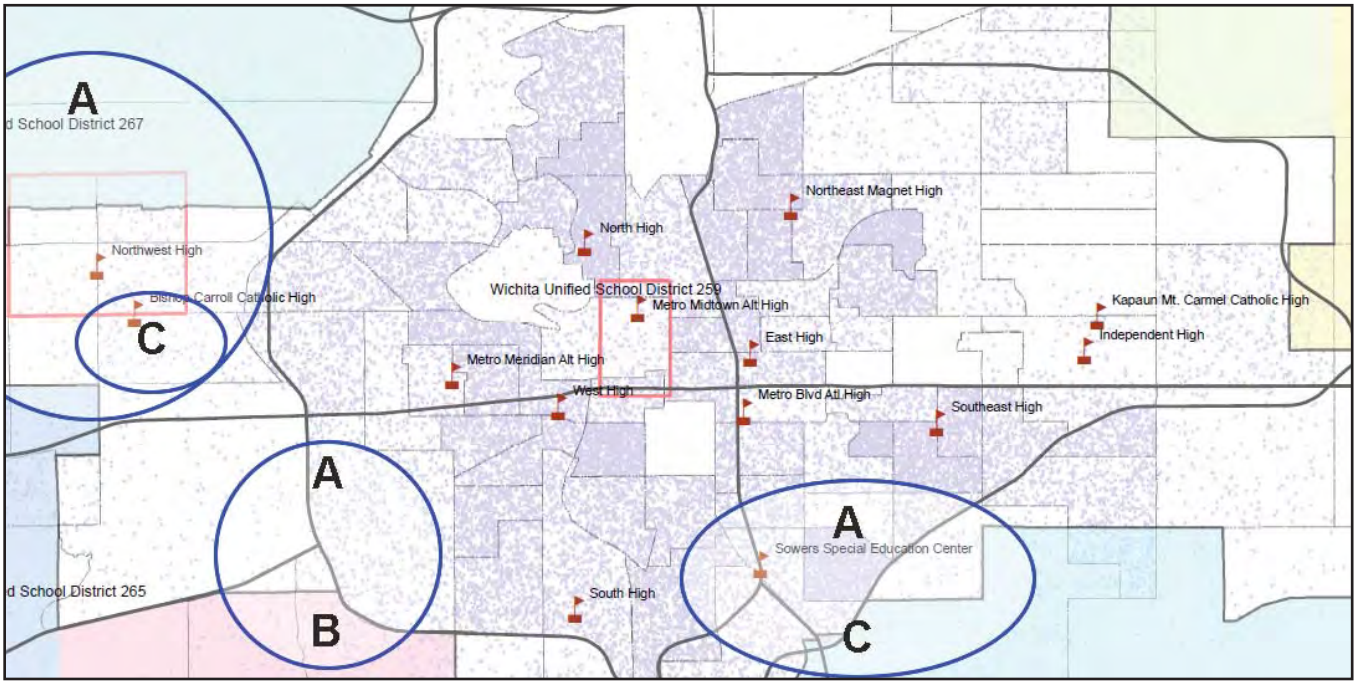
There is not a preponderance of evidence in the literature that links transit to K-12 education, as it mainly focuses on using school buses rather than public bus systems for elementary and high school students. For college students, transit can be an extra financial burden, but university transit programs and subsidies can increase ridership.

Education has an impact on health outcomes, including employment opportunities, health insurance and other long-term benefits. However, transit access alone does not account for performance in the classroom.

The transit concepts vary in how accessible the routes are from residences. Concepts A and B have longer hours of operation during off-peak hours and run more frequently than Concept C. This would be beneficial for college students with night classes, for students with extracurricular activities and for parent-teacher conferences held after hours. Those without access to a car may have barriers to participation in these classes and activities. Concept B does not have routes to northwest Wichita and Concept C has limited service to that area, making it difficult for students in that area to take transit to school. Concept B also eliminates access to transit for Plainview students in southeast Wichita, an area with a high concentration of low-income households. Concept Ds' Extension and Commuter routes would provide access for students living outside the city to universities and for those living in Wichita to institutions in surrounding communities, such as Butler County Community College in Andover.[83] Aside from the limitations mentioned regarding access to schools, the proposed concepts generally cover residents and schools in the rest of Wichita. Figures 21 and 22 (page 46) show high schools and higher education institutions in Wichita and what areas the transit concepts cover.

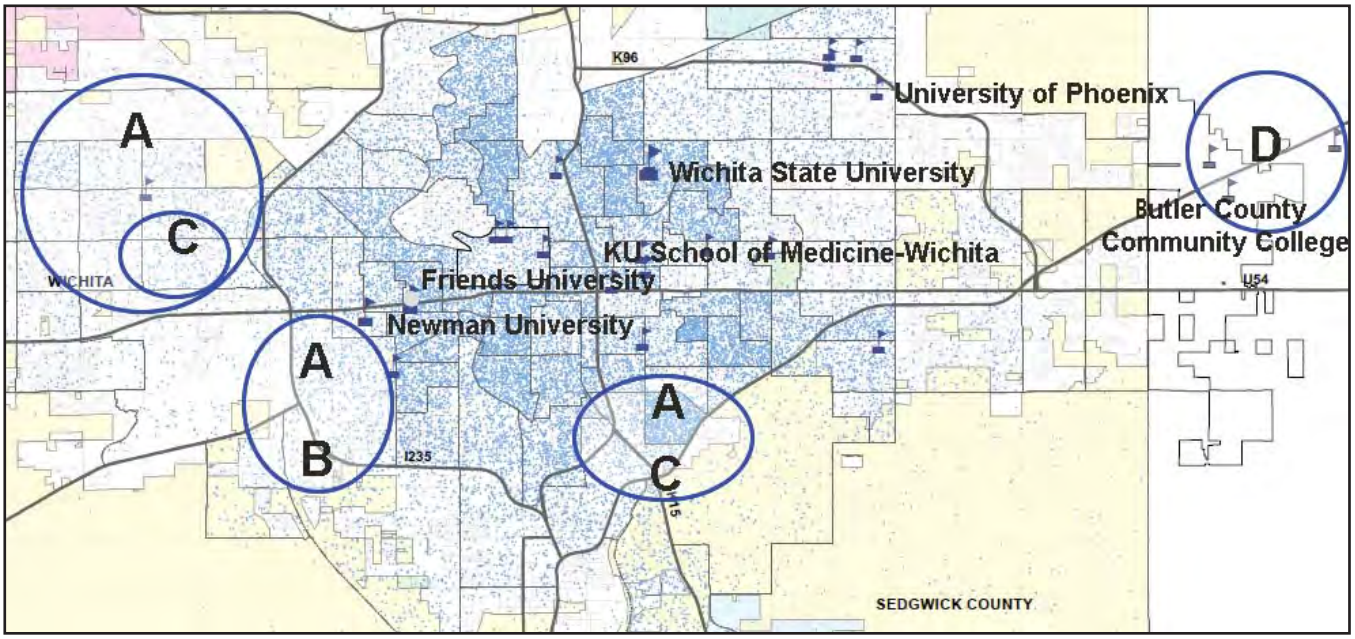
Wichita, 2012.

Figure 21. Transit Concepts' Coverage of K-12 Schools in Wichita



Notes: Transit concepts within each circle cover the geographic area within it.
This analysis does not include K-8 schools, considering students could not take public transit without parental supervision.
Concentrated blue dots represent children 18 and under living in households at or below 100 percent of the federal poverty level.
Source: KHI analysis using GIS mapping tools, 2013.

Figure 22. Transit Concepts' Coverage of Higher Education Institutions in Wichita



Notes: Transit concepts within each circle cover the geographic area within it.
Concentrated blue dots represent people living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, 2013.

Health Implications for Wichita

There is strong correlation between an individual's level of education and health outcomes. For example, research has found that greater educational attainment has been associated with eating healthy, getting exercise and avoiding risk factors such as drinking excessively and smoking. However, the association between access to transit and educational attainment is less clear. The literature review didn't identify a lack of public transportation among commonly cited barriers to education. On the other hand, stakeholders suggested that reliable transit services could benefit students who don't have cars, working parents or those who don't know how to drive. Stakeholders also noted that access to transit could give students the opportunity to participate in after-school activities.

According to data analyses, Concept A would be more likely to increase access to educational facilities. However, as Table 26 shows, it is hard to predict to what extent transit services would be utilized for education-related purposes.

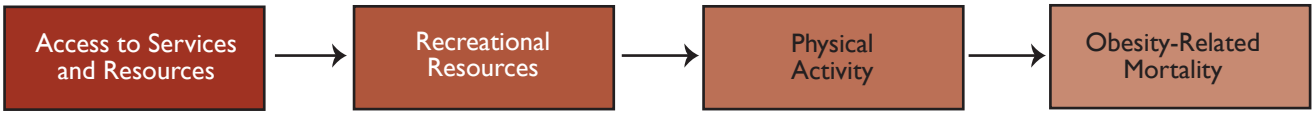
Table 26. Impact of Transit on Access to Education and Potential Health Impacts

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
ACCESS TO SERVICES AND RESOURCES						
Access to Education						
A (Grid)	Increase	Uncertain	Low	Uncertain	K-12 students (and parents) and college students	
B (Optimization)	Decrease	Uncertain	Low	Uncertain		
C (Reduction)	Decrease	Uncertain	Low	Uncertain	Students and parents	*
D1 (Extension)	Increase	Uncertain	Low	Uncertain	College students	
D2 (Commuter)	Increase	Uncertain	Low	Uncertain	College students	

Concept A: Provides access to the majority of K-12 schools and universities except Butler County Community College. Longer hours of operation would provide access to evening classes.
Concept B: Reduces service to northwest and southeast Wichita but increases frequency and timeliness.
Concept C: Limits services to southeast Wichita and reduces frequency and timeliness.
Concepts D1 (Extension) and D2 (Commuter): Provide access for residents of surrounding communities to Wichita universities.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

Access to Recreational Resources

Figure 23. Pathway Diagram: How Transit May Affect Access to Recreational Resources



Source: KHI HIA Transit Project, 2013.

Key Findings

- Convenience is an important part of getting people to exercise, and it is possible that increasing access to recreational resources through public transit will increase how often people exercise.
- The CDC Community Guide recommends improving access to places for physical activity and creating an informational campaign to educate residents of Wichita about enhanced transit service.
- Concept A (Grid) is more likely to increase access to recreational resources.

Recommendations

Wichita Transit should consider:

- Incorporating questions about recreational-related transit use in future assessments.
- Increasing coverage of routes used to access recreational resources.

Wichita schools should consider:

- Establishing shared-use agreements so school grounds can be used as physical activity centers during non-school hours and including transit officials in that planning.

Overall Health Impacts

According to research, one way to increase physical activity is to improve access to recreational resources. The findings suggest that access to trails, parks and swimming pools facilitates physical activity.[84] Additionally, several studies noted that some features of the built environment (e.g., connectivity and proximity) have been associated with adult physical activity. Specifically, several studies report that people in more walkable communities were more physically active and less overweight than

"We must convince the average person that if they looked at transit as part of their transportation package and it was more reliable and ran later, then their lives would be a lot healthier as well."

— Community Stakeholder

people in less walkable communities.[85] Although research doesn't establish a clear connection between access to transit and utilization of recreational resources, it is reasonable to project that transit may help to connect people with recreational resources in their communities. Specifically, transit can help to enhance utilization of school properties during non-school hours, such as weekends, holidays and summer break. A number of key organizations, including the American Academy of Pediatrics and the Office of the Surgeon General, recommend shared use of school facilities as a strategy to increase physical activity.

What We Learned from the Community

Community members indicated that there is support for providing transit to access recreational resources, including gyms and bike paths, but that it was less important than accessing other services. Over 40 percent of those surveyed as a part of the HIA project stated it was either "very" or "extremely" important, while another 40 percent stated it was "somewhat important." Also, access to recreational activities was not listed as a primary reason for using transit in the *Wichita Public Transportation Survey*. However, stakeholders stated the importance of considering public transportation in land use planning. For example, connecting transit to bike paths could provide benefits to the community and to the health of its residents.

What We Learned from the Literature

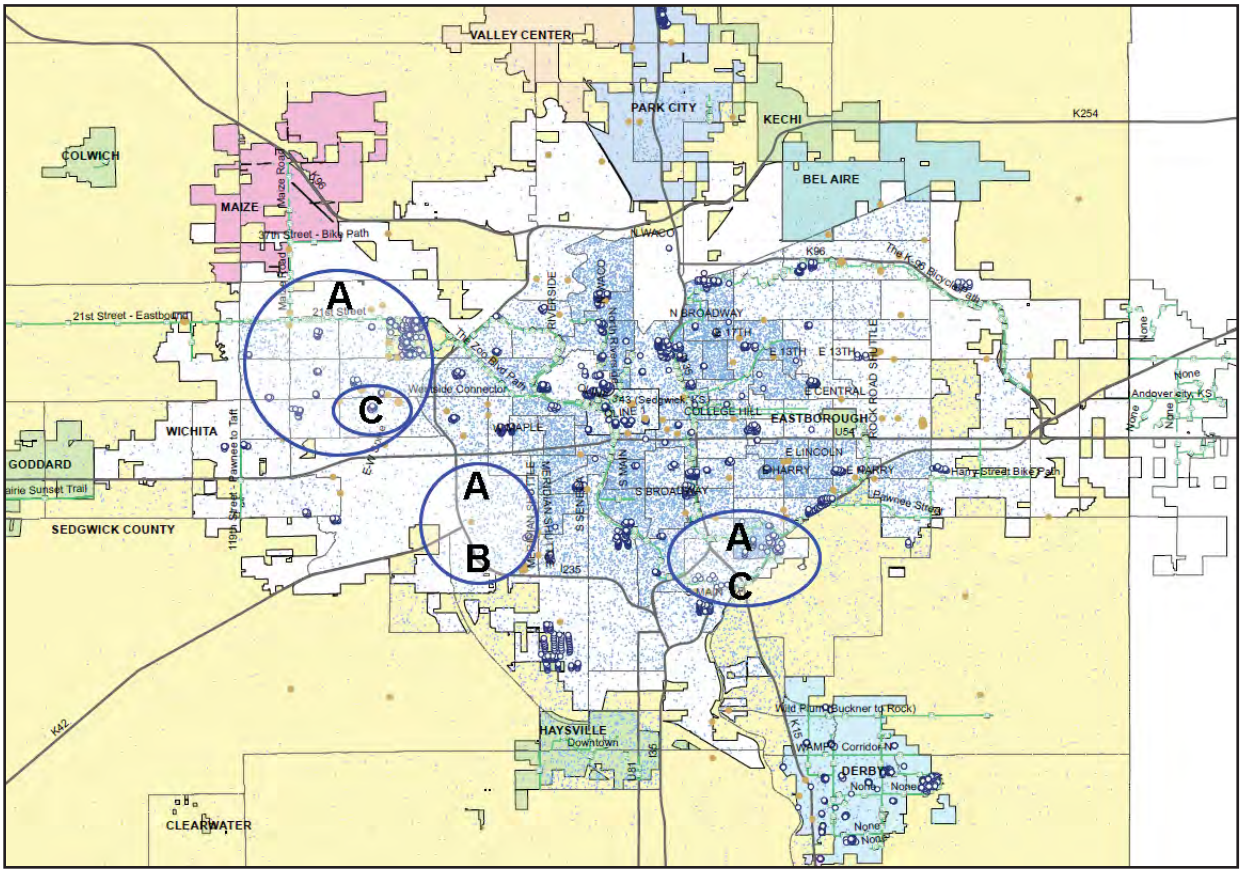
Convenience has an important role in meeting one's physical activity recommendations.[86] The CDC Community Guide states that there is strong evidence that physical activity increases when access to recreational facilities is enhanced and promoted with an informational campaign.[87] An HIA in Oregon found that proximity of a park, trail or recreational facility to a public transportation stop could increase the likelihood of utilizing these areas for exercise.[88] There also is a strong link between using public transportation and meeting the recommended amount of physical activity. This will be discussed in detail in the Pedestrian Access section (page 61).

What We Learned from Data

Literature and community feedback suggest that access to recreational activities is related to increases in physical activity, while reduced availability of recreational resources for people with low socioeconomic status is associated with higher rates of being overweight or obese. Public transportation by nature increases physical activity due to the general necessity of walking or biking to bus stops, which can have positive health effects for individuals.

The concepts vary in terms of resident access. Concept B does not have routes to northwest Wichita and Concept C has limited service to that area, making it difficult for those residents to access gyms and other resources, such as bike paths. It is also difficult for residents living elsewhere to get to these locations in northwest Wichita by transit. Concept B also eliminates access to transit for residents in southeast Wichita, an area with a high concentration of low-income households. Concept A adds bus lines running on a grid, providing greater access to facilities and making it more convenient for riders coming from the north and south of Wichita. Concept Ds' Commuter and Extension routes could give greater access to individuals in outlying cities. For instance, if commuters biked to the bus stop on a path, they could then travel to work via transit. Aside from the limitations mentioned regarding access to recreational activities, the proposed concepts generally cover residents and resources in the rest of Wichita. Figure 24 illustrates recreational resources in Wichita and transit concept coverage.

Figure 24. Transit Concepts' Coverage of Recreational Resources in Wichita



Notes: Transit concepts within each circle cover the geographic area within it.
The HIA Team did not map every recreational facility in the City of Wichita, as it was not feasible to collect all the data.
Concentrated blue dots represent people living in households at or below 100 percent of the federal poverty level.
Definition of terms: Blue circles are recreational facilities (gyms, community centers); green lines are bike paths.
Source: KHI Analysis using GIS mapping tools, 2013.

Health Implications for Wichita

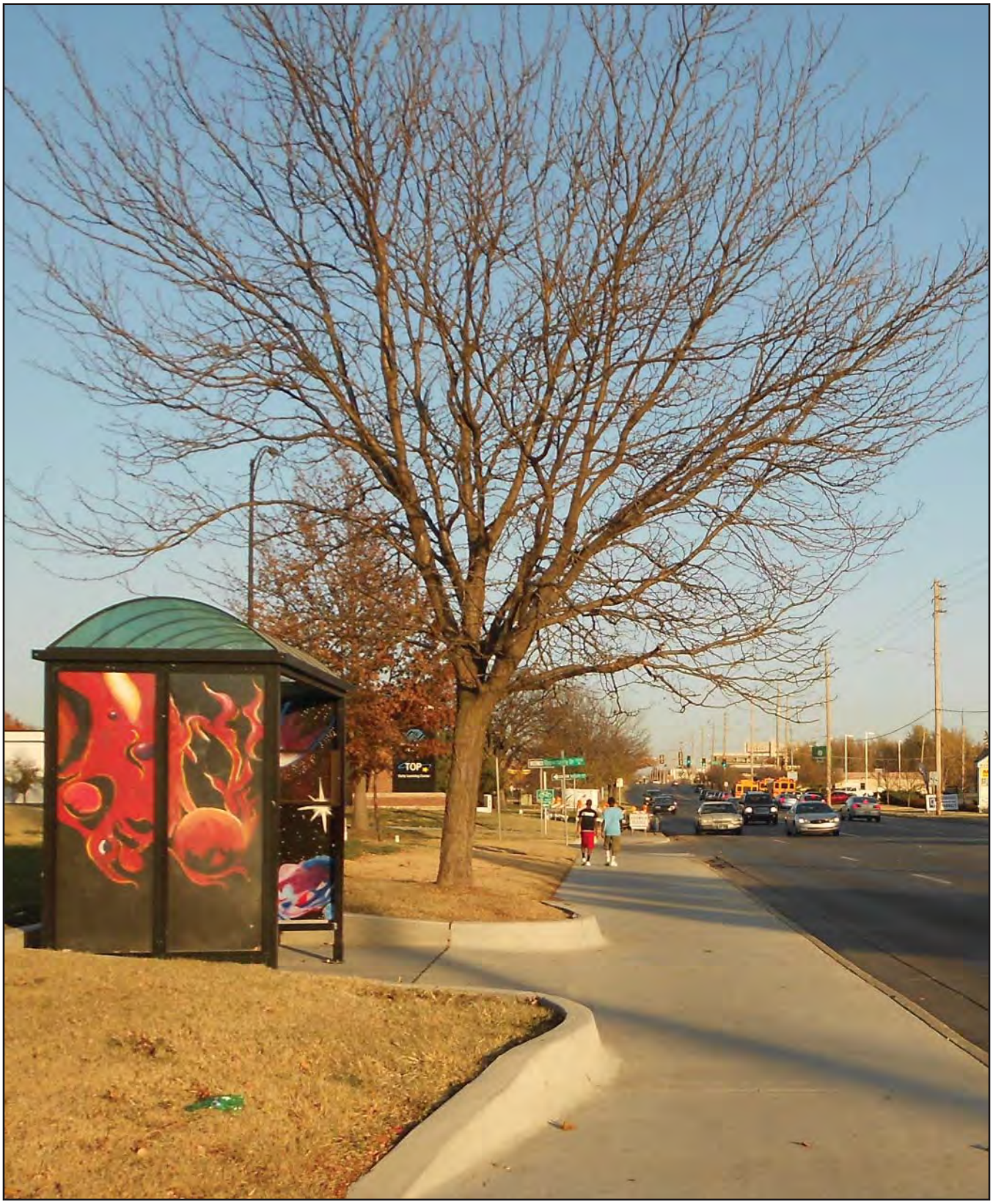
Convenient access to recreational resources could help Wichita residents increase physical activity levels. Higher levels of regular physical activity are associated with lower mortality rates for both older and younger adults. Even those who are moderately active on a regular basis have lower mortality rates than those who are the least active. However, research findings didn't provide a clear picture regarding the association between transit and utilization of recreational resources. Some findings from the literature review suggest that proximity of recreation resources to transit stops increased their utilization. Stakeholder feedback echoed research findings. Although stakeholders noted that increased access to recreational resources will be an asset for the community, they didn't list this issue among their top priorities.

According to data analyses, Concept A would be more likely to increase access to recreational resources. However, as shown in Table 27, it is hard to predict to what extent transit services will be utilized for recreation-related purposes.

Table 27. Impact of Transit on Access to Recreational Facilities and Potential Health Impacts

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
ACCESS TO SERVICES AND RESOURCES						
Access to Recreational Resources						
A (Grid)	Increase	Uncertain	Low	Uncertain	Wichita community members	*
B (Optimization)	Decrease	Uncertain	Low	Uncertain		
C (Reduction)	Decrease	Uncertain	Low	Uncertain		

Concept A: Provides bus service to west, northwest and southeast Wichita. Increases access on Sunday and during evenings.
Concept B: Reduces service to west Wichita, limits service to northwest Wichita and does not cover southeast Wichita.
Concept C: Limits service to west and northwest Wichita, covers southeast Wichita, decreases access on Saturdays and reduces service by one hour.
Concepts D1 (Extension) and D2 (Commuter): Not applicable. Commuters are unlikely to access recreational resources outside their communities.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

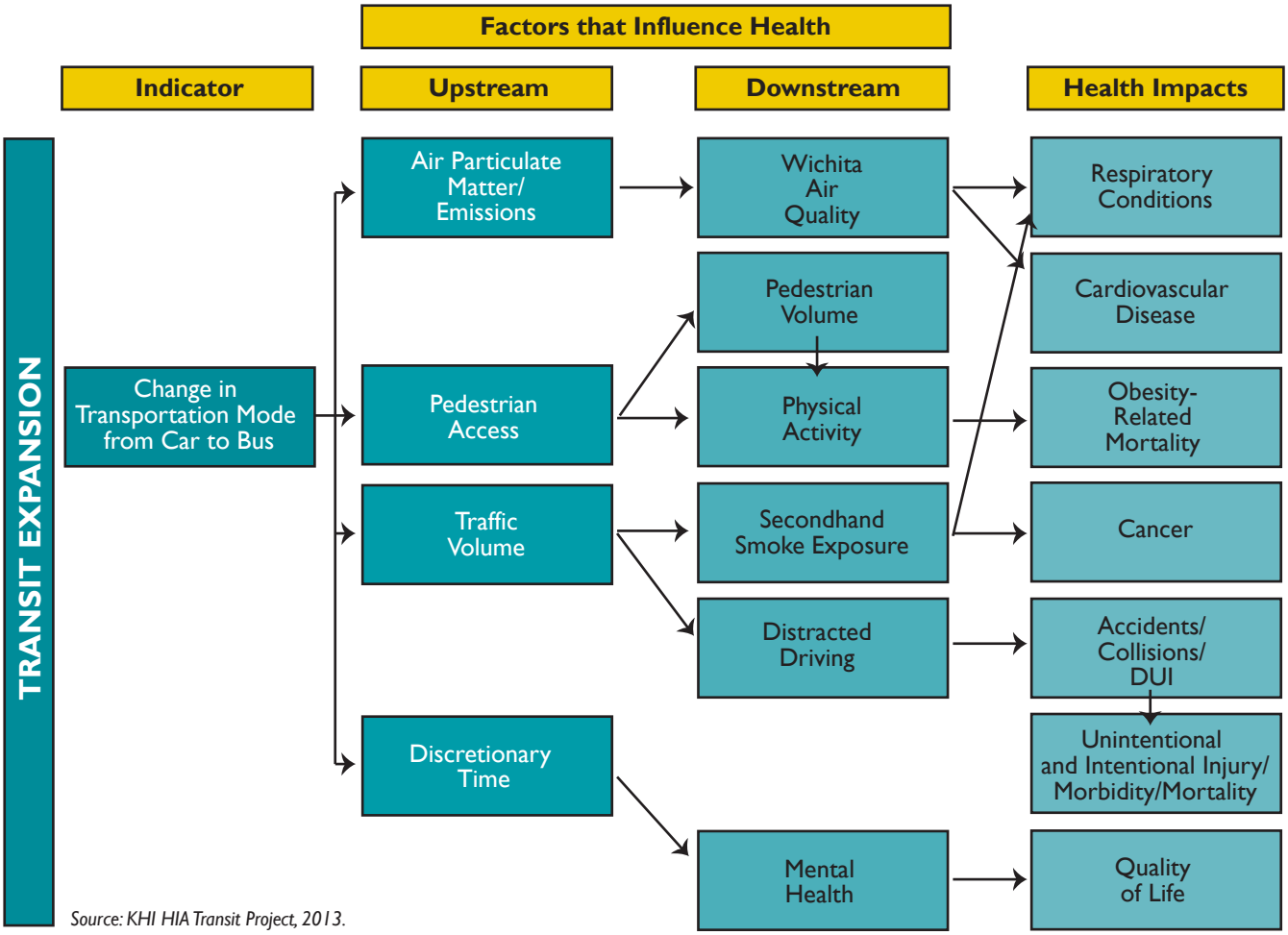


Wichita, 2012.

TRANSPORTATION MODE

TRANSPORTATION MODE

Figure 25. Pathway Diagram: How Transit May Affect Health Issues Associated with Change in Transportation Mode from Car to Bus



Source: KHI HIA Transit Project, 2013.

What We Learned from Economic Analysis

Consumer Reports[89] and the American Automobile Association (AAA)[90] produce estimates of the costs of car ownership. The most recent Consumer Reports study (2012) estimates carrying costs (those tied to vehicle purchase such as depreciation, interest and taxes) and operating costs (those associated with ongoing driving such as fuel, insurance and maintenance) for several makes and models of cars, averaging those costs over five years of ownership. Average annual costs range from $5,000 (Toyota Prius C) to $21,500 (BMW 750Li). The median car costs over $9,100 annually. That figure mirrors AAA's most recent estimates for operation of a medium-size sedan. Based on annual mileage of 15,000 miles per year, these figures equate to 61

cents per mile. The Internal Revenue Service publishes annual mileage reimbursement rates for business use of private vehicles. The rate for 2012 taxes filed in 2013 was 55.5 cents per mile.

Most car ownership costs are fixed and do not vary with the number of miles traveled. Consumer Reports calculates that 72 percent of ownership costs can be attributed to depreciation, interest, insurance and taxes. The remaining 28 percent is for fuel and maintenance/repair.

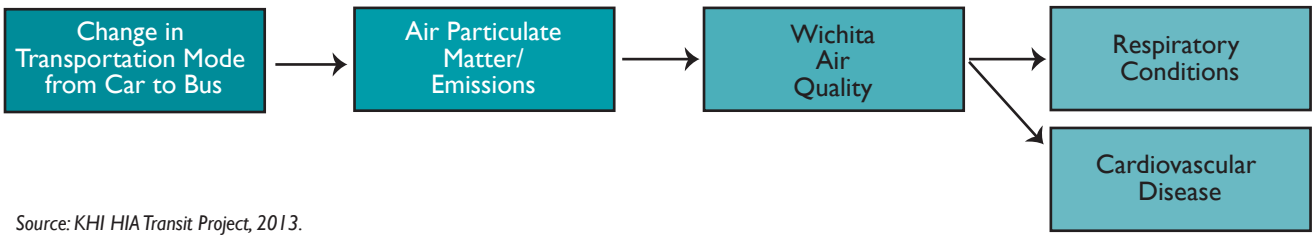
The Federal Highway Administration's 2009 National Household Travel Survey[91] reports that the average household makes 2,068 trips per year: 22 percent to and from work, 23 percent shopping, 24 percent family and personal errands, 10 percent school- or church-related, 21 percent social or recreational, and 10 percent other. The average trip length was 9.7 miles, based on averages of 12.2 miles round trip for work, 6.4 miles for shopping, 7.1 miles for errands and 11.2 miles for social/recreational activities.

In general, vehicle-owning individuals can decrease their out-of-pocket expenditures by using Wichita public transit. However, these savings may not be realized when the value of their time is considered. Current bus fares are $38 for a 20-trip pass with transfer, so that a round trip would average $3.80. Out-of-pocket costs for individuals who commute via transit five days a week, 50 weeks a year, total $950 per year. Using the 61 cents per mile cost of travel for a round trip to work of 12.2 miles, annual vehicle commute costs would be $1,861. Individuals commuting via transit would therefore save over $900 a year on average. However, under the current Wichita Transit System, bus ridership requires longer trip times. These estimates also value the cost of car travel at the full cost of ownership and operation, rather than the variable cost of fuel and maintenance — the primary source of savings for commuters who ride the bus and continue to own a car.

Wichita, 2012.

Air Quality

Figure 26. Pathway Diagram: How Transit May Affect Air Particulate Matter



Source: KHI HIA Transit Project, 2013.

Key Findings

- In terms of overall air quality, high ozone levels are the primary concern for Wichita.
- Ozone levels depend on many things, including other pollution sources, weather, type/age of vehicle engine and fuels used.
- Projected increases in transit ridership under Concepts A (Grid) and B (Optimization) could improve overall air quality but may not decrease ozone levels.
- Concept A (Grid) may increase ridership the most and reduce the number of cars on the road, potentially improving overall air quality. However, because ridership levels in Wichita are so low, even doubling ridership may not have much effect.
- The most likely way to affect local air quality through the transit system is to change the type of buses used (e.g. switching from diesel to compressed natural gas).

Recommendations

Wichita Transit should consider:

- Implementing various strategies, including those suggested in the HIA report, to increase ridership and thereby improve overall air quality in Wichita.*
- Continuing to assess the feasibility, costs and benefits of incorporating clean natural gas or electric buses into the current fleet.
- Using available tools such as the Diesel Emissions Quantifier (DEQ) to determine Wichita-specific effects of transit fleet changes on air quality.

- Continuing to replace and/or modify aging buses to improve air quality.
- Identifying best practices for the placement of bus shelters in order to minimize people's exposure to air pollutants from passing traffic.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Overall Health Impacts

There is a strong association between the number of vehicle trips/miles traveled and vehicle emissions that cause air pollution.[92] The longer that a vehicle is in use (e.g. long commute times), the more air pollution the vehicle will create.[93] Air pollutants from vehicle emissions are associated with respiratory problems, including asthma attacks and lung cancer, myocardial infarction, diabetes mellitus, birth defects, fatigue, headaches and eye irritation.[94, 95] Public transit may counteract the negative impacts of air pollution due to fewer vehicles on the road.

The emission compounds that vehicles produce can create ozone (better known as smog), which is an irritant that causes coughing, damages lung tissue and exacerbates respiratory illness.[96] Ozone is also linked to an increase in asthma attacks, which is why researchers believe that reducing air pollutants would decrease childhood asthma.[97] Carbon monoxide, another byproduct of vehicle emissions, is a poisonous gas that decreases the body's ability to transport oxygen.[98] Vulnerable populations for both of these byproducts are children, the elderly and adults with respiratory conditions.[99]

What We Learned from the Community

Community members who met with the HIA team expressed interest in transit's effects on ambient air quality and the localized air quality that transit riders and bus drivers experience. One community member, Kent Rowe, Ph.D., volunteered to evaluate the quality of air at the transit center, on transit buses and at bus stops. His study focused on air quality measurements at specific transit locations throughout Wichita and a review of relevant literature. There were four main concerns raised in his study. The first focused on the potential dangers posed by hydrocarbon and respirable carbon particulate levels in bus stop shelters and alongside idling diesel buses. Specifically he found that total hydrocarbon levels consistently ranged between 40 and 60 parts per million, and that confined space and short-term exposure limits for diesel exhaust emissions exceeded federal guidelines. Transit shelters that open toward the street increase riders' exposure to vehicle exhaust.[100]

Another concern in the Rowe study centered on the potential negative health effects of bus exhaust in conjunction with exposure to secondhand smoke (potential creation

of phosgene gas), because there are currently no restrictions on smoking at bus stops. The HIA team's literature review found mixed results on what level of phosgene gas is formed from the combination of exhaust and cigarette smoke, although studies have found that it can be formed in those situations. Lastly, Rowe's two other findings included that potential negative health effects could result from injury due to slick spots on the pavement at the transit center, and there is also potential for injury on the bus when traveling over rough streets and potholes.

What We Learned from the Literature

There are two main concerns when discussing air pollution and public transit versus individual car travel: exposure of the individual during their commute and overall increase of air pollution in the atmosphere. At the individual level, bicyclists have the highest exposure to air pollutants due to their increased respiratory rate while in traffic.[101] Individuals also are exposed to air pollutants while they are in a vehicle. Diesel and gasoline buses can create the highest exposure to air pollutants.[102, 103] Electric buses emit significantly fewer air pollutants than diesel buses.[104] Older buses have higher particulate matter and other air pollution than newer buses.[105, 106] Other factors, such as bus idling, window position and shelter orientation, can affect the air quality within the bus.[107, 108, 109] Diesel alternatives like compressed natural gas have been shown to emit 90 percent less particulate matter than diesel-run buses.[110]

The second potential effect of buses is on the overall increase of air pollution as compared to cars. Transportation is the largest end-user of energy (end-user means that the product has been refined and excludes any original uses of energy materials such as oil used to make plastic), so the energy-saving effects of decreased car use could be substantial.[111] In the United States, private passenger vehicles use approximately 1.6 times greater energy per passenger mile than transit buses.[112] Because buses are used as an alternative to single-vehicle trips, they can decrease automobile congestion and the associated environmental emissions.[113, 114, 115] High numbers of vehicle trips and vehicle miles traveled are associated with an increase in air pollution.[116, 117]

The type of fuel used has a large impact on the effects of the bus on air quality. As detailed earlier, diesel buses have greater adverse effects on air quality as compared to other types of fuel. Ultra-low-sulfur diesel, which releases fewer emissions, and compressed natural gas, were shown to provide more health benefits than diesel.[118] The U.S. Environmental Protection Agency (EPA) required all highway diesel fuel to be ultra-low-sulfur diesel (ULSD) by the end of 2012.[119]

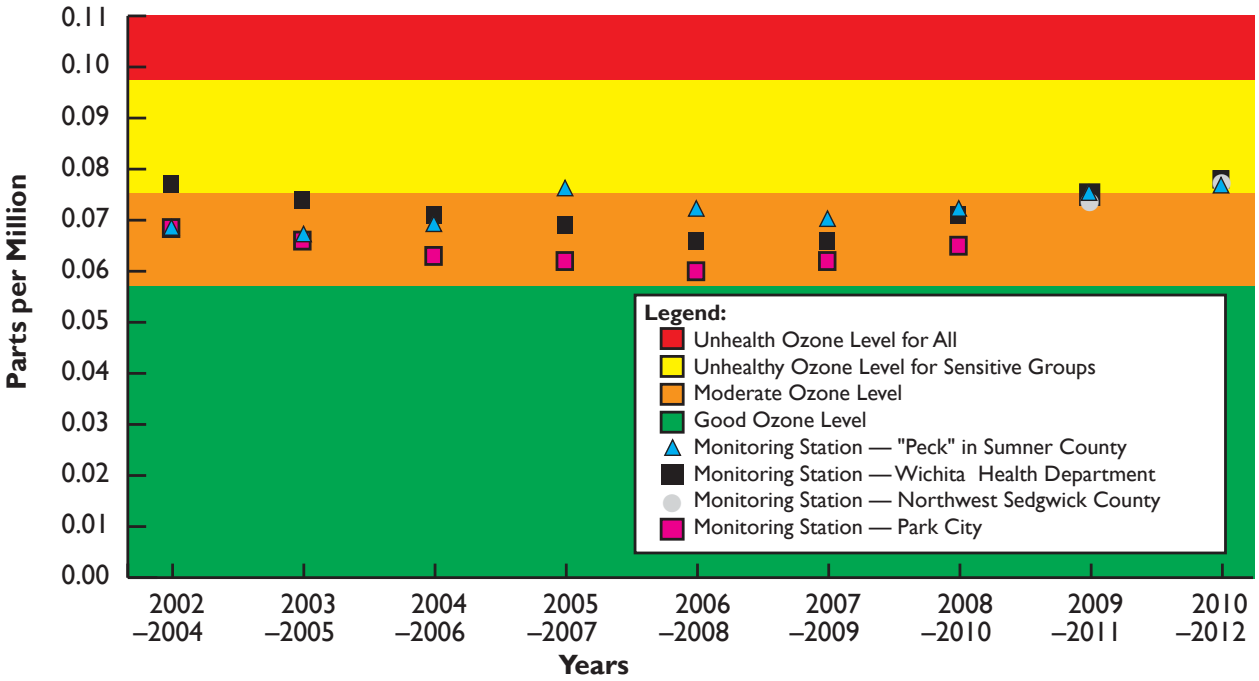
What We Learned from Data

In recent years, Wichita's ambient ozone levels have reached levels considered unhealthy for sensitive groups — those with lung disease, older adults and children — based on current EPA standards, as shown in Figure 27. The EPA also has standards for four other major ambient air pollutants: particulate matter, carbon monoxide, nitrogen dioxide and sulfur dioxide. Based on data from Wichita area air quality monitoring stations, the levels of these other major ambient air pollutants (excluding ozone) are consistently at acceptable levels based on the EPA standards.

The relationships among transportation mode, vehicle emissions, ambient ozone levels and health outcomes in Wichita is quite complex. Although we would expect overall air quality to improve with increased transit use, the HIA team didn't attempt to estimate changes in ozone levels or health outcomes based on changes to the transit system. We were unable to quantify how much air quality, particularly ozone levels, might change within the timeframe of this study for several reasons:

- As we learned from the literature, the type and volume of vehicle emissions can vary significantly depending on the type and size of engine as well as the type (e.g., gasoline, ultra-low-sulfur diesel, compressed natural gas or electric) and amount of fuel used.

Figure 27: Three-Year Averages of High Ozone Levels in Wichita



Source: Kansas Department of Health and Environment, Bureau of Air Monitoring and Planning Data on Eight-Hour Ozone Exceedances of National Ambient Air Quality Standards (NAAQS).

- Whether and how much ozone is produced in the lower atmosphere depends on environmental factors such as weather conditions and levels of other non-motor-vehicle-generated airborne pollutants.
- Based on Wichita Area Metropolitan Planning Organization travel survey data, a large majority of trips that Wichita residents take are by private vehicle (approximately 91 percent) and very few (about 0.5 percent) are by transit. As a result, even a very large change in transit ridership (doubling the number of transit riders) results in a very small change (less than 0.5 percent) in other motor vehicle trips.

Table 28: Age of Wichita Transit Fleet Buses

Number	Model Year	Type	Age in 2013
34	2002	Diesel	11 years
5	2005	Diesel	8 years
5	2006	Diesel	7 years
4	2013	Diesel*	0 years
48	**Average Age of Fleet:**		**9.4 years**

*Just this year, Wichita Transit purchased four new diesel buses to replace four 2001 model-year diesel buses.
Source: Personal communication with Michelle Stroot of Wichita Transit, 2013.

Even with the current bus routes and schedules, changes to the transit bus fleet have the potential to improve air quality in the city and surrounding areas. Until Wichita Transit purchased four new buses earlier this year, all 48 diesel buses in the fleet were manufactured before the latest EPA standards for diesel bus emissions went into effect. Thirty-four buses in the fleet were manufactured in 2002 and are approaching the end of their useful life (which is 12 years) as shown in Table 28. The four newest buses cost $368,000 each, have lower maintenance costs and are expected to get almost 10 percent better gas mileage than the existing fleet. The new buses have diesel engines that meet 2010 EPA emission standards, in part by burning an additive called diesel exhaust fluid. Ten more diesel buses have been ordered and are expected to arrive in 2014. In addition to purchasing new diesel buses, the Wichita City Council approved funding for a compressed natural gas feasibility study for Wichita Transit to be completed in August 2013.

Health Implications for Wichita

According to the research findings, increased transit ridership has been associated with declining car use. One of the potential benefits of decreased car use is improved air quality, which in turn is associated with positive health effects such as lower asthma rates and decreases in other respiratory conditions. Stakeholders expressed concerns about local air quality but were divided on whether proposed changes to the existing transit system would be sufficient to affect air quality.

The data analyses for Wichita suggested that Concepts A and B would likely result in a slight decrease of personal car use. However, Concept C would not yield the same benefit. It is important to note that improvement in air quality would also depend on the type of buses used in Wichita.

Table 29. Impact of Transit on Air Quality and Potential Health Impacts

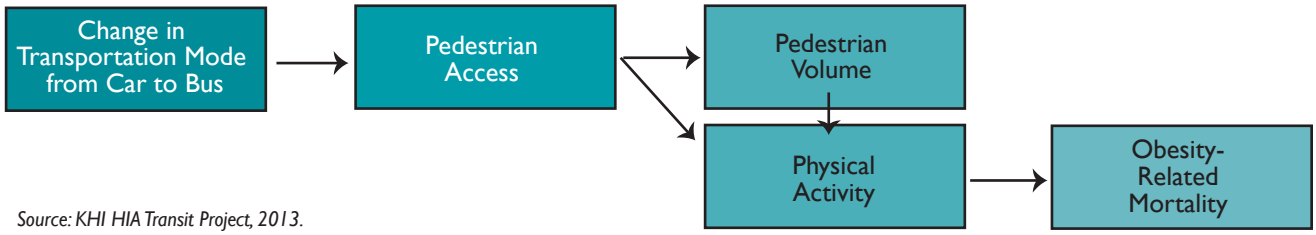
Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
CHANGES IN MODE OF TRANSPORTATION FROM CAR TO BUS						
Air Quality						
A (Grid)	Decrease	Positive	Low	Unlikely	Wichita community members, people with respiratory conditions, children	***
B (Optimization)	Decrease	Mixed	Low	Unlikely		
C (Reduction)	Increase	Negative	Low	Unlikely		

Concept A: Passenger vehicle miles traveled are estimated to decrease by about 0.13 percent or 5.1 million miles per year.
Concept B: Is estimated to yield a similar change in passenger vehicle miles — a decrease of about 0.12 percent or 4.9 million miles per year.
Concept C: Is estimated to increase passenger vehicle miles by about 0.04 percent or 1.6 million miles a year.
Concepts D1 (Extension) and D2 (Commuter): Not applicable.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

Wichita, 2012.

Pedestrian Access

Figure 28. Pathway Diagram: How Transit May Affect Pedestrian Access



Source: KHI HIA Transit Project, 2013.

Key Findings

- People who have an employer-sponsored transit pass are more likely to use transit to get to work and meet physical activity recommendations.
- Increases in ridership under Concept A (Grid) can be expected to translate into additional community health care savings of $76,141 per year due to walking and receiving the recommended physical activity. Concept B (Optimization) would yield similar savings of $72,528 per year and Concept C (Reduction) would *decrease* the level of current health care savings by $24,231 per year.

Recommendations

Wichita employers in collaboration with Wichita Transit should consider:

- Subsidizing the cost of bus passes to encourage ridership over car use and improve employee health status.*

Wichita Area Metropolitan Planning Department in collaboration with Wichita Transit should consider:

- Placing bus stops in locations that are connected to sidewalks, crosswalks, and pedestrian and bike paths when possible.*
- Integrating and aligning transit plans with city zoning.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Overall Health Impacts

A potential benefit of public transit is increased walking time.[120, 121] Physical activity helps people control weight, strengthen bones and muscles, and improve mental health.[122] Exercise also reduces the risk of cardiovascular disease, type 2 diabetes, and cancer.[123] Walking is a particularly beneficial activity because it is low-impact exercise, which is often easier for older and disabled people. Walking can contribute to decreasing low-density lipoprotein cholesterol (the "bad" cholesterol) and increasing high-density lipoprotein cholesterol (the "good" cholesterol). It can also lower blood pressure, help manage type 2 diabetes and control weight.[124] Research shows that brisk walking is able to reduce the risk of heart attack just as well as vigorous exercise.[125] Research on the built environment and obesity link increased time spent in a car (such as commuting) and risk of obesity.[126, 127, 128]

While highlighting increased physical activity, it is important to note the air quality of the region and increased breathing rate when walking. As discussed earlier in the report, bicyclists had the greatest exposure to air pollution due to their increased respiratory rate along roads. A person walking to a transit stop would be exposed to the same pollution. However, a recent study found that the benefits from physical activity outweighed the risks of exposure to air pollution.[129]

What We Learned from the Community

Stakeholders were interested in the issue of pedestrian access as it relates to transit. They stipulated that city planning, including the placement of sidewalks, bike paths and destinations, should be integrated with transit services in order to facilitate ridership and access to services. According to the *Wichita Public Transportation Survey*, half of the respondents said they would choose to walk shorter distances to bus service that is slower and less direct, while the other half of respondents would be satisfied walking longer distances to bus service that is faster and more direct (50 percent). Survey responses suggest that incorporating pedestrian access is important to riders, but that decision-makers should consider all factors, including walking distances, frequency of services and direct routes.

What We Learned from the Literature

Public transportation users potentially achieve up to 30 minutes of physical activity each day simply from walking to and from transit.[130] One review of the literature on walking to public transit found that a range of eight to 33 minutes of walking are added if someone uses public transit.[131] Easy-to-access public transportation access points, such as a bus stop, increase levels of walking and make it more likely that people meet their physical activity recommendations.[132, 133] In an Atlanta study, transit

users had fewer car trips and more walking distance covered.[134] Although these studies have connected public transit and physical activity, there may not be sufficient evidence to support a causal link.[135]

The Atlanta study looked at the effects of an employee-sponsored transit pass and found that people with the pass were more likely to meet their physical activity recommendations.[136] In a review of employee-sponsored transit passes, ridership generally increased with this benefit.[137] The program also induced commuters who were driving alone to work to switch to riding transit.[138] Employees used the pass for both work and non-work trips, especially if the voucher is in monthly and annual pass form.[139] The cost of the pass for an employer can be deducted from payroll taxes or the employee can use pre-tax income to buy a pass.[140]

Table 30. Estimated Change in Number of Wichita Residents Meeting Physical Activity Needs With Changes in Transit

Potential Savings Related to Physical Activity in 2013 Dollars							
	Estimated Annual Person Trips for Population	Estimated Individuals — "FTE"	Percent of Transit Riders that Meet Physical Activity Needs by Walking — 29% of Transit Riders	Normal Weight (BMI ≤24.9) 29.6%	Overweight (BMI 25–29.9) 45.5%	Obese (BMI ≥30) 24.9%	Total Estimated Savings
Baseline – (2012) Trips, FTE, etc.	1,933,925	1,602	465	$31,494.09	$40,206.20	$69,900.53	$141,601
Estimated Change in Each Variable By Transit Concept							
Change By Concept	**Estimated Annual Person Trips for Population**	**Estimated Individuals — "FTE"**	**Percent of Transit Riders that Meet Physical Activity Needs by Walking — 29% of Transit Riders**	**Normal Weight (BMI ≤24.9) 29.6%**	**Overweight (BMI 25– 29.9) 45.5%**	**Obese (BMI ≥30) 24.9%**	**Total Potential Savings**
Concept A (Grid)	1,039,908	861	250	$16,934.97	$21,619.63	$37,586.84	$76,141
Concept B (Optimization)	990,560	821	238	$16,131.34	$20,593.69	$35,803.19	$72,528
Concept C (Reduction)	-330,938	-274	-80	-$5,389.34	-$6,880.18	-$11,961.54	-$24,231

Source: KHI calculations based on ridership estimates and published physical activity and health care cost data.

What We Learned from Data

One study[141] found that 29 percent of transit riders achieve 30 minutes or more of daily physical activity by walking to and from transit. That percentage — along with estimated changes in ridership for each concept and an estimate of health care costs related to physical activity[142] — was used to estimate the potential population health savings associated with riders walking to and from transit service. Based on current ridership levels, the Wichita community currently saves an estimated $142,000 a year in health care costs for transit riders. Under Concept A, the community would save an estimated additional $76,141, and under Concept B the community would save an estimated additional $72,528 annually. With decreased ridership under Concept C, the community's health care savings would *decrease* by $24,231 each year. (Table 30, page 63).

Health Implications for Wichita

Individuals who take public transit are more likely to spend time walking and engaging in other forms of physical activity. Walking to and from transit can help physically inactive people get their recommended level of physical activity, and studies have shown that people who utilize public transit increase physical activity in other parts of their life. Concepts that increase ridership could yield these results. According to the data analysis, Concept A would increase transit ridership more than Concept B while Concept C would result in decreased ridership. Thus, Concept A would likely result in greater positive health impacts, such as reduced obesity-related mortality, associated with increased physical activity.

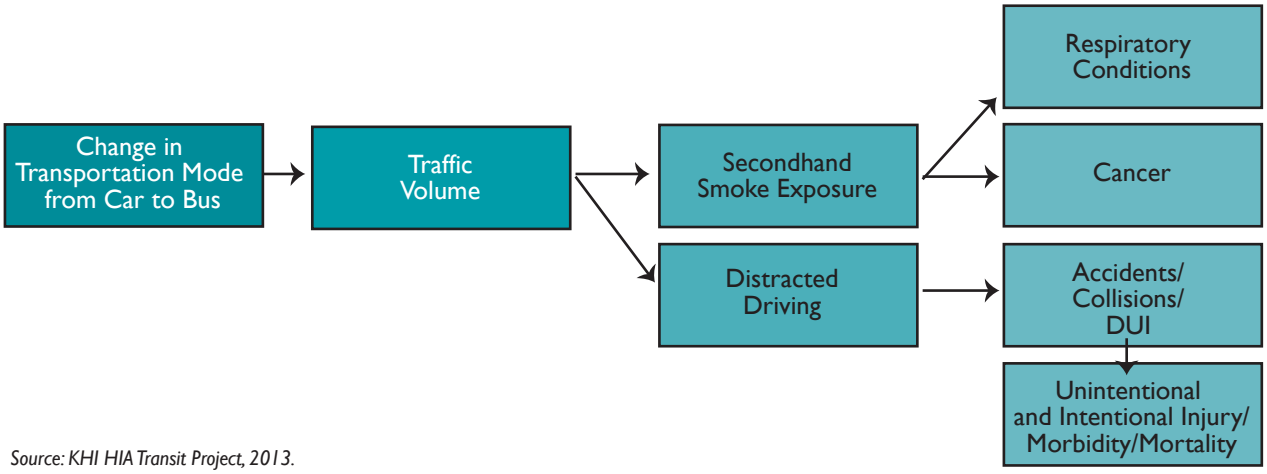
Table 31. Impact of Transit on Pedestrian Access (Physical Activity) and Potential Health Effects

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
CHANGES IN MODE OF TRANSPORTATION FROM CAR TO BUS						
Pedestrian Access						
A (Grid)	Increase	Positive	Medium	Likely	Wichita community members, employees	***
B (Optimization)	Increase	Positive	Medium	Likely		
C (Reduction)	Decrease	Negative	Medium	Possible		

Concept A: Increases ridership by 1,039,908 rides — moderate number of people will yield benefits associated from walking to and from transit.
Concept B: Increases ridership by 990,560 rides — moderate number of people will yield benefits associated from walking to and from transit.
Concept C: Decreases ridership by 330,938 rides — less people will yield benefits associated from walking to and from transit.
Concept D1 (Extension) and D2 (Commuter): Not applicable.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

Traffic Volume, Distracted Driving and Secondhand Smoke

Figure 29. Pathway Diagram: How Transit May Affect Traffic Volume



Source: KHI HIA Transit Project, 2013.

Traffic Volume

Key Findings

- Bus occupants had the least risk of injury as compared to car or bike users, pedestrians or motorcycle riders.
- Vulnerable populations, such as the elderly or children, are at a greater risk for fatal injuries.
- Traffic volume and population density are the main influencers on crashes involving pedestrians.
- There is a threshold effect that shows that as more people walk or bike, injuries decrease due to greater awareness among drivers.
- Because so many of the trips Wichita residents take are by car, the estimated changes in transit ridership result in very small changes in daily vehicle miles traveled.
- Wichita would observe annual savings due to reduced traffic injuries for Concept A ($532,000) and Concept B ($513,000). However, for Concept C, the cost of traffic injuries would increase by $172,000.

Recommendations

Wichita City Council should consider:

- Choosing the concept that will have the largest increase in ridership and the largest reduction in motor vehicle-related injuries and deaths.

The Wichita Area Metropolitan Planning Department should consider:

- Continuing to plan and create an infrastructure conducive to walking and biking in order to meet the threshold for reducing pedestrian-related injuries.*

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

"My understanding is that it (transit) is perhaps a healthy alternative to regular transportation."

— Community Stakeholder

Distracted Driving

Key Findings

- In general, one in six fatal vehicle collisions results from distracted driving.
- The HIA team estimates that 80 percent of new transit riders will have switched from driving to public transit.
- As a result of switching to public transit under Concept A, about 0.19 percent fewer individuals would encounter the risk of distracted driving annually. Under Concept B, 0.18 percent fewer individuals would encounter the risk of distracted driving annually. However, under Concept C, 0.06 percent more individuals would encounter distracted driving annually.

Recommendations

The Sedgwick County Health Department and health advocacy organizations should consider:

- Increasing efforts (e.g. publications, announcements and/or media) to inform car users about the health risks associated with distracted driving.
- Utilizing ad spaces on buses and shelters to highlight the benefits of transit as a way to reduce distracted driving.

Secondhand Smoke Exposure

Key Findings

- One in five children is exposed to secondhand smoke in cars. Switching from car to bus, where smoking is not allowed, could help decrease children's exposure

"I am interested in the change in dynamic from an automobile society to one that uses public transportation."

— Community Stakeholder

to secondhand smoke. However, the health effects will depend on an individual's overall exposure to secondhand smoke and the extent of use of public transit versus a car.

Recommendations

The Sedgwick County Health Department and health organizations should consider:

- Increasing efforts (e.g., publications, announcements and/or media) to inform car users about the negative health impacts of secondhand smoke exposure in cars on adults and especially children.*
- Utilizing ad spaces on buses and shelters to disseminate information to highlight the benefits of transit as a way to reduce exposure to secondhand smoke.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Overall Health Impacts

Public transit users may benefit from several potential positive health effects associated with decreased traffic volume (fewer vehicle-related injuries), decreased exposure to secondhand smoke and decreased distracted driving. Research findings suggest that bus occupants have a lower risk of injuries in comparison with people who use other modes of transport. However, the increased use of transit stops have been associated with more pedestrian/motor-vehicle collisions.[143] Effective strategies to address this issue include increasing the number of people walking and biking (threshold effect) and improving pedestrian and bicycle infrastructure (e.g., continuous sidewalks, signed and marked crosswalks). In addition, people who use public transit reduce their risk of being involved in a car accident. This is especially true for distracted driving, which causes one out of six accidents.

People who switch from driving a car to riding a bus also can reduce their exposure to secondhand smoke, as smoking is not permitted on any of the Wichita buses. Potential positive health impacts associated with reduced exposure to secondhand smoke include decreased risk of lung disease, heart disease and respiratory conditions. However, transit users might be exposed to secondhand smoke at the bus stops and experience associated health risks. To mitigate negative health consequences associated with exposure to secondhand smoke, a number of states passed restrictions prohibiting smoking in bus stops.

What We Learned from the Community

Traffic Volume

Community members and stakeholders cited traffic volume as an issue that transit might affect. Stakeholders suggested that if more residents choose transit over driving, it might cause positive health effects, including fewer traffic accidents. Additionally, community members expressed their interest in choosing a concept that would promote changing the dynamic in Wichita from an automobile society to one that uses public transportation. In considering Concept Ds' Commuter and Extension routes connecting outlying cities to Wichita, stakeholders thought it would encourage commuters to use transit, also reducing traffic congestion. In fact, in the *Wichita Public Transportation Survey*, 64 percent of respondents living in outlying cities said they would use a park-and-ride service if it met their transportation needs, indicating support of stakeholders' assertions.

Secondhand Smoke Exposure and Distracted Driving

Stakeholders expressed an interest in improving health through transit by reducing the number of distracted drivers and lowering exposure to secondhand smoke in cars. Their hope is that transit will be viewed as a healthy alternative and that this benefit will help raise the awareness of the importance of the system. Literature has suggested that secondhand smoke in cars is dangerous and can negatively affect health, especially for children. Stakeholders were also interested in the potential health effects associated with distracted driving. As a result, the HIA team included this analysis in the report.

The community's interest in transit as an alternative to traditional car transportation should be considered when choosing concepts in an effort to maximize ridership.

What We Learned from the Literature

Traffic Volume

According to the CDC, the leading cause of injury death in the United States is unintentional motor vehicle traffic accidents.[144] Over 30,000 people were killed in 2010 (15.65 fatality rate per 100,000 licensed drivers) and over 2.2 million people were injured (1,066 injury rate per 100,000 licensed drivers).[145] Ninety-seven percent of vehicles involved in police-reported crashes were passenger vehicles (e.g., passenger cars and light trucks).[146] In 2010, Kansas saw a 12 percent increase in traffic fatalities from 2009.[147] Sedgwick County has a rate of 14 motor vehicle crash deaths per 100,000 population, which is above the national benchmark of 12 vehicle crash deaths per 100,000.[148] As seen in these rates, vehicle accidents are a principal public health concern.[149]

When examining rates, motor vehicle fatalities are the highest of the modes of transportation (e.g., car versus walking), but the picture is very different when examining risk.[150] Studies have found that when comparing injury risk by transportation mode, bus occupants had the least risk of injury as compared to car or bike users, pedestrians or motorcycle riders (Table 32, page 70).[151, 152] An important note is that these numbers are only for the time that the person is inside the vehicle or bus; this does not take into account injuries or fatalities sustained during the walk to and from the bus or vehicle.

Traffic accidents involving pedestrians can be particularly devastating, especially when the vehicle is traveling at speeds over 30 mph.[153] Some populations are more vulnerable to fatal injuries, and differences in age group fatality rates are the first discrepancy. The highest overall fatality rate is among the 15–24 age group, followed by people older than 65.[154] The pedestrian groups most vulnerable to injury are the elderly and children.[155] Children have the most injuries, and the elderly have the most fatalities.[156] There is no gender difference in fatality rates among bus occupants, although males have higher fatality rates than females in other modes of travel.[157] Pedestrian crashes are also disparate, with higher levels of pedestrian crashes associated with low-income areas, and, for children, socioeconomic status and race.[158] The main influence on pedestrian crashes is traffic volume and population density.[159] A study conducted in San Francisco associated higher pedestrian crash rates with a high number of arterial streets without transit service.[160]

It would seem that as more people walk, such as traveling to and from the bus terminal, there will be more injuries and deaths to pedestrians, but there is a potential "threshold effect" that influences fatality and injury risks. This hypothesis states that as more people walk or bike, fatality or injury rates will decrease.[161] Studies looking at data from Australia,[162] the United States and European countries[163] found that this effect is consistent across communities. This may be due to motorists becoming more accustomed to pedestrians and cyclists and changing their behavior to more defensive driving.[164] Due to the relatively low number of Kansans who walk (31.2 percent)[165] or bike (8.8 percent)[166] to and from work, to run errands or for other travel, Kansas has probably not reached a threshold to protect pedestrians and cyclists.

Secondhand Smoke Exposure

According to a study by the California Environmental Protection Agency, secondhand smoke in cars can be 10 times more concentrated than the level considered unhealthy by the U.S. Environmental Protection Agency.[167] Literature shows that secondhand smoke in cars can cause negative health effects, especially among children. A study that focused on an ethical analysis of secondhand smoke policies stated that exposure is a known contributor to lung cancer, heart disease and sudden infant death

Table 32: Fatal and Non-Fatal Injury Rates by Travel Mode (Per 100 Million Person-Trips)

Mode of Travel	Non-Fatal Injury Rate	Fatal Injury Rate	Total Death/ Injury Rate
Motorcycle	10,336.6	536.6	10,873.2
Other Vehicle	1,020.6	28.4	1,049.0
Bicycle	1,461.2	21.0	1,482.2
Walking	215.5	13.7	229.2
Passenger Vehicle	803.0	9.2	812.2
Bus	160.8	0.4	161.2
Total	754.6	10.4	765.0

Source: Beck, L. F., Dellinger, A. M., & O'Neil, M. E. (2007). Motor vehicle crash injury rates by mode of travel, United States: Using exposure-based methods to quantify differences. American Journal of Epidemiology, 166(2), 212–218.

Table 33: Modes of Travel Wichita Residents Use by Number of Trips

	Estimate of Annual Person Trips (2010)	Estimated Share of All Person Trips (2010)
Motor Vehicle:		
Private Vehicle	409,988,423	91.25%
Public Bus/Transit (Actual Ridership Data)	1,933,925	0.43%
Motorcycle	1,007,684	0.22%
School Bus	12,561,247	2.80%
Commercial Vehicle and Other	7,893,081	1.76%
Subtotal for Motor Vehicles	433,384,360	96.46%
Bicycled	1,978,638	0.44%
Walked	13,943,309	3.10%
Grand Total	449,306,308	100.00%

Source: KHI estimates based on the Wichita Area Metropolitan Planning Organization Household Travel Survey data, National Household Travel Survey data and Wichita Transit Ridership data.

Table 34. Estimated Changes in Wichita Vehicle Miles Traveled Based on Estimated Changes in Passenger Trips

Changes in Wichita Daily Vehicle Miles Traveled (DVMT)*	Concept A	Concept B	Concept C
Estimated Changes in DVMT Based on Estimated Changes in Vehicle Trips	-14,040	-13,373	4,468
Estimated Percent Change in DVMT	-0.13%	-0.12%	0.04%
Estimated Change in Annual VMT	-5,124,462	-4,881,285	1,630,796

*Wichita 2011 DVMT: 11,075,528.
Source: KHI estimates based on KDOT Daily Vehicle Miles Traveled and estimated changes in passenger vehicle trips.

syndrome. Legislation banning smoking in cars with children has been introduced in Kansas but has not been passed.[168]

Distracted Driving

Literature shows that distracted driving has become a major health issue in recent years. The CDC reported that activities like texting take the driver's attention away from the road more frequently and for a longer time than other distractions. Younger, inexperienced drivers — those under the age of 20 — have the highest proportion of fatal crashes that involve distracted driving. The CDC also reported that almost one in five crashes (18 percent) involved an injury resulting from distracted driving. Nationwide, over 3,000 people were killed and 387,000 were injured in 2011 due to distracted driving.[169] According to a study published in the *American Journal of Public Health*, fatalities from distracted driving increased 28 percent between 2005 and 2008, with the crashes increasingly involving male drivers colliding with roadside obstructions in urban areas.[170, 171]

What We Learned from Data

Traffic Volume

Based on analysis of the Wichita Area Metropolitan Planning Organization Household Travel Survey, the National Household Travel Survey and Wichita Transit ridership data, the vast majority of trips Wichita residents take are by private passenger vehicle (91.3 percent), as shown in Table 33 (page 70).

Because so many of the trips that Wichita residents take are by car, the estimated changes in transit ridership result in very small changes in daily vehicle miles traveled, as shown in the Table 34 (page 70).

Distracted Driving and Secondhand Smoke Exposure

Distracted driving encompasses a range of behaviors, such as texting or talking on the phone, that take a driver's attention off the road. Drivers may be distracted visually (eyes off the road), manually (hands off the wheel) and/or cognitively (mind off the road). Everyone on the road is at risk of being involved in an accident involving a distracted driver. Additionally, secondhand smoke exposure in vehicles has several negative health effects, especially for children. However, individuals who ride the bus avoid becoming a distracted driver — even if they text and ride — and "no smoking" policies on buses prevent riders who might have otherwise smoked while driving from doing so. Therefore, potential negative health impacts may be avoided if a proportion of these individuals choose to ride the bus rather than drive. Also, motor vehicle accident data clearly indicate that bus riders are less likely to be fatally or non-fatally injured than individuals who drive, walk, bike or ride a motorcycle to their

destination. Though riders are at lower risk while on the bus, the higher injury rates for pedestrians and bicyclist are also important to note because most riders walk to and from the bus.

With the small reductions in travel by other modes that would accompany increases in transit ridership under Concepts A and B, the HIA team predicts small decreases in overall fatal and non-fatal injury rates (Table 36, page 73). Likewise, decreases in transit ridership under Concept C would likely lead to small increases in use of other modes of travel with small increases in the overall fatal and non-fatal injury rates.

What We Learned from Economic Analysis

According to the initial data analysis, the ridership change for each of the transit scenarios is quite small. Consequently, the change in the number of motor vehicle trips and traffic accidents is very small.

The cost of motor vehicle accidents includes wage and productivity losses, medical expenses and property damage to motor vehicles. Estimates of the cost of accidents have been made by many organizations, including the Victoria Transport Policy Institute,[172] CDC,[173] National Highway Traffic Safety Administration[174] and AAA.[175] Many of these cost estimates are calculated in dollars per vehicle mile traveled or dollars per person.

This report uses recent estimates by the National Safety Council,[176] which estimated that for 2011 the average cost of an accident that resulted in death was $1.42 million. The economic cost of non-fatal disabling injury accidents averaged $78,700 and of nondisabling and property damage-only crashes was $9,100. The National Safety

Table 35: Current Wichita Injury Estimates by Mode of Travel

Mode of Travel	Share by Mode	Annual Person Trips	Annual Non-Fatal Injury Estimate	Estimated Number of Annual Fatal Injuries
Motorcycle	0.22%	1,007,684	104.2	5.4
Other Vehicle	4.55%	20,454,328	208.8	5.8
Bicycle	0.44%	1,978,638	28.9	0.4
Walking	3.10%	13,943,309	30.0	1.9
Passenger Vehicle	91.25%	409,988,423	3,292.2	37.7
Bus	0.43%	1,933,925	3.1	0.0
Total	100.00%	449,306,308	3,667.2	51.3

Source: KHI estimates based on estimated changes in ridership and transportation mode usage as well as Beck, L. F., Dellinger, A. M., & O'Neil, M. E. (2007). Motor vehicle crash injury rates by mode of travel, United States: Using exposure-based methods to quantify differences. American Journal of Epidemiology, 166(2), 212–218.

Council did not include estimates for property damage only, but other estimates of comprehensive cost of non-injury accidents were $2,400. Comprehensive costs include estimates of lost quality of life and are calculated using empirical data on what people are willing to pay for improved safety. While these comprehensive estimates are appropriately incorporated into benefit-cost analysis of public safely measures, they are not useful for assessing the economic benefits of changes in traffic resulting from changes in transit ridership.

The National Safety Council estimates that for every traffic fatality in the United States, there are 52 nonfatal disabling injuries and 234 property/minor injury crashes. These numbers are consistent with KHI's estimates that changes in transit ridership for Concepts A and B would cause annual reductions of 0.09 traffic fatalities and a reduction of about five injuries (Table 36). Applying the National Safety Council's cost estimates to the numbers calculated by the HIA team show that the annual economic savings from reduced traffic injuries would be $532,000 for Concept A and $513,000 for Concept B. For Concept C, the annual cost of traffic injuries would *increase* by $172,000. When these figures are spread across the roughly 400 million Wichita vehicle trips per year, cost savings are about 0.1 cent per trip for Concepts A and B, with no measureable change for Concept C.

Health Implications for Wichita

Individuals who use public transit reduce their risk of being involved in a car accident or driving while distracted. In addition, they may experience less exposure to secondhand smoke as smoking is prohibited on buses. However, the extent of these potential positive health impacts would depend upon their exposure to secondhand smoke in other environments, including bus stops. Community stakeholders

Table 36: Changes in Total "Annual Person Trips" by Concept and Associated Change in Estimated Number of Annual Fatal Injuries

Concepts	Change in Annual Person Trips	Change in Annual Non-Fatal Injury Estimate	Change in Estimated Number of Annual Fatal Injuries
Concept A Differences from Baseline	207,982	-5.14	-0.09
Concept B Differences from Baseline	198,112	-4.90	-0.09
Concept C Differences from Baseline	-66,188	1.64	0.03

Source: KHI estimates based on estimated changes in ridership and transportation mode usage as well as Beck, L. F., Dellinger, A. M., & O'Neil, M. E. (2007). Motor vehicle crash injury rates by mode of travel, United States: Using exposure-based methods to quantify differences. American Journal of Epidemiology, 166(2), 212–218.

expressed interest in this issue, particularly emphasizing the importance of addressing exposure to secondhand smoke at bus stops.

According to the data analyses, Concepts A and B would increase transit ridership and slightly reduce traffic fatalities and injuries, as shown in Table 37. Both concepts also could decrease the number of people exposed to secondhand smoke on the bus.

In contrast, Concept C would not increase ridership and or reduce traffic fatalities and injuries. It also might result in more people being exposed to secondhand smoke in cars, as shown in Table 38.

Table 37. Impact of Transit on Traffic Injury and Potential Health Impacts

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
CHANGES IN MODE OF TRANSPORTATION FROM CAR TO BUS						
Traffic Volume						
A (Grid)	Decrease	Positive	Low	Possible	Wichita community members, elderly, children	***
B (Optimization)	Decrease	Positive	Low	Possible		
C (Reduction)	Increase	Negative	Low	Possible		

Concepts A and B: Increased ridership translates to fewer traffic fatalities and injuries.
Concept C: Decreases ridership translates to more traffic fatalities and injuries.
Concepts D1 (Extension) and D2 (Commuter): Not applicable.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

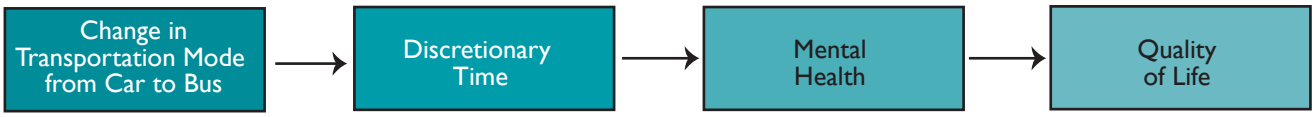
Table 38. Impact of Transit on Distracted Driving and Secondhand Smoke Exposure and Potential Health Impacts

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
CHANGES IN MODE OF TRANSPORTATION FROM CAR TO BUS						
Distracted Driving and Secondhand Smoke Exposure						
A (Grid)	Mixed	Mixed	Low	Possible	Wichita community members, people with respiratory conditions, children	**
B (Optimization)	Mixed	Mixed	Low	Possible		
C (Reduction)	Increase	Negative	Low	Possible		

Concepts A and B: Increased ridership translates into fewer people exposed to secondhand smoke in cars. However, they might be exposed to secondhand smoke at bus stops.
Concept C: Decreased ridership translates to more people exposed to secondhand smoke in cars. This issue is particularly important for children.
Concepts D1 (Extension) and D2 (Commuter): Not applicable.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

Discretionary Time

Figure 30. Pathway Diagram: How Transit May Affect Health



Source: KHI HIA Transit Project, 2013.

Key Findings

- Concept B (Optimization) would save the largest estimated amount of discretionary time — about 141,719 hours a year.
- Concept A (Grid) would save 34,887 hours of discretionary time each year, while Concept C would result in no measureable change in discretionary time.
- The annual value of increased discretionary time would be $1,027,000 ($424 per rider) annually for Concept B and $253,000 ($103 per rider annually) for Concept A.
- The extent of health benefits produced by discretionary time would depend upon its uses.

Recommendations

The Wichita City Council should consider:

- Factoring in average travel times, and wait times in particular, when choosing a concept.
- Choosing a concept that reduces wait times to maximize ridership and increase discretionary time.

What We Learned from the Community

Community members expressed interest in potential health impacts resulting from switching from vehicle to bus transportation. According to the *Wichita Public Transportation Survey*, the factors that were most likely to influence transit use at least once a week were the cost of gasoline going above $5 per gallon (59 percent), transit stops being located closer to homes or most frequent destinations (51 percent) and whether the time it took to use transit versus driving a car was comparable (47 percent). This community input indicates that if certain conditions were met, residents would be more likely to use public transportation rather than drive their

cars. But stakeholders suggested there may be some reluctance in doing so, stating: "There probably wouldn't be any improvement in the amount of discretionary time from switching back and forth from car to bus transport." However, they supported transit concepts with greater route frequency to encourage ridership.

"There probably wouldn't be any improvement in the amount of discretionary time from switching back and forth from car to bus transport."

— Community Stakeholder

What We Learned from Data

The amount of time between buses on the same route, also known as "headway," has an effect on ridership as well as transit riders' available discretionary time. Time spent waiting at a bus stop is time that's generally not available for other activities such as work, recreation or education. The HIA team roughly estimated how service changes might alters riders' discretionary time based on aggregate changes in service frequency during the peak and midday service hours. Currently the median rush-hour wait time for transit service in Wichita is almost 15 minutes.[177] The time between buses and therefore the potential wait time for a bus may be much longer than 15 minutes, depending on the route, time of day and day of week. Wait times may be mitigated if riders have access to bus schedules and use them to avoid extended periods at the bus stop.

Based on aggregate changes in peak and midday bus route frequencies, Concept B would result in the largest estimated amount of discretionary time saved — about 142,000 hours a year, as shown in Table 39. Estimated discretionary time saved under Concept A is about 35,000 hours a year. No discretionary time savings would be expected under Concept C because none of the changes under this concept alter the frequency of scheduled service.

What We Learned from Economic Analysis

Economic theory proposes that individuals face a trade-off between work and leisure. Higher wages make leisure time more expensive because each additional hour of leisure costs more in foregone wages. On the other hand, increased wages boost income, which makes it possible for a worker to afford more leisure. The final

Table 39. Changes in Discretionary Time for Transit Riders

Concept	Average Minutes Between Buses (Peak and Midday)*	Minutes Saved (+) / Spent (-) Per Trip	Annual Change in Person Trips	Annual Total Transit Hours Saved (+) or Lost (-)
Current System	45.0	—	—	—
Concept A (Grid)	41.8	3.2	647,001	34,887
Concept B (Optimization)	29.3	15.7	541,256	141,719
Concept C (Reduction)	45.0	0.0	—	—

*Based on Olsson Associates and Wichita Transit data.

Source: McCarthy Snyder, N., & Bannon, C. (2013). Economic Analysis of Health Impact Assessment of Wichita Transit. Wichita, KS: Hugo Wall School of Urban and Public Affairs.

outcome depends on individual workers' preferences for income and leisure and on wage rates, which are determined by the supply and demand for labor. From an economic perspective, the value of leisure is the value of foregone income, typically measured as hourly wage. While all discretionary time is not available for what most people consider "leisure," the economic theory applies to all time not allocated to paid employment.

In general, vehicle-owning individuals can decrease their out-of-pocket expenditures by using Wichita public transit. However, these savings may not be realized when the value of their time is considered. Current bus fares are $38 for a 20-trip pass with transfer, so a round trip would average $3.80. Out-of-pocket costs for individuals who commute via transit five days a week, 50 weeks a year, total $950 per year. Using the 61 cents per mile cost of travel for a round trip to work of 12.2 miles, annual vehicle commute costs would be $1,861. Individuals commuting via transit would therefore save over $900 a year on average. However, under the current Wichita Transit System, bus ridership requires longer trip times. These estimates also value the cost of car travel at the full cost of ownership and operation, rather than the variable cost of fuel and maintenance — the primary source of savings for commuters who ride the bus and continue to own a car.

The HIA team estimates that the annual increase in discretionary time would be 34,887 hours under Concept A and 141,719 hours under Concept B. Concept C would result in no measureable change in discretionary time. Assessing the economic impact of these savings on health requires an estimate of the value of increased leisure time. The Texas Transportation Institute at Texas A&M University produces annual Urban Mobility Reports[178] that estimate the time and dollar cost of traffic congestion. For the 2012 estimates the institute used an hourly rate of $16.79, which is a national figure based on a theoretical construct of value of time rather than average wages. The Kansas Department of Labor produces an annual wage survey for the Wichita metropolitan statistical area.[179] The 2012 survey showed a median wage of $15.14 for all occupations in 2011.

Evidence indicates that bus riders have below-average wages. The Wichita Transit Development Plan includes a 2008 survey of transit system users that confirms that Wichita bus users have very low incomes. Over two-thirds of the respondents indicated household income below $20,000 and only 15 percent reported that they had a car to use instead of transit. Given this information, it is reasonable to assume that the value of increased discretionary time for transit users should be valued at the minimum wage of $7.25/hour. At that rate, the annual value for increased leisure time would be $253,000 for Concept A and $1,027,000 for Concept B.

Based on KHI's estimates of full-time equivalent (FTE) ridership for physical activity benefits, the value of increased discretionary time per rider per year would be $103 for Concept A and $424 for Concept B. Although these figures are not very high, they would be significant for families earning less than $20,000. Clearly not all increases in discretionary time will be directed toward improved health. Nevertheless, a significant portion could be used to mitigate stress and provide time for access to health care.

Health Implications for Wichita

Some evidence suggests that discretionary time is associated with better mental health and quality of life. People that have discretionary time might spend it on activities that result in health improvements. However, the extent of positive health benefits associated with discretionary time would depend upon its uses. According to data analyses, Concept B would yield the largest estimated amount of discretionary time saved — about 141,719 hours a year, which would translate into the value of increased discretionary time of $1,027,000 ($424 per rider). Concept A would result in an estimated amount of discretionary time saved of 34,887 hours a year and $252,933 ($103 per rider). Concept C, however, would not result in any discretionary time savings. Based on these findings, Concept B would result in more health benefits associated with discretionary time.

Table 40. Impact of Transit on Discretionary Time and Related Potential Health Impacts

Health Factor or Outcome	Expected Change to Wichita (Based on Literature and Data)	Expected Health Impact	Magnitude of Impact	Likelihood of Impact	Distribution (Population Mostly Affected)	Quality of Evidence: Scale 1–3 (3 is Strongest)
CHANGES IN MODE OF TRANSPORTATION FROM CAR TO BUS						
Discretionary Time						
A (Grid)	Increase	Positive	Low	Possible	Transit riders (i.e., transit-dependent)	*
B (Optimization)	Increase	Positive	Medium	Possible		
C (Reduction)	No change	Uncertain	Low	Possible		

Concept A: Results in the largest estimated amount of discretionary time saved — about 34,887 hours a year ($252,933 /$103 per rider).
Concept B: Results in the largest estimated amount of discretionary time saved — about 141,719 hours a year ($1,027,000 /$424 per rider).
Concept C: No discretionary time savings would be expected because none of the changes alter the frequency of scheduled service.
Concept D1 (Extension) and D2 (Commuter): Not applicable.
Legend is available in Appendix A (page A-1).
Source: KHI HIA Transit Project, 2013.

OVERALL OPERATING COSTS AND REVENUES

OVERALL OPERATING COSTS AND REVENUES

OVERALL OPERATING COSTS AND REVENUES

Each concept developed by Olsson Associates would affect Wichita Transit System's operating costs and revenues. While this section of the report compares the estimated cost of each concept, it also is important to consider the potential positive and negative health effects of each concept. Additionally, Wichita Transit System indicated that the actual costs associated with implementation of service improvements could vary from Olsson Associates estimates based on the alternatives selected for implementation and more detailed levels of planning. Wichita Transit System currently operates using funds received from farebox revenues and local, state and federal dollars. The only form of revenue discussed in this section is farebox revenue. Changes to the transit system would require reviewing available resources and identifying opportunities to increase revenue from various sources (e.g., grants, taxes).

The following section summarizes information developed by Olsson Associates, including estimates of annual operating costs and capital investment costs for Concept A (Grid), Concept B (Optimization) and Concept C (Reduction). Concept D1 (Extension) and D2 (Commuter) are not discussed in this section due to their supplemental nature. Expenses associated with changes to the city's transit system will depend upon the extent of adoption of Olsson Associates concepts or any other alternative concepts.

Farebox revenues and ridership estimates were produced by the Kansas Health Institute and Wichita State University's Hugo Wall School of Urban and Public Affairs (WSU). For more information about how each of these concepts could affect the health of Wichita residents, see pages 21–78 of this report.

Concept A (Grid)

Concept A would double the amount of buses needed in peak areas and require that buses run on Sundays, which would affect the number of employees needed to operate the system. WSU reported that 22 additional bus mechanics, 81 additional bus operators, an additional supervisor and potentially four new administrative support staff would be needed to operate the system. Using the average salaries for these professions in 2012, annual payrolls (excluding fringe benefits) would increase by approximately $3.6 million under Concept A.

According to Olsson Associates, Concept A could be operated at an annual cost of $21.1 million (Table 41). It would increase frequency of service and hours of operation and include a grid system. Concept A also is more likely to produce a larger number of positive health effects. With these changes, annual ridership is projected to increase to approximately 3.0 million rides. Annual farebox revenues would be about $2.8 million. Projections for Concept A estimate that farebox revenues would fund approximately 13.1 percent of annual operating expenses for the altered system.

In order to implement this system, Concept A would require an additional capital investment for new buses and equipment estimated by Olsson Associates at $78.5 million. According to Olsson Associates, "This capital investment cost of $78.5 million includes 40 new vehicles ($19 million), a facility expansion for maintenance and storage of new vehicles ($25 million), bus stop improvements and hub improvements. This also includes capital costs for the Douglas Avenue Bus Rapid Transit Service." (See pages 75–77 of the *Wichita Transit Community Outreach Study*.)

Concept B (Optimization)

Concept B would increase buses needed in peak areas by a third and require that buses run on Sundays; however, it wouldn't provide transit coverage to southeast Wichita. As a result, it is likely to produce fewer positive health effects as compared to Concept A but more positive health effects than Concept C. The increased number of buses and Sunday transit service would affect the number of employees needed to operate the system. WSU reported additional staff needs for Concept B at nine bus mechanics, 39 bus operators, one supervisor and potentially four administrative support staff. This could increase annual payrolls (excluding fringe benefits) by $1.9 million.

Concept B could be operated at an annual cost of $14.9 million (Table 41). The estimated annual ridership for Concept B would be approximately 2.9 million rides. Farebox revenues are projected to be about $2.7 million and would fund approximately 18.3 percent of annual operating expenses. Concept B would require an additional capital investment estimated by Olsson Associates at $15.7 million, "which includes bus stop improvements, further development of a transit spine along Douglas Avenue, and additional transit vehicles." (See pages 75–77 of the *Wichita Transit Community Outreach Study*.)

Concept C (Reduction)

Concept C would have the lowest operating costs of all the proposed concepts at $10.4 million (Table 41) and would result in fewer positive health effects than Concepts A and B. Concept C would reduce the number of bus routes and hours of operation, and this may in turn reduce the number of employees and/or resources needed to operate the system. Projected ridership is expected to decrease by about 331,000 rides. Fares from Concept C would also produce less revenue as a portion of total operating costs (14.3 percent). The Olsson Associates report did not include capital cost estimates for Concept C due to its reduction of services, but it did predict fewer costs required to run the system. According to Olsson Associates, "No additional vehicles will be required to deliver the reduced service, and maintenance costs will be lower with lowered revenue hours and revenue miles." (See pages 75–77 of the *Wichita Transit Community Outreach Study*.)

Table 41. Wichita Transit System Concepts — Annual Operating Costs and Farebox Revenue Projections (Dollars in Millions)

	A (Grid)	B (Optimization)	C (Reduction)
Annual Operating Cost	$21.1	$14.9	$10.4
Annual Farebox Revenue	$2.8	$2.7	$1.5
Farebox Revenue as a Percentage of Annual Operating Cost	13.1%	18.3%	14.3%

Note: Calculations reported include estimates provided by KHI, Wichita Transit and Olsson Associates. Farebox revenues were calculated using a cost recovery rate of $.93 per trip provided by Wichita Transit.

Source: McCarthy Snyder, N., & Bannon, C. (2013). Economic Analysis of Health Impact Assessment of Wichita Transit. Wichita, KS: Hugo Wall School of Urban and Public Affairs.

Wichita, 2012.

Wichita, 2012.

HIA RECOMMENDATIONS

HIA RECOMMENDATIONS

An important part of the HIA process is to create recommendations to increase potential positive impacts and mitigate potential negative impacts on health. Each section provides specific examples on how to improve health and suggests potential agencies or organizations that could carry out those recommendations. For additional details about how the recommendations were created, see page 18.

Utilization of Transit for Accessing Services

In order to maximize health benefits associated with increased transit ridership and utilization of services, Wichita Transit, in collaboration with partner organizations, should consider:

- Increasing transit reliability, including frequency and night/weekend bus service.
- Increasing awareness about transit routes, stops and schedules.
- Improving access to employment, health care facilities and food sources.
- Improving bus stop infrastructure and connectivity.

Transit reliability has been defined in terms of frequency and timeliness of services as well as riders' knowledge of or certainty about bus arrival times. During the past several years, Wichita Transit took necessary steps to decrease riders' anxiety of waiting for buses by providing real-time bus information. In 2011, Wichita Transit, in partnership with Downtown Development Corporation, launched a mobile application that provides real-time bus information (i.e, current location of buses) for Q-line. In 2012, the system was extended to cover all transit routes. This strategy could help increase transit reliability. According to the research about travel behavior, inconvenience and uncertainty about the arrival time of buses could diminish user confidence and result in decreased ridership.[180] The HIA recommends that Wichita Transit continues to utilize and improve this system. Additionally, the HIA recommends assessing riders' awareness and satisfaction with the real-time bus information. Based on the assessment results, Wichita Transit should consider employing marketing strategies to maximize the use of the real-time bus information.

The selected concept should include increased route frequency and be accessible to low-income households, such as the Plainview area of southeast Wichita. System reliability is extremely important for transit-dependent riders, who are most likely to utilize buses.

The HIA recommends implementing a concept that increases bus timeliness and frequency and provides weekend service. These improvements in combination with a transit marketing campaign highlighting routes, stops and schedules can help increase transit use. The marketing efforts would require partnerships among Wichita Transit, agencies and organizations that serve transit riders (e.g., health care facilities, universities, schools, grocery stores and social service organizations) as well as prospective riders.

Furthermore, to increase transit use for accessing services, the HIA recommends increasing access to areas with low-income households, who have the most need for transit and are the most likely to use transit. The HIA also recommends several changes, including:

- Locating bus stops near health care offices and specialty clinics.
- Placing buses with a low floor area for rolling carts on routes that have the most grocery stores.
- Providing a universal pass to students.
- Establishing shared-use agreements between schools and community organizations. By increasing transit use and connecting Wichita residents to services, the community could observe a number of health benefits, such as early detection and treatment of health conditions, associated with increased access to health care facilities.

Lastly, the HIA encourages Wichita Transit to work in collaboration with partner organizations to continue improving bus stop infrastructure and connectivity of bus stops to sidewalks, trails and pedestrian paths. The research findings suggest when public transportation is easier to access, individuals are more likely to walk to access transit and meet their physical activity recommendations. According to Healthy People 2020, physical activity can lower the risk of early death, coronary heart disease, stroke, high blood pressure, type 2 diabetes, breast and colon cancer, falls and depression among adults and older adults.[181]

Air Quality and Environment

To maximize potential improvement of air quality associated with increased transit use and decreased car use, Wichita Transit should consider:

- Improving the bus fleet by updating or purchasing new clean-air technology buses.
- Considering environmental characteristics of bus shelters to enhance safety and minimize exposure to air pollutants.

Research indicates a strong association between the number of vehicle trips/miles traveled and vehicle emissions that cause air pollution.[182] These air pollutants caused by vehicle emissions are associated with respiratory problems including asthma attacks and lung cancer, myocardial infarction, diabetes mellitus, birth defects, fatigue, headaches and eye irritation.[183, 184] The negative effects of air pollution may be counteracted by public transit due to the decrease in number of transit trips per person. In order to improve air quality, the HIA recommends that Wichita Transit continue to replace or modify aging buses. For example, diesel alternatives like compressed natural gas have been shown to emit 90 percent less particulate matter than diesel-run buses.

Studies also show that other factors, such as bus idling, window position and shelter orientation, can affect exposure to air pollutants. The HIA team recommends Wichita Transit considers environmental characteristics of bus shelters. Specifically, the HIA recommends orienting shelters away from the roadway. The research findings suggest that bus shelters open toward the roadway were consistently observed to have higher concentrations of pollutants inside the shelter than outside the shelter.[185]

Marketing of Transit-Related Benefits

To increase utilization of transit and mitigate risks associated with driving cars, Wichita Transit in collaboration with the Wichita Area Metropolitan Planning Department and other partners, should consider:

- Creating an infrastructure conducive to walking and biking.
- Increasing efforts to inform car users about the benefits of transit:
    - As a way to prevent distracted driving.
    - As a way to reduce exposure to secondhand smoke.

The CDC Community Guide rates community interventions on their effectiveness. The Community Guide has shown the importance of marketing and informational outreach campaigns in community improvement, and this lesson applies to transit as well. When Wichita leaders change the transit system, they need to include funds for marketing and outreach in order to increase the number of riders and the benefits to the community.

One way to help inform Wichita residents is to have a campaign that discusses the benefits of transit. Research indicates that bus occupants had the least risk of injury as compared to car or bike users, pedestrians or motorcycle riders. This is specifically important for vulnerable populations, such as the elderly or children, who are at a

greater risk for fatal injuries. Changing from car to bus could cause an increase in the number of pedestrian-related injuries due to more people walking to and from public transit, although there is a threshold effect that may decrease injury rates. In order to mitigate this unintended consequence, the HIA recommends focusing on increasing the number of pedestrians and bicyclists by creating an infrastructure conducive to walking and biking.

Another important benefit of switching from driving a car to riding the bus is that fewer people would encounter the risk of distracted driving. In general, distracted driving causes one in six fatal vehicle collisions. The HIA recommends that the Sedgwick County Health Department and health advocacy organizations increase efforts (e.g., publications, announcements and/or media) to inform car users about the health risks associated with distracted driving.

Research also indicates that driving or riding in cars increases the risk of exposure to secondhand smoke. One in five children is exposed to secondhand smoke in cars. Switching from car to bus, where smoking is not allowed, could help decrease children's exposure to secondhand smoke. In order to decrease Wichita residents' exposure to secondhand smoke, the HIA report recommends that the Sedgwick County Health Department and health organizations consider increasing efforts (e.g., publications, announcements and/or media) to inform car users about the negative health effects of secondhand smoke exposure in cars on adults and especially children. These efforts can include using ad spaces on buses and shelters to highlight the benefits of transit as a way to reduce exposure to secondhand smoke.

Wichita, 2012.

APPENDICES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APPENDIX A: LEGEND

Table A-1. Health Impacts for Wichita: Legend

TRANSIT SYSTEM	DESCRIPTION
Expected Change to Wichita (based on literature and data): How will this indicator change with the implementation of each concept?	No change — The literature and data analysis achieve consensus that this indicator will likely remain unchanged. Mixed — The literature and data analysis lack consensus about this indicator's potential impact. Increase — The literature and data analysis achieve consensus that this indicator will likely increase. Decrease — The literature and data analysis achieve consensus that this indicator will likely decrease. N/A — Literature or data analysis was not possible or performed for this indicator.
Expected Health Impact: How will each concept affect the health of Wichita?	Positive — Changes that may improve health. Negative — Changes that may worsen health. Mixed — Changes can be positive as well as negative. Uncertain — Unknown how health will be impacted. No effect — No identified effect on health. Note: When findings from different sources (data, literature, stakeholder opinion) were not consistent, expected health impact was determined primarily based on findings from the data analysis because the HIA team determined it was the best available source of information.
Magnitude of Impact: How large or small of an impact will this concept have on the health of Wichita?	Low — Affects no or very few people. Medium — Affects larger numbers of people. High — Affects many people.
Likelihood of Impact: How likely or unlikely is it that the concept will affect the health of Wichita?	Likely — It is likely that impacts will occur as the result of this concept. Possible — It is possible that impacts will occur as the result of this concept. Unlikely — It is unlikely that impacts will occur as the result of this concept. Uncertain — It is uncertain that impacts will occur as the result of this concept.
Distribution: What populations in Wichita will be mostly affected under this concept?	The population most likely to be affected by changes in the health factor or outcome; determination was based on literature review, data analysis and expert opinion.
Quality of Evidence	*** — Exceptional data and literature. ** — Sufficient data and literature. * — Lacks either quality data or literature.

Note: Legend for Tables 13, 19, 21, 24, 25, 26, 27, 29, 31, 37, 38 and 40.

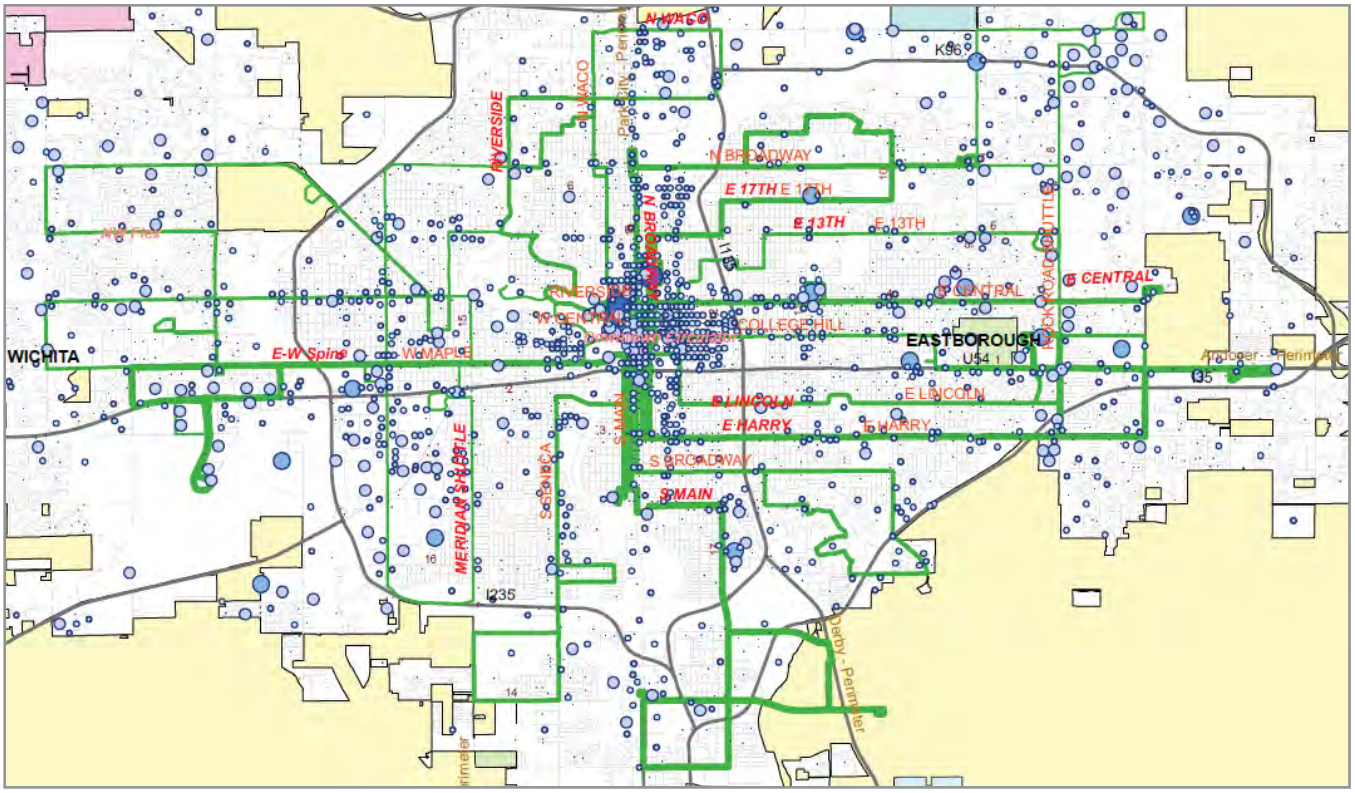
Source: KHI HIA Transit Project, 2013.

Notes

APPENDIX B: MAPS

To analyze the availability of services according to concept, maps were created using GIS mapping tools and data from various sources, including geographic locations of services and the state of Kansas.

Map B-1: Current System and Access to Employment



Legend:

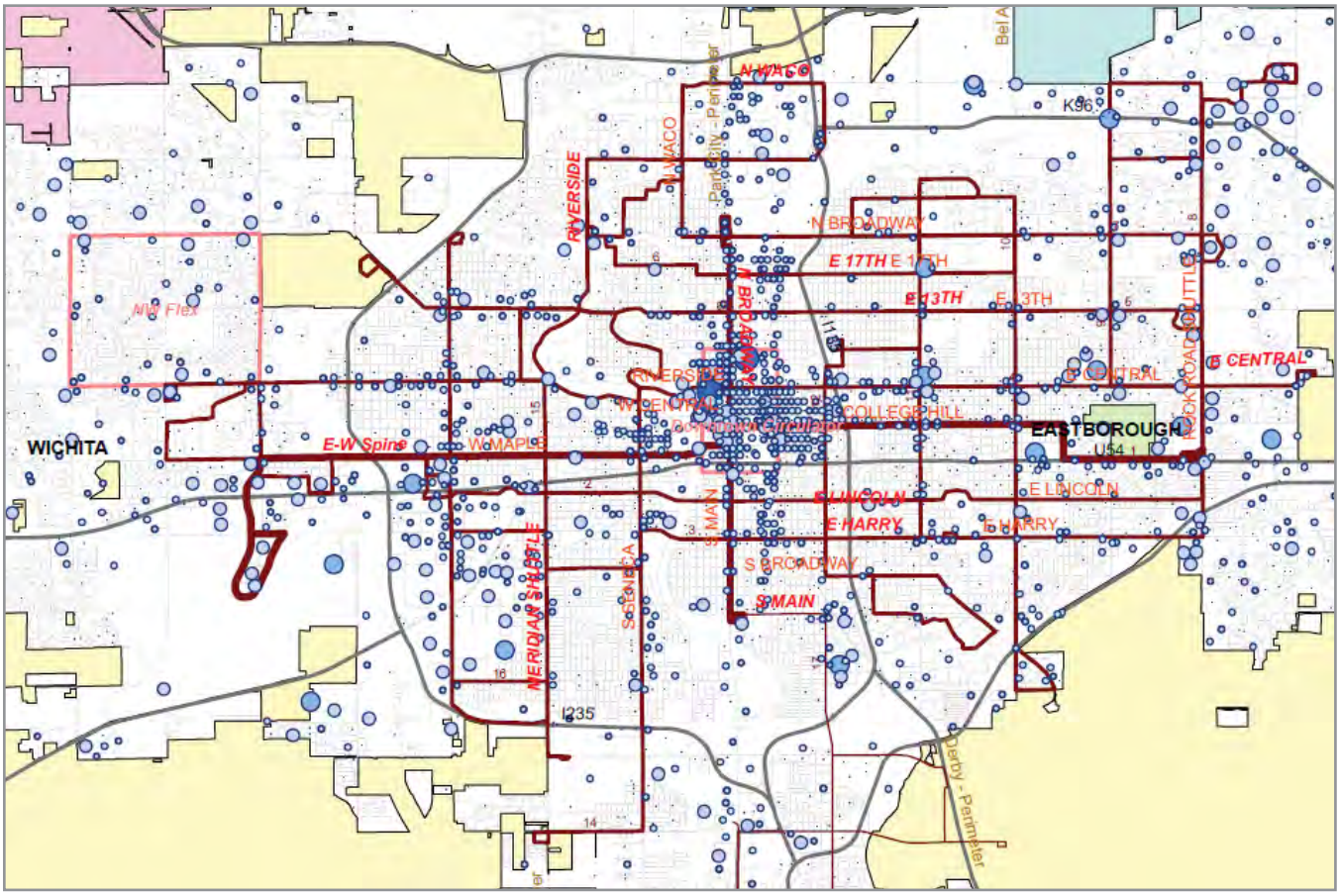
Green Lines: Current bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Blue Circles: Location of jobs in Wichita.

Source: KHI analysis using GIS mapping tools, Olsson Associates (current routes) and OnTheMap from U.S. Census Bureau Center for Economic Studies, 2013.

Notes

Map B-2: Concept A and Access to Employment



Legend:

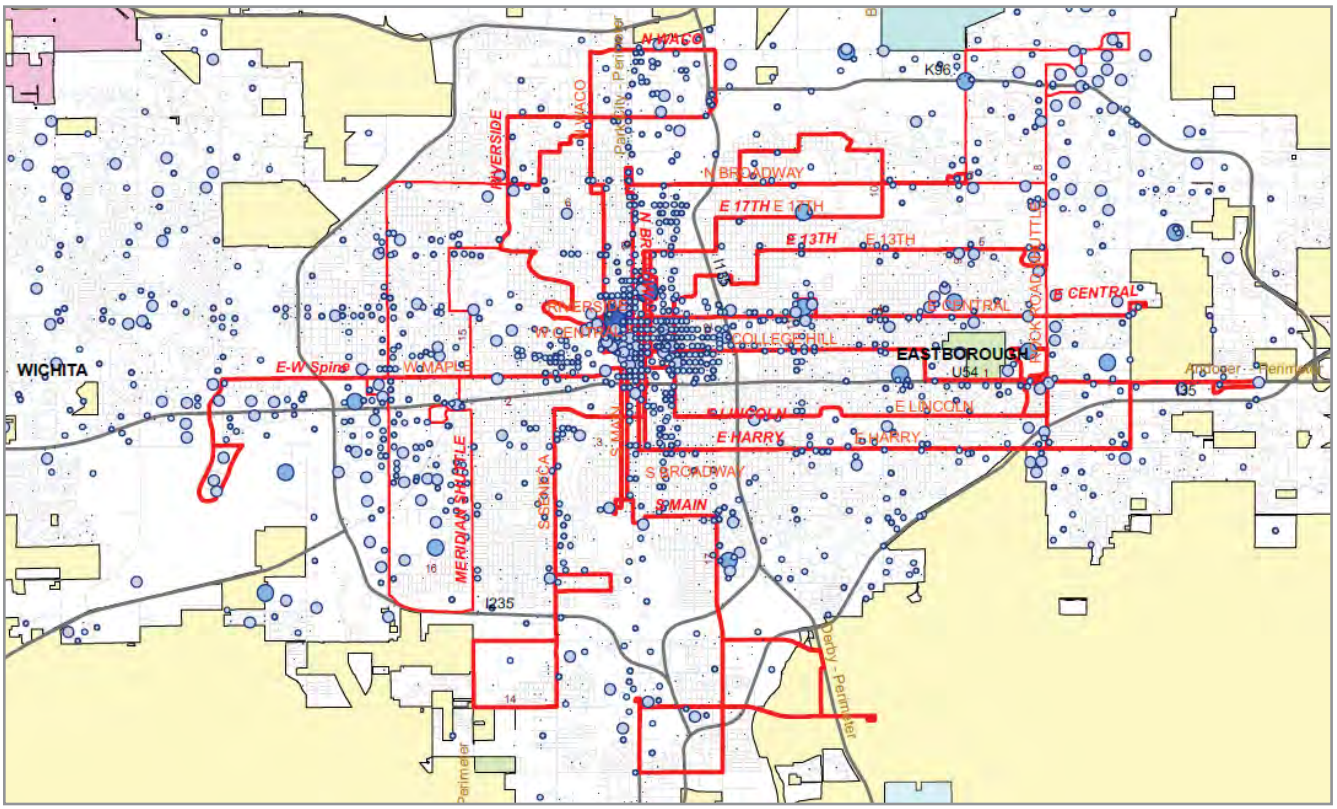
Maroon Lines: Concept A bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Blue Circles: Location of jobs in Wichita.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and OnTheMap from U.S. Census Bureau Center for Economic Studies, 2013.*

Notes

Map B-3: Concept B and Access to Employment



Legend:

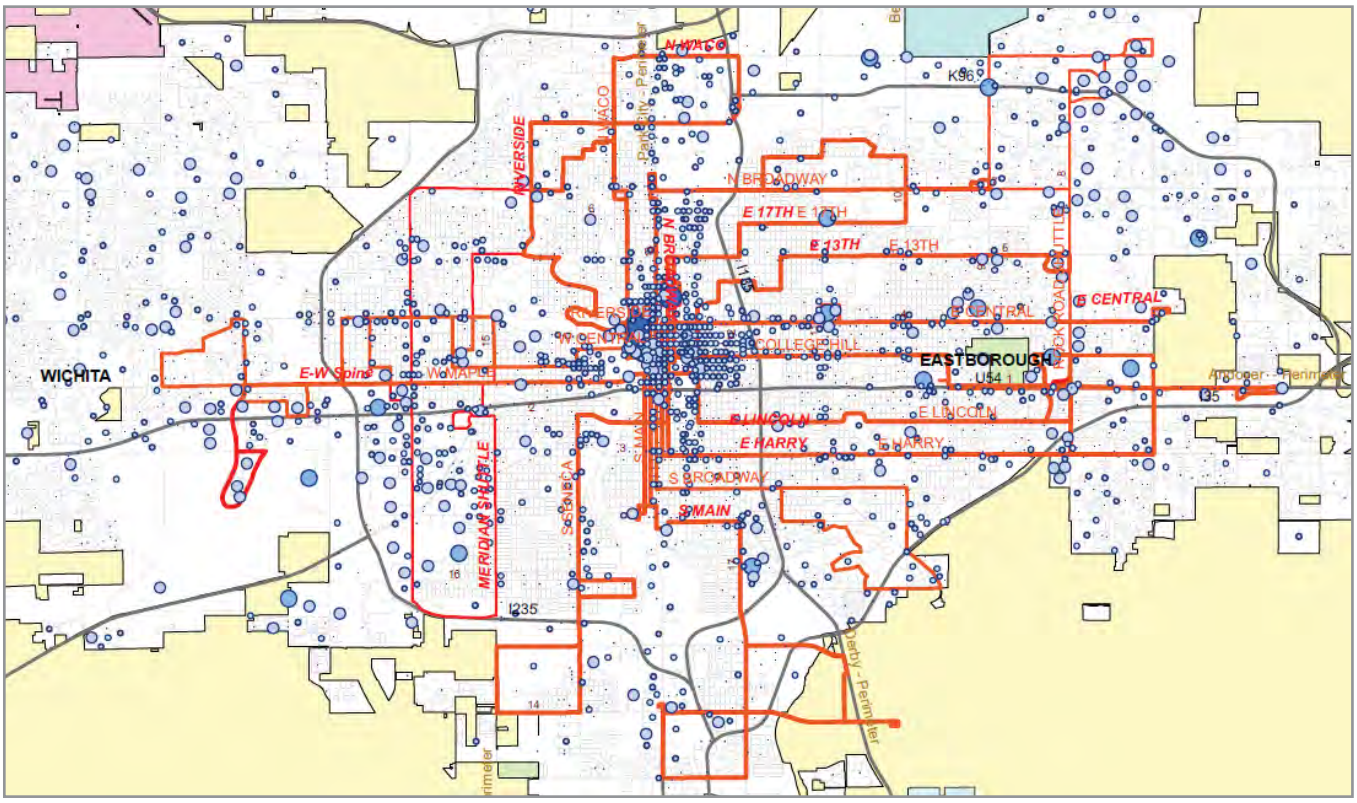
Red Lines: Concept B bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Blue Circles: Location of jobs in Wichita.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and OnTheMap from U.S. Census Bureau Center for Economic Studies, 2013.*

Notes

Map B-4: Concept C and Access to Employment



Legend:

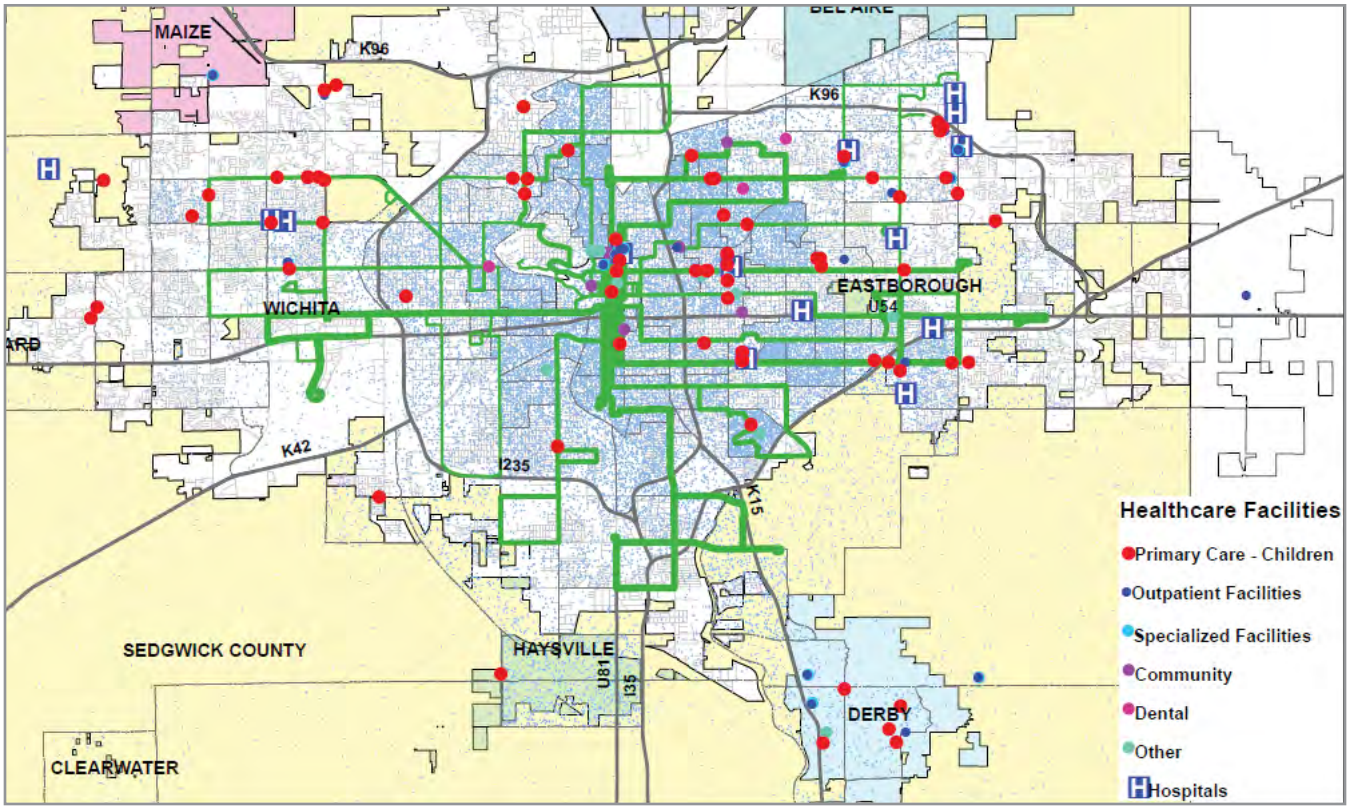
Red Lines: Concept C bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Blue Circles: Location of jobs in Wichita.

Source: KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and OnTheMap from U.S. Census Bureau Center for Economic Studies, 2013.

Notes

Map B-5: Current System and Access to Health Care Facilities



Notes: This analysis does not include locations of private providers, because it was not feasible to collect the data. However, the locations of the health care facilities mapped are a sufficient barometer of access to these services.

Legend:

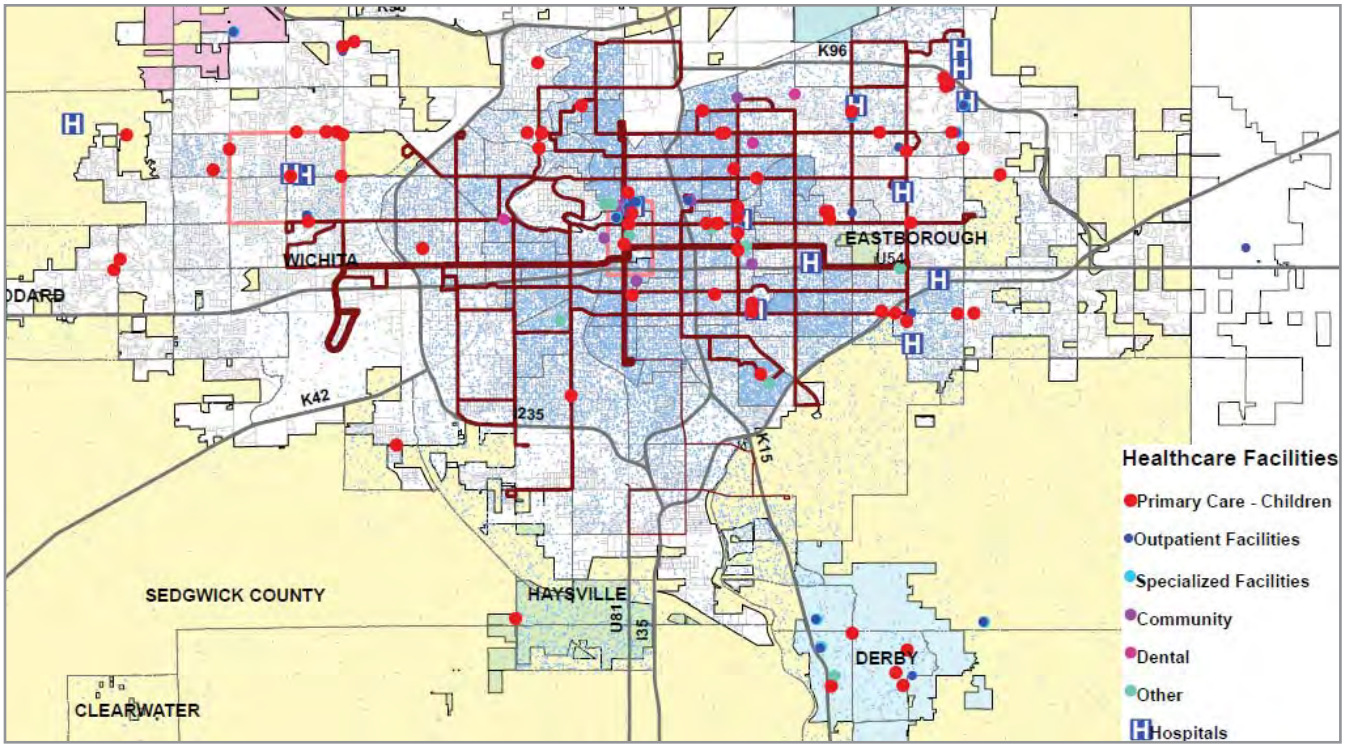
Green Lines: Current bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of health care facilities, including hospitals, health departments, outpatient and specialized facilities.

Notes

Map B-6: Concept A and Access to Health Care Facilities



Notes: This analysis does not include locations of private providers, because it was not feasible to collect the data. However, the locations of the health care facilities mapped are a sufficient barometer of access to these services.

Legend:

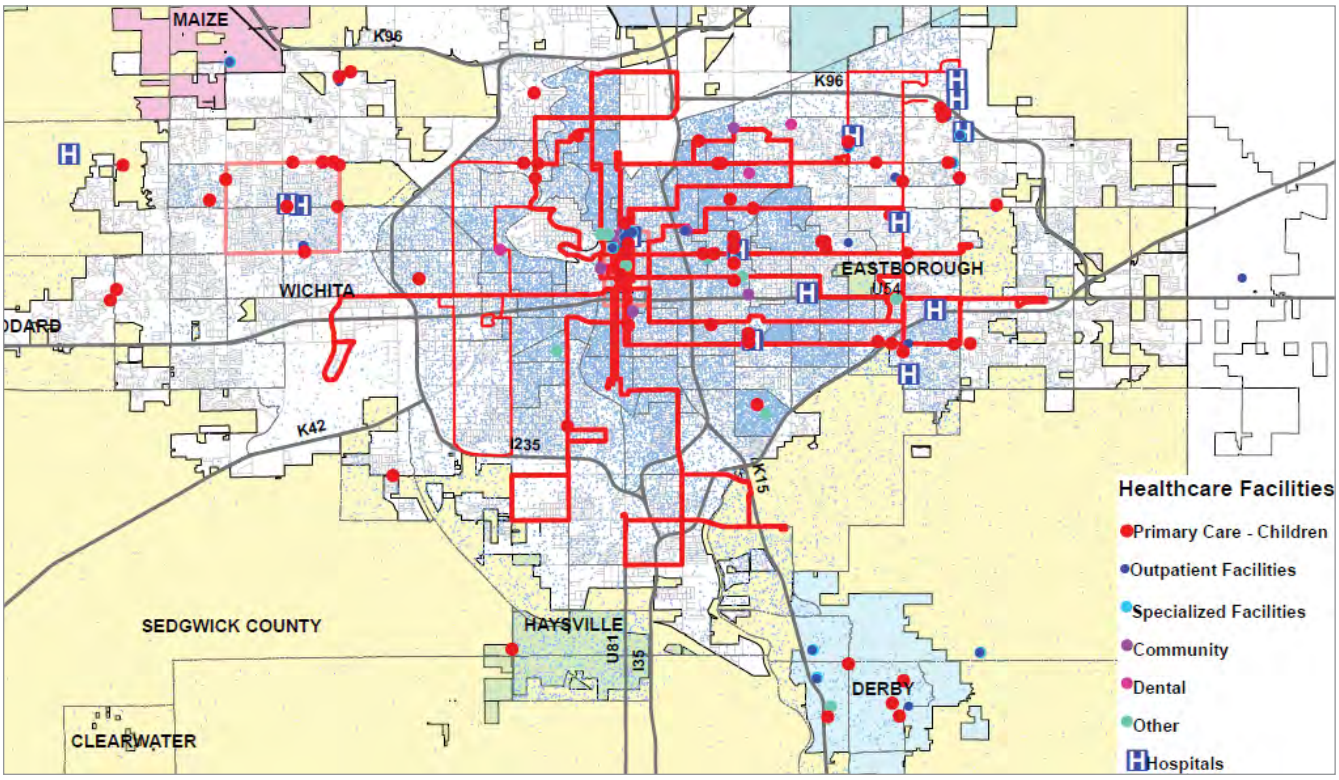
Maroon Lines: Concept A bus routes. The thickness of the lines represents the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of health care facilities, including hospitals, health departments, outpatient and specialized facilities.

Notes

Map B-7: Concept B and Access to Health Care Facilities



Notes: This analysis does not include locations of private providers, because it was not feasible to collect the data. However, the locations of the health care facilities mapped are a sufficient barometer of access to these services.

Legend:

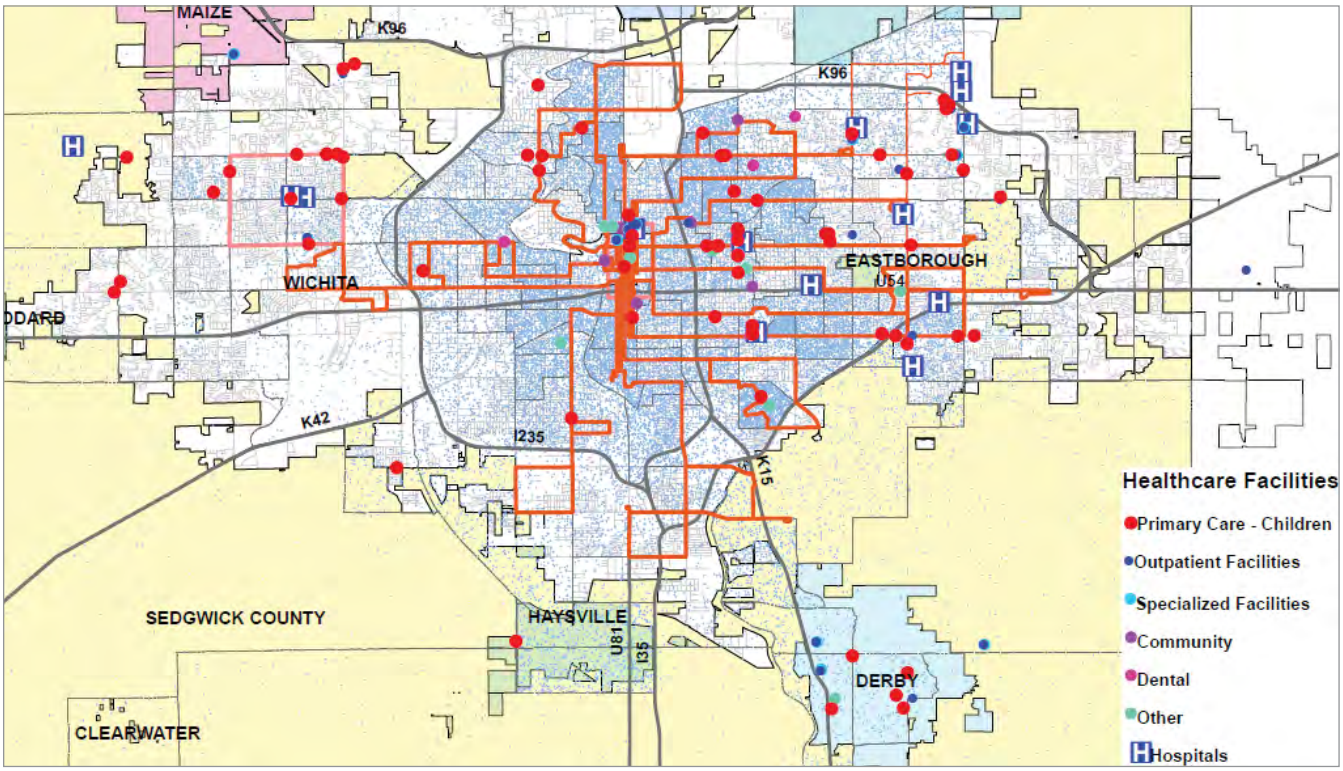
Red Lines: Concept B bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of health care facilities, including hospitals, health departments, outpatient and specialized facilities.*

Notes

Map B-8: Concept C and Access to Health Care Facilities



Notes: This analysis does not include locations of private providers, because it was not feasible to collect the data. However, the locations of the health care facilities mapped are a sufficient barometer of access to these services.

Legend:

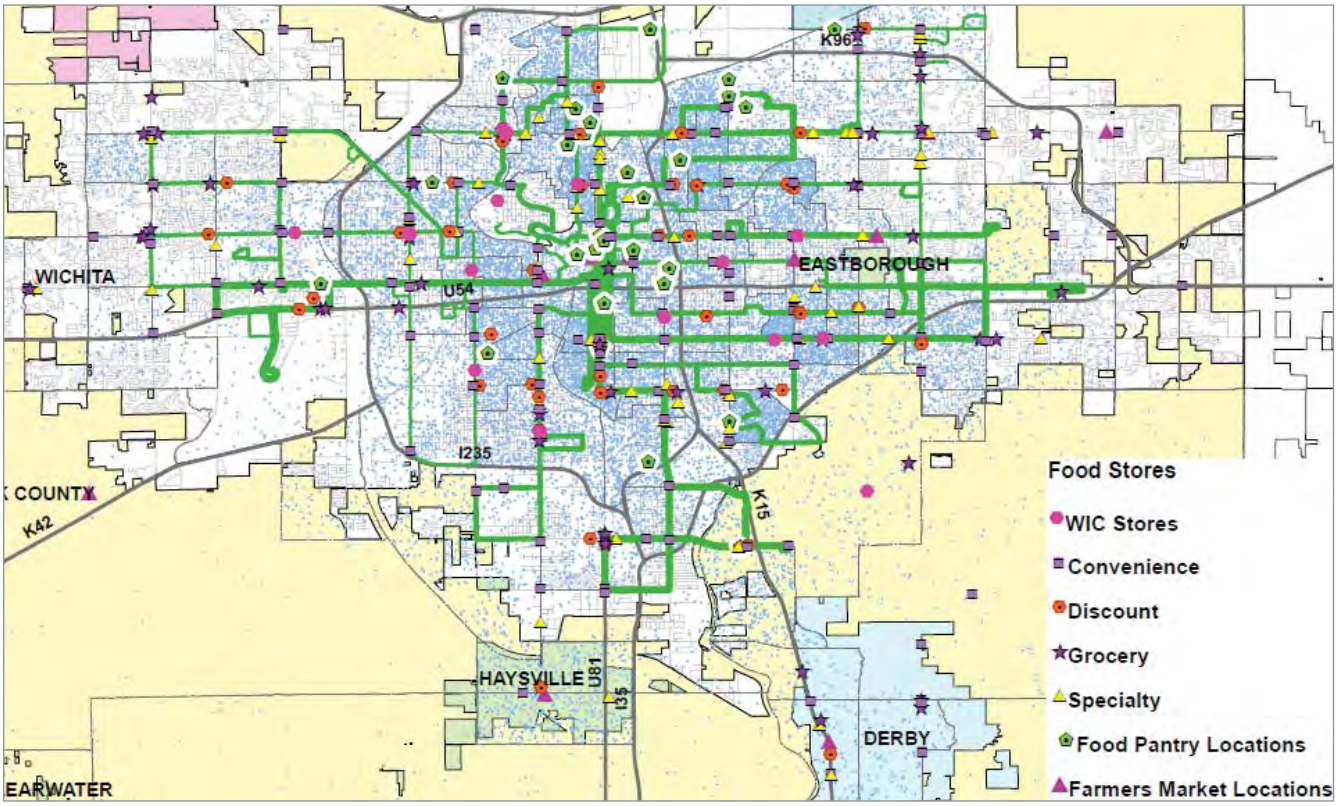
Red Lines: Concept C bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of health care facilities, including hospitals, health departments, outpatient and specialized facilities.*

Notes

Map B-9: Current System and Access to Food Sources



Notes: This analysis does not include locations of all food sources, because it was not feasible to collect the data. However, the locations of the food sources mapped are a sufficient barometer of access to these services.

Legend:

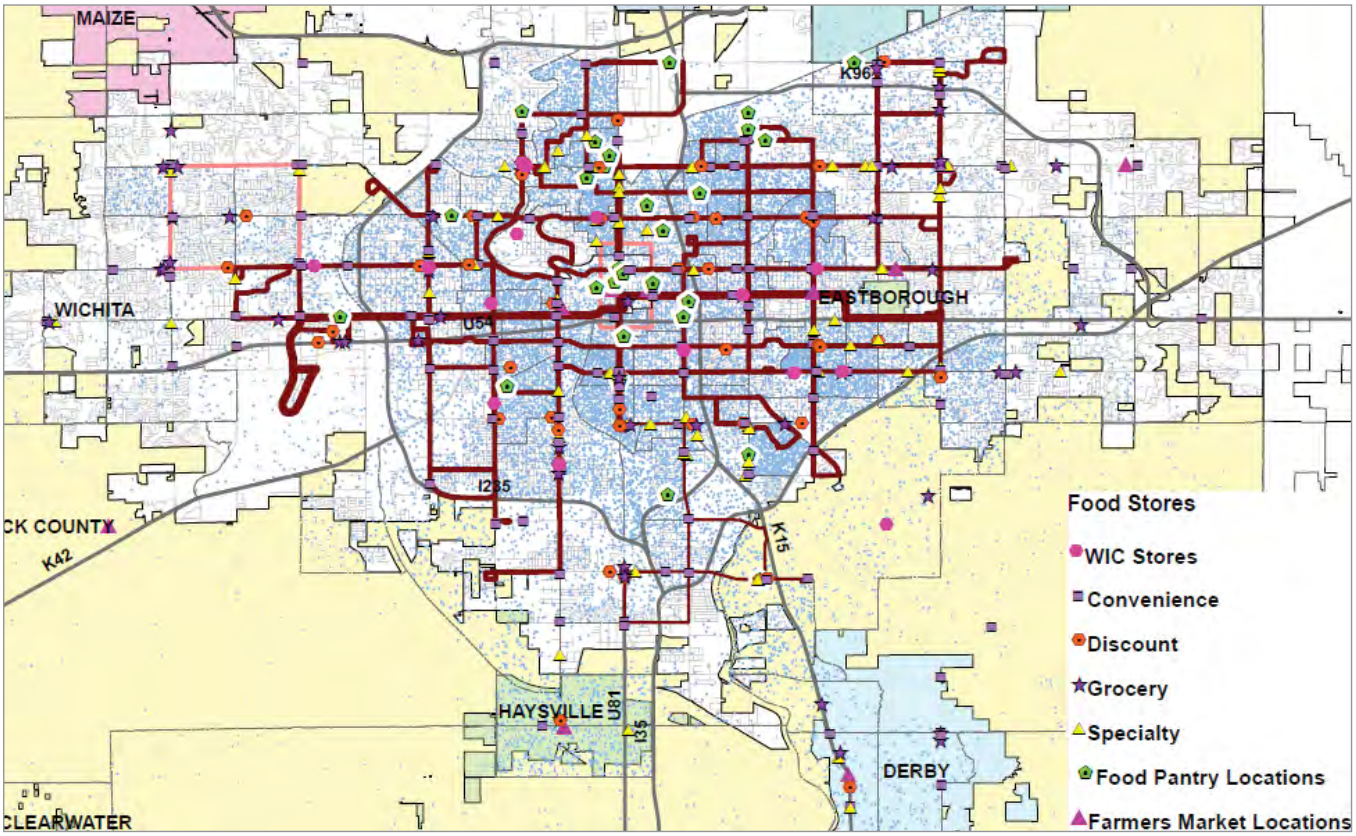
Green Lines: Current bus routes. The thickness of the lines represents the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (current routes) and geographic locations of food sources, including SNAP and WIC stores (grocery, discount and convenience — excluding fast food), farmers markets and food pantries.*

Notes

Map B-10: Concept A and Access to Food Sources



Notes: This analysis does not include locations of all food sources, because it was not feasible to collect the data. However, the locations of the food sources mapped are a sufficient barometer of access to these services.

Legend:

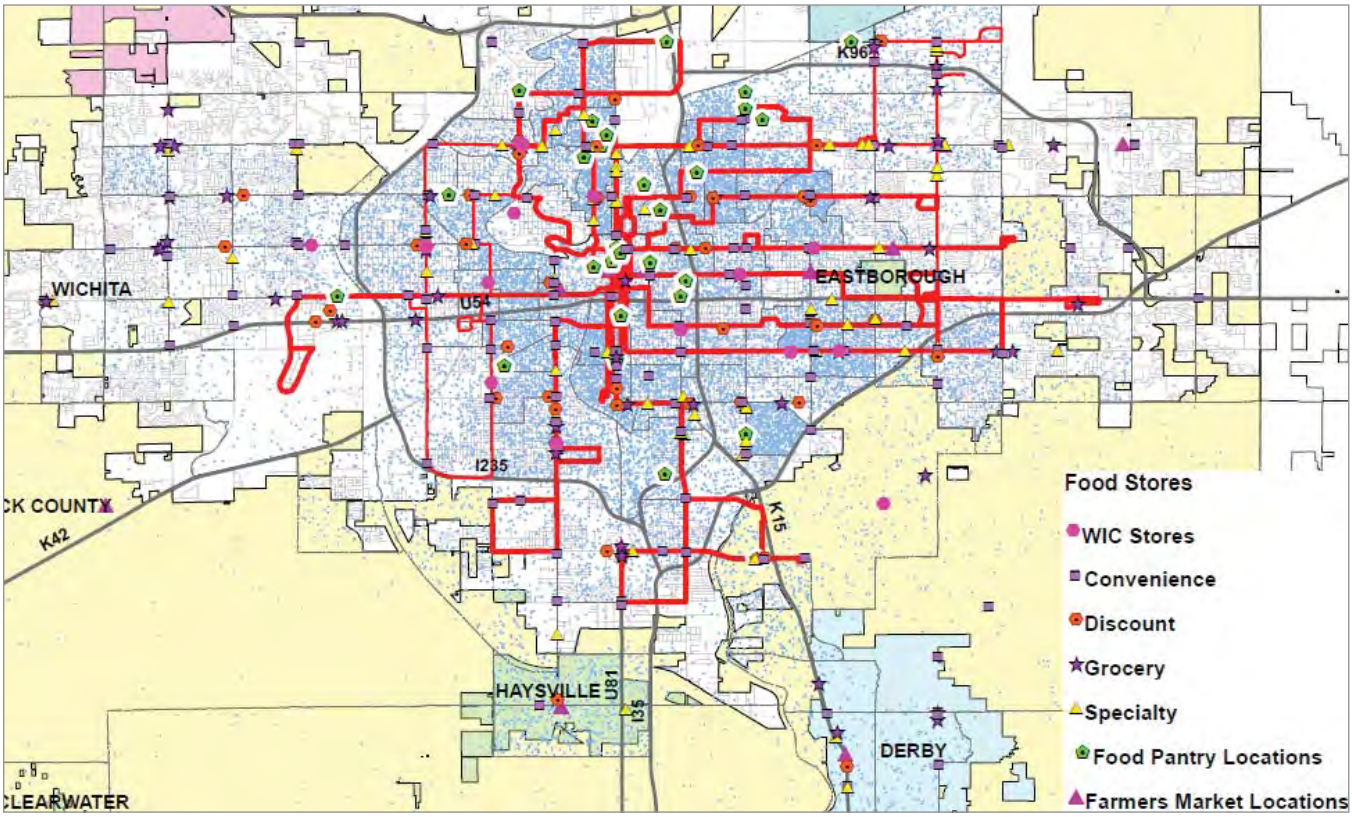
Maroon Lines: Concept A bus routes. The thickness of the lines represents the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of food sources, including SNAP and WIC stores (grocery and discount), farmers markets and food pantries.

Notes

Map B- 11: Concept B and Access to Food Sources



Notes: This analysis does not include locations of all food sources, because it was not feasible to collect the data. However, the locations of the food sources mapped are a sufficient barometer of access to these services.

Legend:

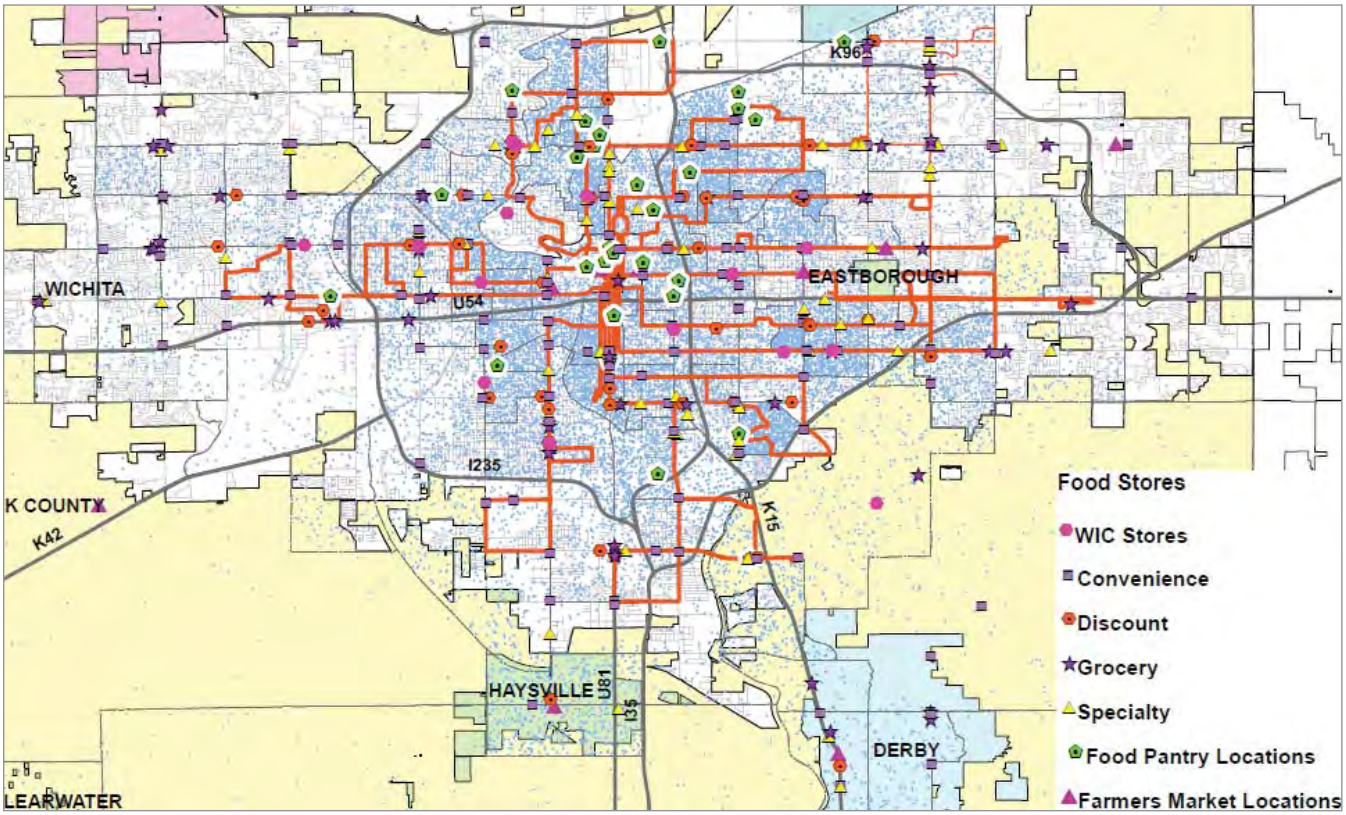
Red Lines: Concept B bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of food sources, including SNAP and WIC stores (grocery and discount), farmers markets and food pantries.*

Notes

Map B-12: Concept C and Access to Food Sources



Notes: This analysis does not include locations of all food sources, because it was not feasible to collect the data. However, the locations of the food sources mapped are a sufficient barometer of access to these services.

Legend:

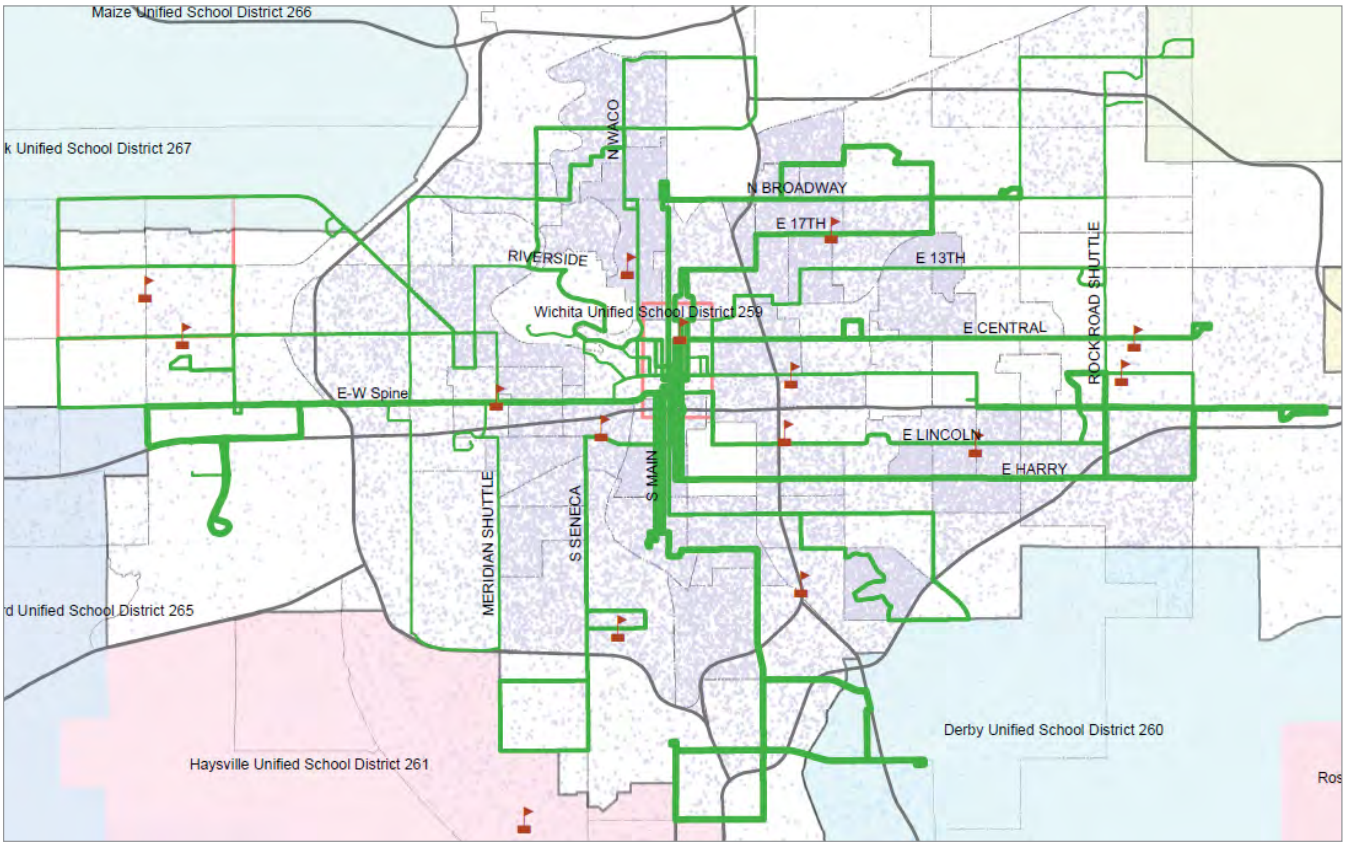
Red Lines: Concept C bus routes. The thickness of the lines represents the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of food sources, including SNAP and WIC stores (grocery and discount), farmers markets and food pantries.*

Notes

Map B-13. Current System and Access to Education: K–12 School Districts and High Schools



Notes: This analysis does not include locations of K–8 schools. However, the locations of the schools mapped are a sufficient barometer of access to these schools.

Legend:

Green Lines: Current bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

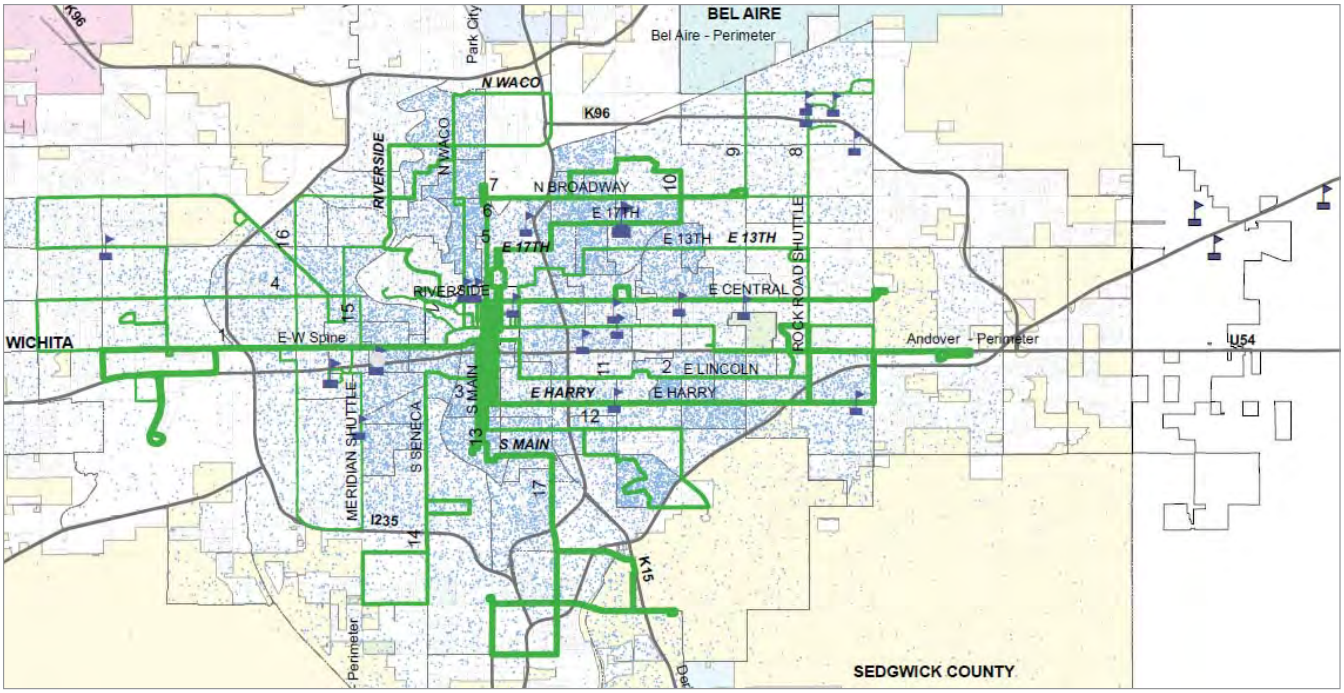
Maroon Flags: High schools in Wichita.

Concentrated Blue Dots: Children 18 and under living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (current routes) and geographic locations of Wichita school districts and high schools (grades 9–12).*

Notes

Map B-14: Current System and Access to Education: Universities



Notes: This analysis does not include the location of every post-secondary institution in or around Wichita. However, the locations of the institutions mapped are a sufficient barometer of access to these institutions.

Legend:

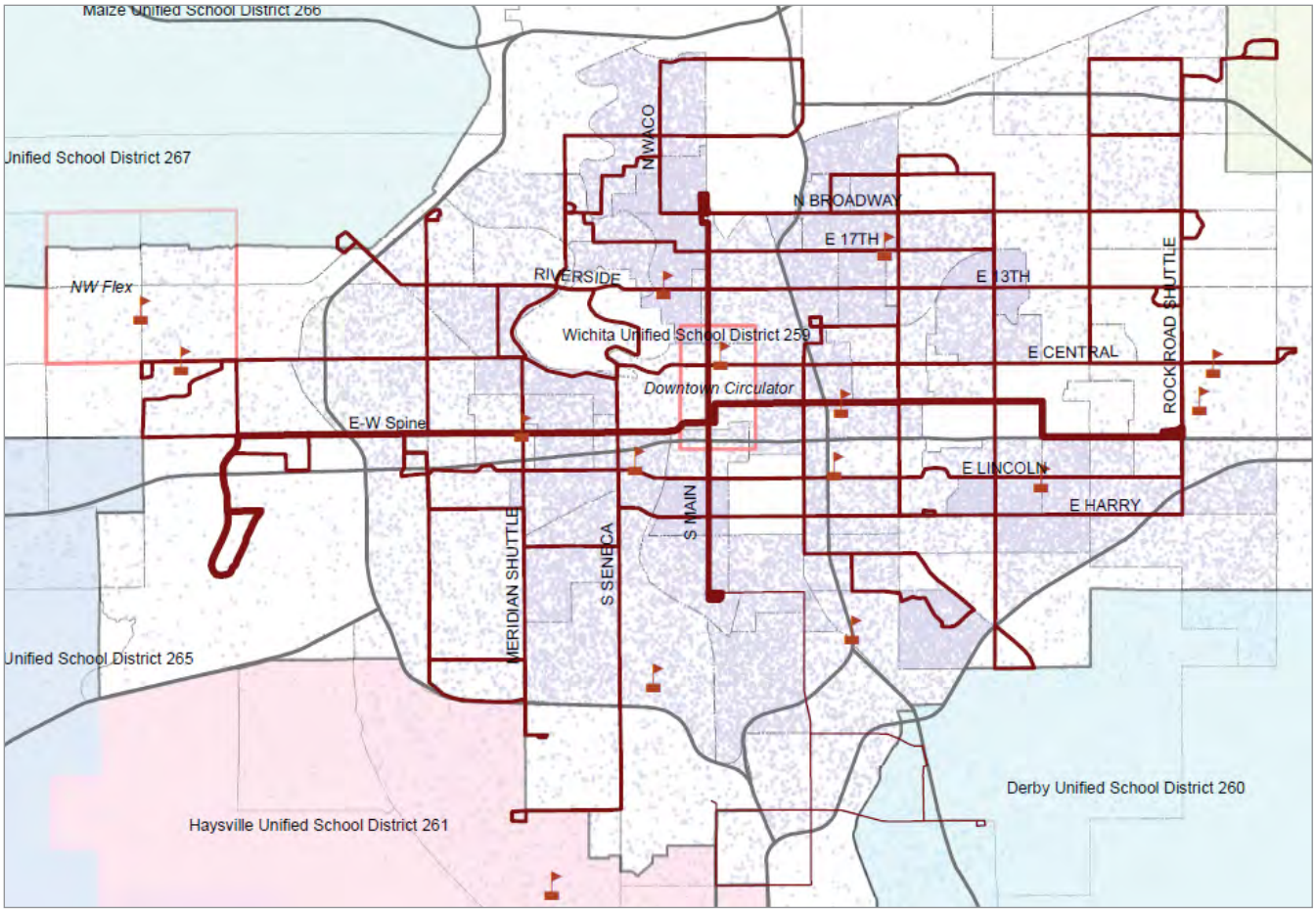
Green Lines: Current bus routes. The thickness of the lines represents the frequency of service (i.e. the thicker the line, the more frequent the service); Blue Flags: Universities in Wichita.

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (current routes) and geographic locations of post-secondary institutions (universities, community colleges and trade schools) in Wichita and Andover, KS.*

Notes

Map B-15: Concept A and Access to Education: K–12 School Districts and High Schools



Notes: This analysis does not include locations of K–8 schools. However, the locations of the schools mapped are a sufficient barometer of access to these schools.

Legend:

Maroon Lines: Concept A bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

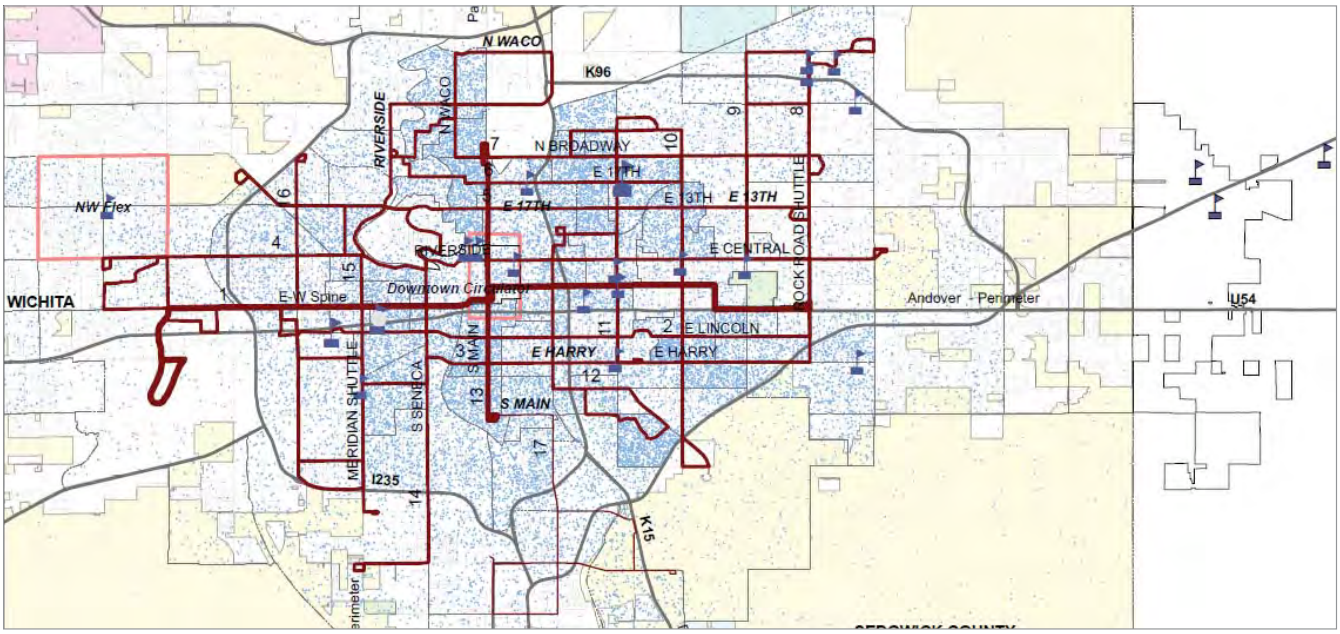
Maroon Flags: High schools in Wichita.

Concentrated Blue Dots: Children 18 and under living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of Wichita school districts and high schools (grades 9–12).*

Notes

Map B-16: Concept A and Access to Education: Universities



Notes: This analysis does not include the location of every post-secondary institution in or around Wichita. However, the locations of the institutions mapped are a sufficient barometer of access to these institutions.

Legend:

Maroon Lines: Concept A bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

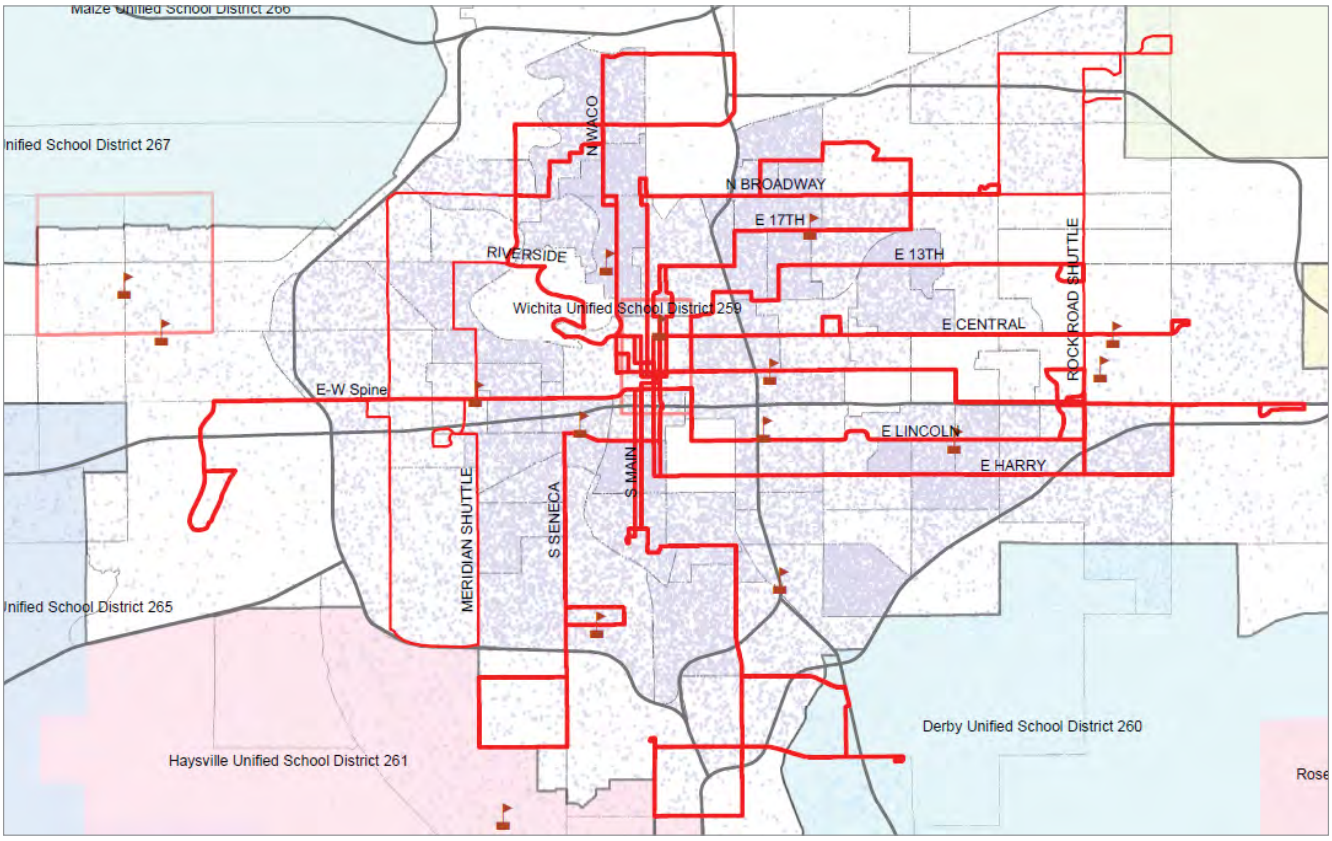
Blue Flags: Universities in Wichita.

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of post-secondary institutions (universities, community colleges and trade schools) in Wichita and Andover, KS.*

Notes

Map B-17: Concept B and Access to Education: K–12 School Districts and High Schools



Notes: This analysis does not include locations of K–8 schools. However, the locations of the schools mapped are a sufficient barometer of access to these schools.

Legend:

Red Lines: Concept B bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

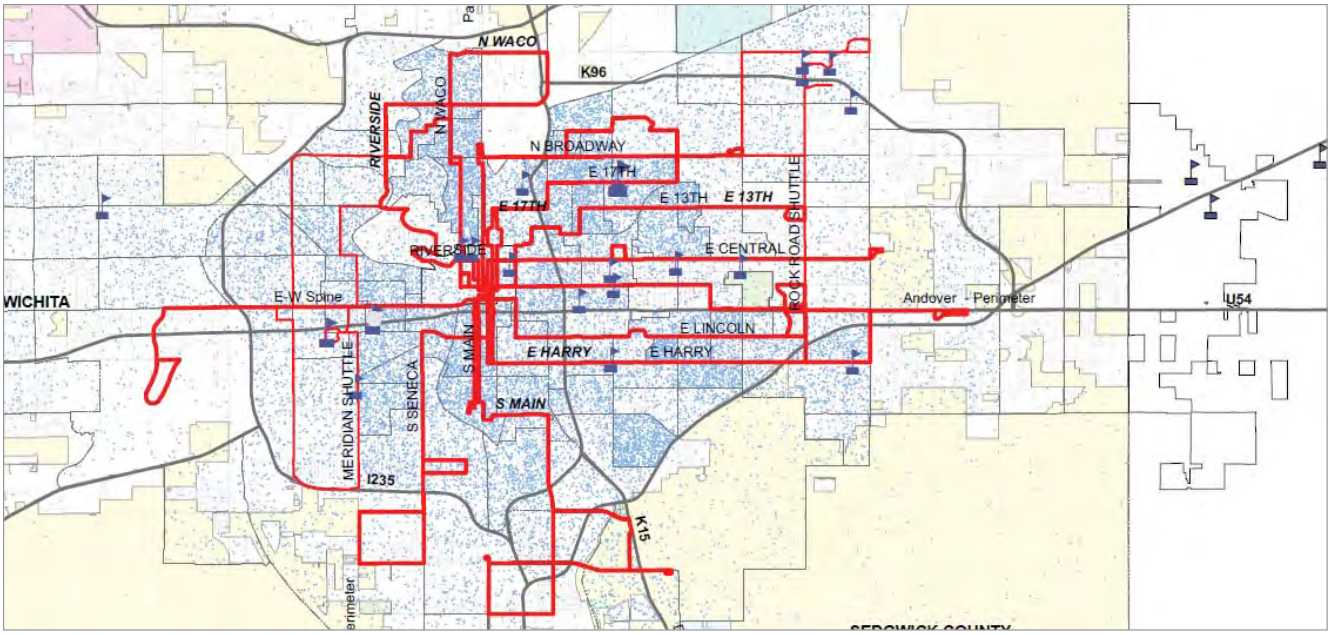
Maroon Flags: High schools in Wichita.

Concentrated Blue Dots: Children 18 and under living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of Wichita school districts and high schools (grades 9–12).

Notes

Map B-18: Concept B and Access to Education: Universities



Notes: This analysis does not include the location of every post-secondary institution in or around Wichita. However, the locations of the institutions mapped are a sufficient barometer of access to these institutions.

Legend:

Red Lines: Concept B bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

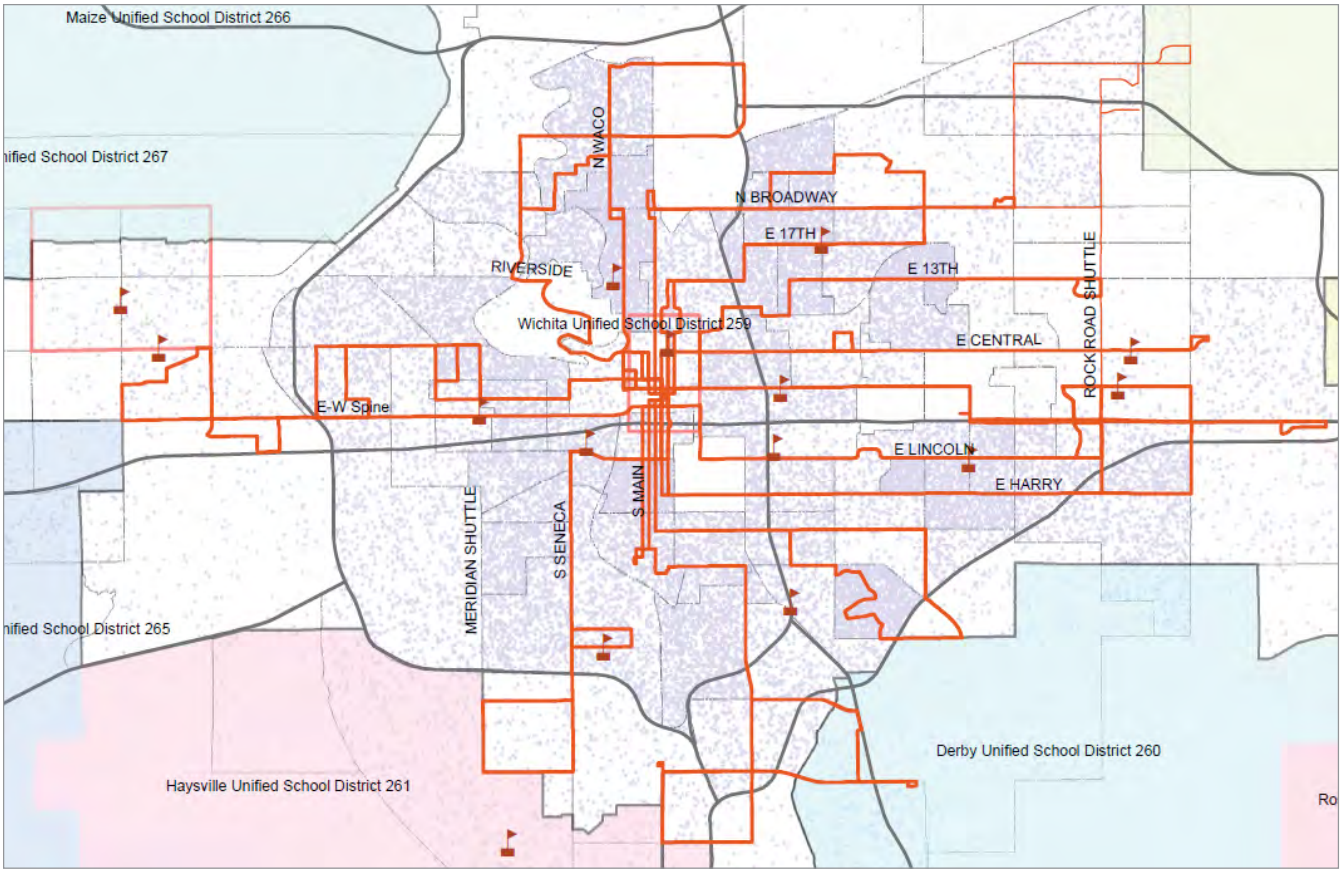
Blue Flags: Universities in Wichita.

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of post-secondary institutions (universities, community colleges and trade schools) in Wichita and Andover, KS.

Notes

Map B-19: Concept C and Access to Education: K–12 School Districts and High Schools



Notes: This analysis does not include locations of K–8 schools. However, the locations of the schools mapped are a sufficient barometer of access to these schools.

Legend:

Red Lines: Concept C bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

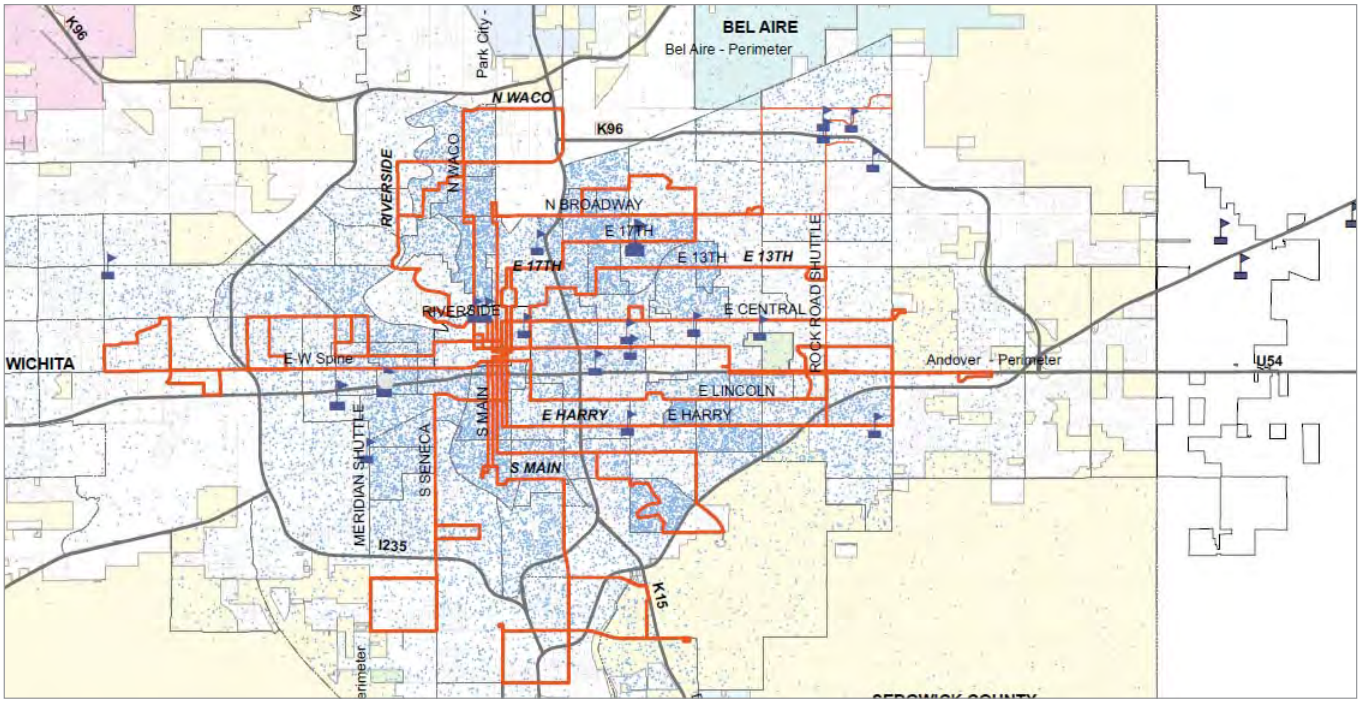
Maroon Flags: High schools in Wichita.

Concentrated Blue Dots: Children 18 and under living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of Wichita school districts and high schools (grades 9–12).*

Notes

Map B-20: Concept C and Access to Education: Universities



Notes: This analysis does not include the location of every post-secondary institution in or around Wichita. However, the locations of the institutions mapped are a sufficient barometer of access to these institutions.

Legend:

Red Lines: Concept C bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

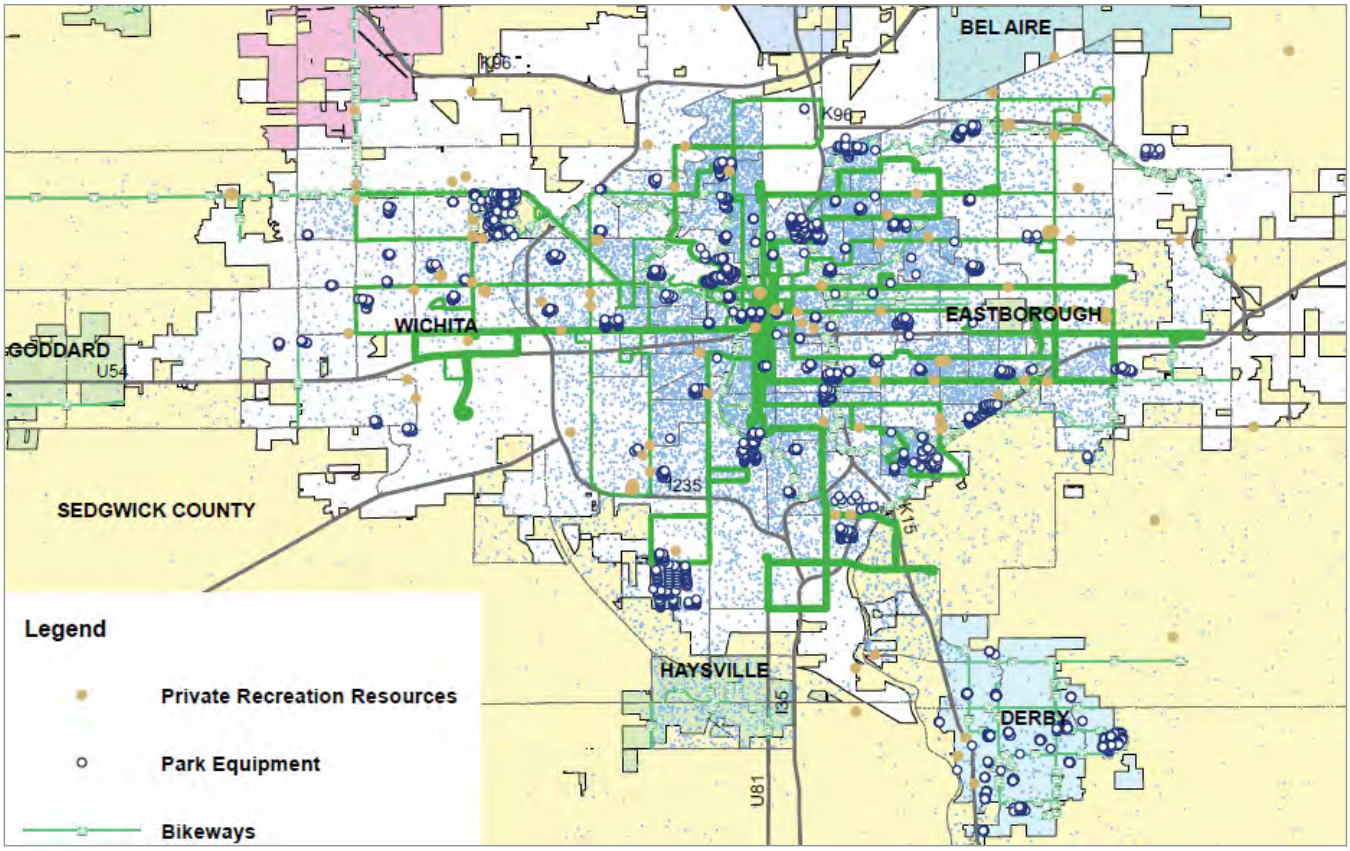
Blue Flags: Universities in Wichita.

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of post-secondary institutions (universities, community colleges and trade schools) in Wichita and Andover, KS.

Notes

Map B-21: Current System and Access to Recreational Resources



Notes: This analysis does not include locations of every recreational resource in Wichita, because it was not feasibile to collect the data. However, the locations of the recreational resources mapped are a sufficient barometer of access to these resources.

Legend:

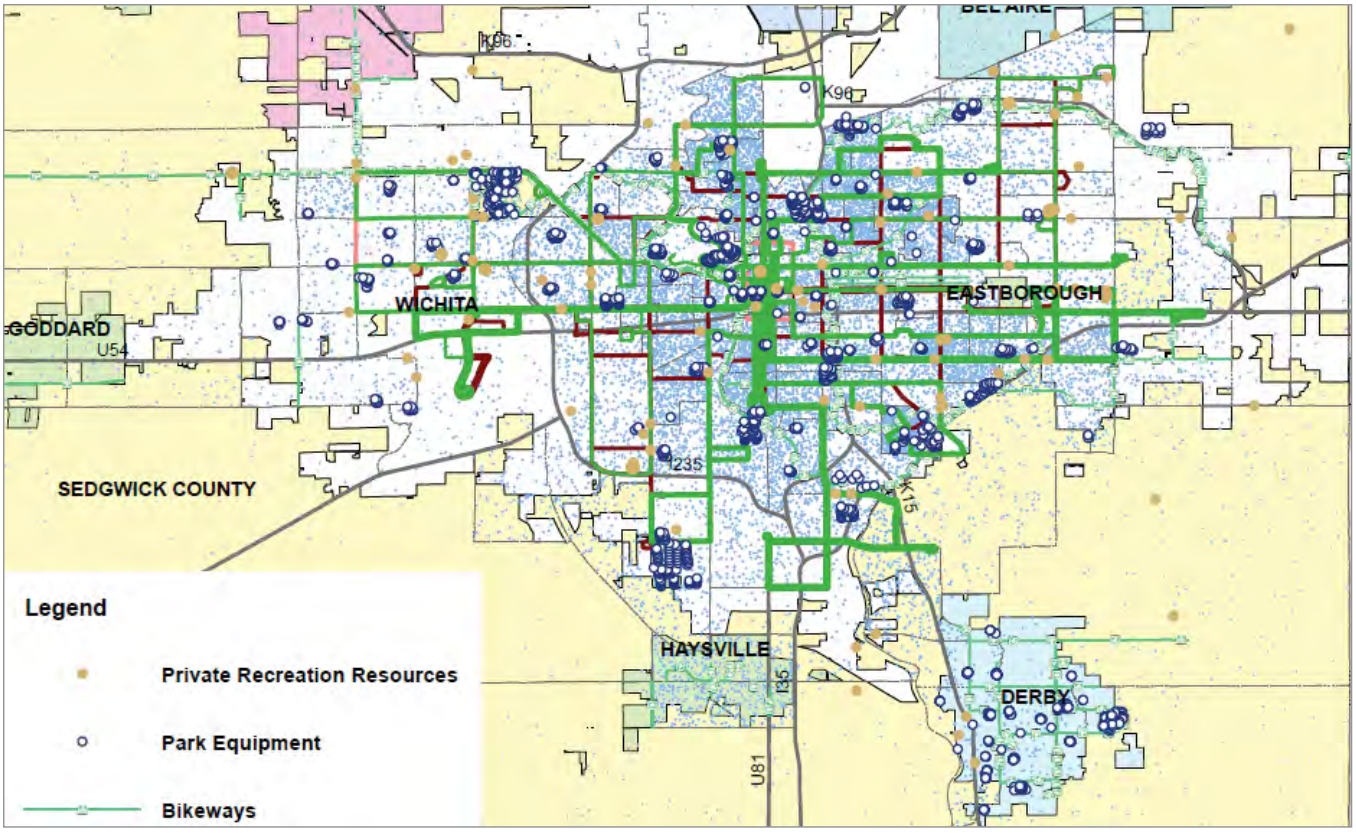
Green Lines: Current bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (current routes) and geographic locations of recreational resources, including private recreational facilities (e.g. gym), park equipment and bike paths.*

Notes

Map B-22: Concept A and Access to Recreational Resources



Notes: This analysis does not include locations of every recreational resource in Wichita, because it was not feasibile to collect the data. However, the locations of the recreational resources mapped are a sufficient barometer of access to these resources.

Legend:

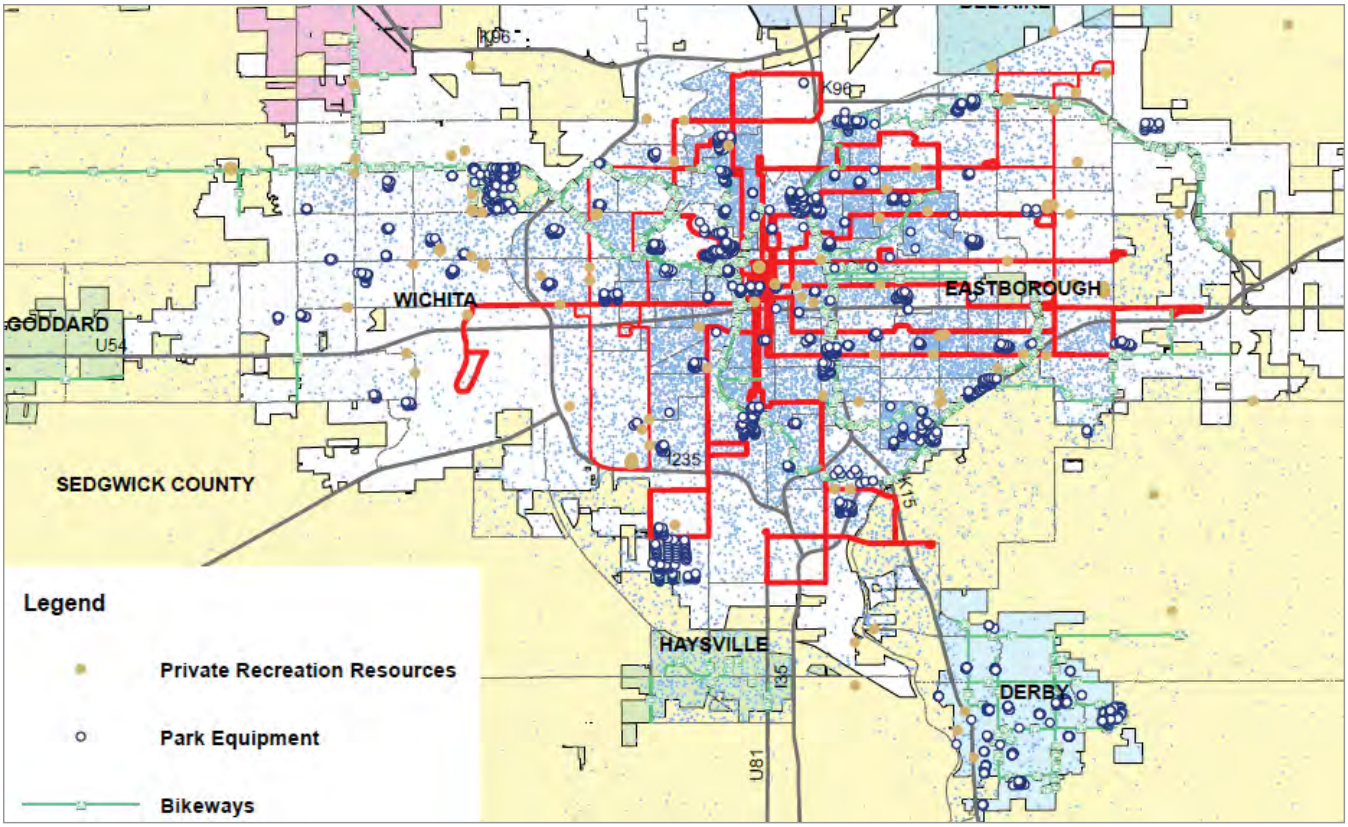
Green Lines: Concept A bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of recreational resources, including private recreational facilities (e.g. gym), park equipment and bike paths.*

Notes

Map B-23: Concept B and Access to Recreational Resources



Notes: This analysis does not include locations of every recreational resource in Wichita, because it was not feasibile to collect the data. However, the locations of the recreational resources mapped are a sufficient barometer of access to these resources.

Legend:

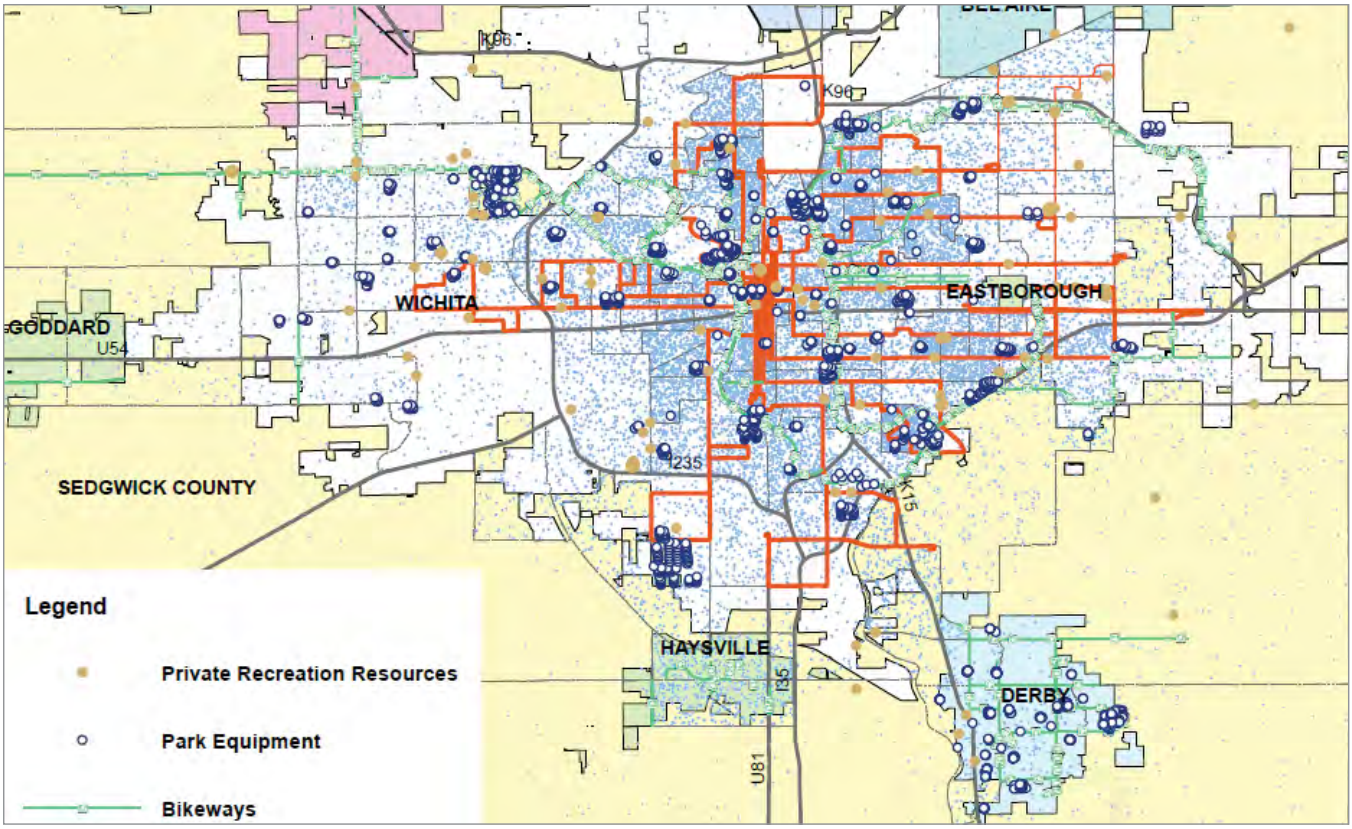
Red Lines: Concept B bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of recreational resources, including private recreational facilities (e.g. gym), park equipment and bike paths.*

Notes

Map B-24: Concept C and Access to Recreational Resources



Notes: This analysis does not include locations of every recreational resource in Wichita, because it was not feasibile to collect the data. However, the locations of the recreational resources mapped are a sufficient barometer of access to these resources.

Legend:

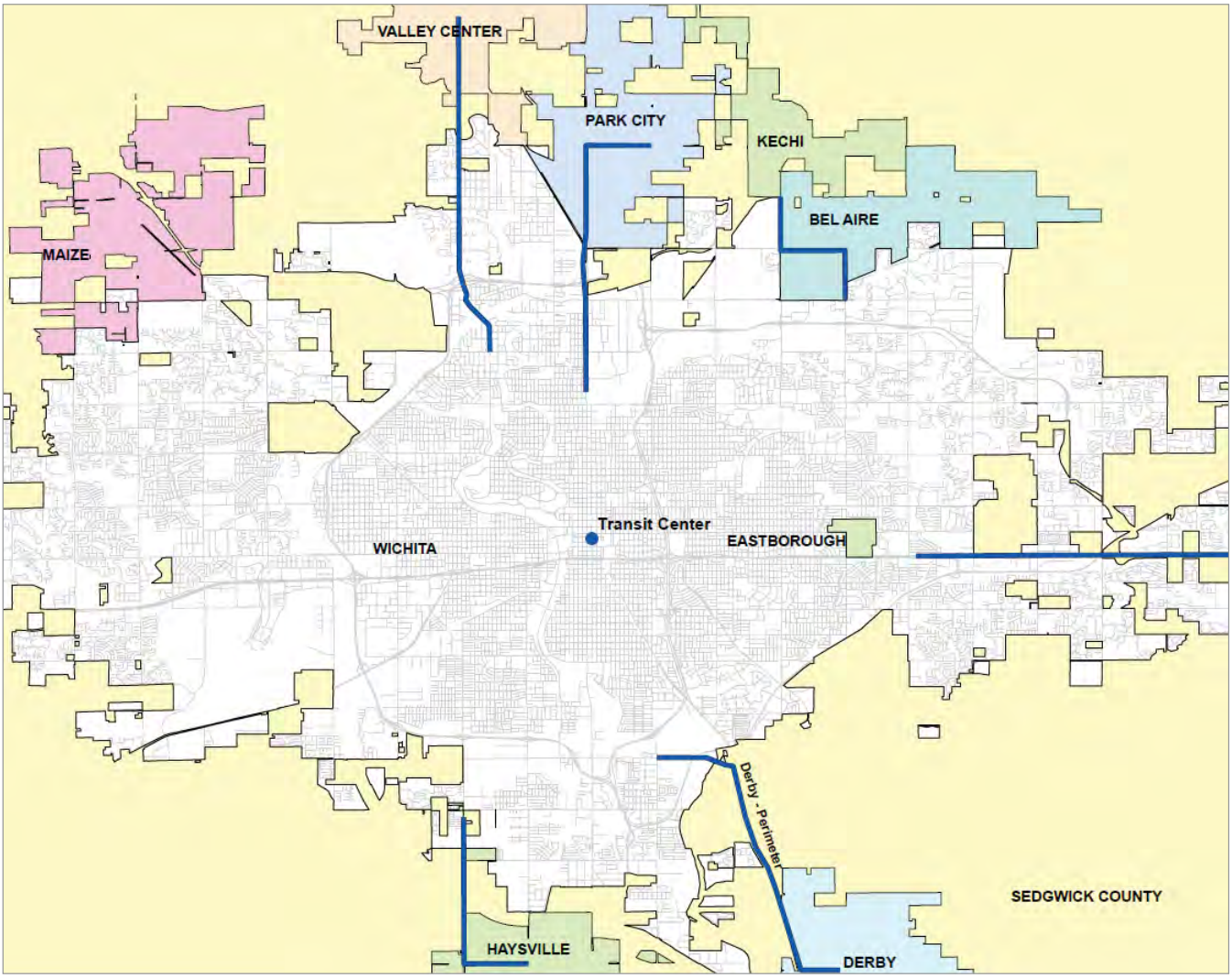
Red Lines: Concept C bus routes. The thickness of the lines represent the frequency of service (i.e. the thicker the line, the more frequent the service).

Concentrated Blue Dots: Individuals living in households at or below 100 percent of the federal poverty level.

Source: *KHI analysis using GIS mapping tools, Olsson Associates (concept routes) and geographic locations of recreational resources, including private recreational facilities (e.g. gym), park equipment and bike paths.*

Notes

Map B-25: Concept D1: Extension Routes to Access Services in Wichita

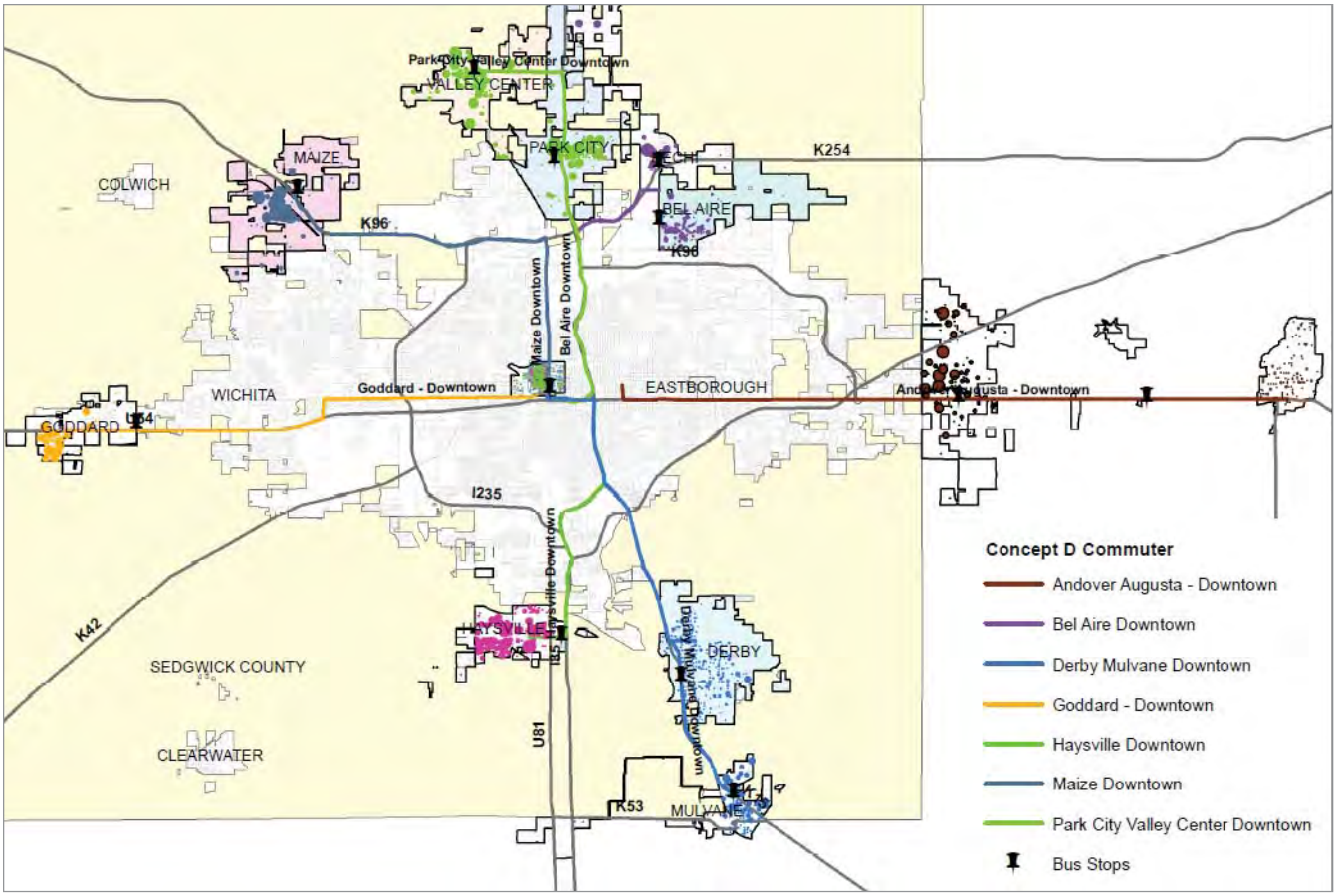


Legend:
Dark Blue Lines: Concept D Extension bus routes accessing Wichita's outlying communities.

Source: *KHI analysis using GIS mapping tools, Olsson Associates.*

Notes

Map B-26: Concept D2: Commuter Access to Services in Wichita



Legend:

Concentrated Blue Dots: Residents of outlying communities that work in the City of Wichita.

Source: *KHI analysis using GIS mapping tools, Olsson Associates and OnTheMap from U.S. Census Bureau Center for Economic Studies, 2013.*

Notes

APPENDIX C: EVALUATION

Background

As part of the Kansas Health Institute's Health Impact Assessment (HIA) on the potential impacts of proposed changes to the scope or services provided by the Wichita Transit Authority, a three-stage evaluation plan accessing both the process and the outcomes of the HIA was conducted. To date, two phases of this study have been completed, with this report representing all evaluation data having been collected through May 31, 2013.

Methodology

The evaluation utilized by KUSM-W to this point relied on five key indicators to assess the effectiveness of the HIA process as conducted by KHI: 1) The degree to which community stakeholders were engaged in the process, 2) the effectiveness of KHI in developing the draft HIA findings and recommendations, 3) the degree to which capacity was built for utilizing HIAs in the future within the community and city council, 4) the total resources and time required to participate in the HIA, and 5) overall satisfaction with the process.

In addition to assessing process indicators, the evaluation for the Wichita Transit HIA to this point also assessed some of the preliminary outcomes of the HIA. Preliminary outcome indicators that were available at this time: 1) The degree to which members of the City Council and Wichita Transit Authority took part in the process, 2) the degree to which the community at large was able to increase its awareness of transit as a health issue, and 3) the degree to which HIA participants were able to assess the health impacts of each of the four proposed transit concepts under consideration.

In order to assess these indicators, a quantitative survey was administered to all key stakeholders at baseline and at follow-up, assessing their experiences of taking part in the HIA process with KHI and measuring changes in attitudes and knowledge surrounding transit and HIAs as a result of taking part in the HIA process. Additionally, a series of qualitative interviews were conducted with key community stakeholders about their experiences and perceptions in taking part in the HIA.

Results

Pre-Post Results

A total of five items are included for pre-post analysis: 1) KHI interactions, 2) information from staff, 3) HIA awareness, 4) HIA utility, and 5) transit awareness and attitudes.

KHI Interactions

Interaction with KHI staff or representatives were assessed using a closed-ended survey item asking respondents to rate their level of satisfaction with their interaction with KHI staff or their representatives. The five-point scale ranged from a low of "poor" to a high of "excellent." At follow-up, greater than 75 percent of respondents rated their interactions with KHI staff as "excellent" or as "very good," compared to just 60 percent who rated their interactions with KHI staff as highly at baseline.

Staff Information

Respondents were asked to comment on how sufficient the information they received regarding the HIA was from KHI staff using a four-point Likert scale. Respondents were most likely to 'somewhat' agree they had sufficient information about the HIA at baseline, but respondents were most likely to indicate they 'strongly' agreed the information they had received from KHI surrounding the HIA was sufficient at follow-up.

HIA Awareness

From baseline to follow-up, the percentage of respondents who "somewhat" or "strongly" agreed with these statements increased: they had a clear understanding of HIA as a concept, they could explain it to colleagues, they had a positive reaction to the term HIA, they thought taking part in HIA is important and they would recommend HIA to others.

HIA Utility

There was little change in respondents' views of the usefulness of HIA from baseline to follow-up, but at both baseline and follow-up at least 90 percent of respondents 'agreed' to some degree with each of five positive statements about the utility of HIA, leaving very little room for movement from baseline to follow-up.

Transit Awareness and Attitudes

At both baseline and follow-up, respondents were asked to their level of understanding and awareness of transit and health-related issues in Wichita based on five positive statements. For each of the five items, there was an improvement from baseline to follow-up in the percentage of respondents who 'agreed' to some degree with the positive statements about transit.

Follow-Up Only Results

A total of three items were included for pre-post analysis: 1) Transit issues, 2) HIA Process, 3) HIA engagement and HIA activities.

Transit Issues

During the course of completing the HIA, a number of specific transit and health issues were either revealed through the literature review or based on community feedback. Respondents indicated that access to employment was the most significant health issue related to transit, with over 40 percent indicating it was "extremely" important and 100 percent indicating it was either "extremely" or "very" important. Access to health care and access to education also figured prominently in participant responses, as over 80 percent of respondents rated those issues as either "extremely" or "very" important.

HIA Process

Respondents were asked to rate the HIA process on a series of five indicators using a five-point scale ranging from "poor" to "excellent." Respondents indicated the HIA was most effective in the degree to which the HIA provided a balanced assessment of potential health impacts, with nearly 70 percent of respondents indicating the KHI staff has done an "excellent" or "very good" job on this indicator. The most noteworthy areas for improvement in the HIA process were improving opportunities for community participation, providing a stronger introduction and explanation of HIA, and including a more diverse group of community stakeholders. The most prominent areas of strength in the HIA process included respondents' indications they were most impressed with the comprehensive assessment of potential health impacts. In addition to respondents' high rankings of the comprehensiveness of the KHI approach, over 60 percent also indicated the HIA did a strong job of introducing and explaining the proposed changes to the transit system based on the four concepts under consideration.

HIA Engagement and HIA Activities

Participants were also asked to indicate their level of engagement with the HIA in terms of time expended to participate and the various activities participants may have taken part in. Respondents were most likely to report having spent a moderate amount of time on the HIA, ranging from one to ten hours total. In terms of engagement activities, respondents were most likely to have taken part in a December community engagement meeting, with over 90 percent of respondents having taken part in one of those two December meetings.

Notes

APPENDIX D:
KEY HIA FINDINGS AND RECOMMENDATIONS

Table D-1. Key Findings and Recommendations

	KEY FINDINGS	RECOMMENDATIONS
AREAS	**The findings were developed based on the literature review, community input and secondary data analysis.**	**These recommendations are intended to inform relevant decision-makers' efforts to improve the Wichita Transit System. The recommendations are drawn from the findings and are intended to maximize health benefits while minimizing health risks.**
ACCESS TO SERVICES AND RESOURCES	• Concepts A and C will provide access to services, including employment, health care, food sources, education and recreational resources, especially for approximately 18,600 individuals who reside in the southeast part of Wichita (the area south of East Harry and east of South Main). Approximately 4,800 of these individuals live in a low-income household. • Concept B will limit or prevent access to services for residents in this area.	**Wichita City Council should consider (that):** • Choosing a concept that connects populations to services.* • If all access issues cannot be addressed, consider giving priority to the concept that maximizes access to employment, health care and food sources. **Wichita Transit should consider:** • Including bus routes that provide adequate service to low-income neighborhoods and neighborhoods with a high proportion of immigrant population.* • Encouraging service organizations (e.g., Salvation Army, United Way) to inform and link their constituents to available transit services.* • Bus stops are located near service locations and are connected to sidewalks and pedestrian paths.* • Bus stop infrastructure provides adequate shelter and addresses needs of all riders, including those with special needs.* • Prospective riders receive adequate information about transit routes, stops and schedules.*
ACCESS TO HEALTH CARE	• Generally, the concepts provide access to health care facilities throughout Wichita. However, all three concepts (A, B and C) would limit access to at least six hospitals and several health care facilities. • Concept A is most likely to increase access to health care and result in positive health impacts (e.g., early screening and reduction of vaccine-preventable diseases). • Increasing access to health care depends on timeliness and frequency of transit services and increased access for vulnerable populations. Concepts A and B would increase timeliness and frequency of transit services. • Access to reliable transit increases the likelihood of primary care and chronic care visits as well as decreases the number of ER visits.	**Wichita Transit should consider:** • Locating bus stops near health care offices and specialty clinics, especially those that serve children.* • Encouraging health care organizations to inform and link their patients to available transit services.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table D-1 (continued). Key Findings and Recommendations

AREAS	KEY FINDINGS	RECOMMENDATIONS
	The findings were developed based on the literature review, community input and secondary data analysis.	**These recommendations are intended to inform relevant decision-makers' efforts to improve the Wichita Transit System. The recommendations are drawn from the findings and are intended to maximize health benefits while minimizing risks.**
ACCESS TO EMPLOYMENT	• Typically one of the most predominant uses of transit is to get to work, but Wichita may not follow this trend. • Concepts A and B increase timeliness and frequency of services, thus improving access to transit especially for shift workers, while C does not. • The hub-and-spoke system doesn't provide easy access to jobs outside downtown Wichita. However many of the jobs in Wichita are located elsewhere. • The impact on the Wichita economy resulting from additional Wichita area resident payroll earnings would be $6.1 million annually for Concept A, $3.1 million annually for Concept B and $1.2 million annually for Concept D1.	**Wichita Transit should consider:** • Exploring the reasons for low ridership in the southeast part of Wichita. • Increasing frequency of bus routes and availability of routes at night or on weekends to align the transit schedule with shift workers' needs.* • Exploring the viability of a grid system.
ACCESS TO FOOD SOURCES	• In general, people who are more likely to use bus service for grocery shopping do not have access to alternative modes of transportation. • The use of a bus for grocery shopping also depends on available places on the bus to store groceries. • The use of transit for grocery shopping is dependent on convenience (e.g., proximity, timeliness, pedestrian access, adequate information about transit schedules). • People who are able to shop at supermarkets that offer healthy choices may be more likely to have lower BMI and obesity.	**The Metropolitan Area Planning Department should consider:** • Locating future grocery stores near transit routes. This can be achieved through zoning changes or other incentives. **Wichita Transit should consider:** • Placing buses with low floor areas for rolling carts on the routes that have the most grocery stores and purchasing any new buses with a low floor to support grocery shoppers. • Reviewing and changing the two-bag limit on buses or raising it to a higher number, such as six.* • Making transit-related materials (e.g., maps) and bus passes available in grocery stores.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table D-1 (continued). Key Findings and Recommendations

AREAS	KEY FINDINGS	RECOMMENDATIONS
	The findings were developed based on the literature review, community input and secondary data analysis.	**These recommendations are intended to inform relevant decision-makers' efforts to improve the Wichita Transit System. The recommendations are drawn from the findings and are intended to maximize health benefits while minimizing risks.**
ACCESS TO EDUCATION	• Concepts A and B provide more frequent and timely access to K–12 school programs held after school and evening university classes, while Concept C does not. • Unlimited access transit passes purchased by universities for all of their students may be beneficial for the university, students, and the transit agency. • Easy access to a university does not increase higher education participation but it can impact institutional choice and student retention.	**Wichita USD 259 should consider:** • Identifying the need for transit services to access activities and classes held after school. • Collaborating with Wichita Transit to address any identified needs for education sector employees and students, including available public transportation during off-peak hours for activities and evening classes.* **Universities located in Wichita should consider:** • Working with Wichita Transit to develop a universal pass for students.*
ACCESS TO RECREATIONAL RESOURCES	• Convenience is an important part of getting people to exercise and it is possible that increasing access through public transit will increase exercise. • The Centers for Disease Control and Prevention (CDC) Community Guide recommends improving access to places for physical activity along with an informational campaign to educate residents about the enhanced service. • Concept A would be more likely to increase access to recreational resources.	**The City of Wichita, Parks and Recreation in collaboration with Wichita Transit should consider:** • Incorporating questions about recreational-related transit use in future assessments. • Increasing coverage of routes used to access recreational opportunities. **Wichita schools should consider:** • Establishing shared-use agreements so that school grounds can be used as physical activity centers during non-school hours, and including transit officials in that planning.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table D-1 (continued). Key Findings and Recommendations

	KEY FINDINGS	RECOMMENDATIONS
AREAS	**The findings were developed based on the literature review, community input and secondary data analysis.**	**These recommendations are intended to inform relevant decision-makers' efforts to improve the Wichita Transit System. The recommendations are drawn from the findings and are intended to maximize health benefits while minimizing risks.**
TRANSIT AND EXPOSURE TO AIR POLLUTANTS	• In terms of overall air quality, high ozone levels are the primary concern for Wichita. • Ozone levels depend on many things including other pollution sources, weather, type/age of engine and fuels used. • Projected increases in transit ridership under Concepts A and B would improve overall air quality, but may not decrease ozone levels. • Concept A may result in the largest increase in ridership thus decreasing the number of cars on the road and improving overall air quality.	**Wichita Transit should consider:** • Implementing various strategies, including those suggested in the HIA report (e.g., improve timeliness and frequency of buses, develop a universal pass for students), to increase ridership and thereby improve overall air quality in Wichita.*
AIR QUALITY	• Diesel buses and gasoline cars can create the highest potential for exposure to air pollutants. • Diesel alternatives like Compressed Natural Gas have been shown to emit 90 percent less particulate matter than diesel-run buses. • Electric buses create significantly lower exposure to air pollutants than diesel buses. • Older buses create higher particulate matter and other air pollution than newer buses. • Other factors, such as bus idling, window position, and shelter orientation, can affect individual's exposure to air pollutants.	**Wichita Transit should consider:** • Continuing to assess the feasibility, costs and benefits of incorporating clean natural gas or electric buses into the current fleet. • Using available tools such as Diesel Emissions Quantifier (DEQ)[A] to determine Wichita-specific effects of changes in the transit fleet on air quality. • Continuing replacing and/or modifying aging buses to improve air quality. • Identifying best practices for the placement of bus shelters in order to minimize individual's exposure to air pollutants.
PHYSICAL ACTIVITY	• Public transportation users potentially achieve up to 30 minutes of physical activity daily simply from walking to and from transit. • When public transportation is easier to access (e.g., bus stops are conveniently located), individuals are more likely to walk to access transit and meet their physical activity recommendations.	**The Wichita Area Metropolitan Planning Department in collaboration with Wichita Transit should consider:** • Placing bus stops in locations that are connected to sidewalks, crosswalks, and pedestrian and bike paths when possible.* • Assessing the current infrastructure and connectivity of bus stops to sidewalks, crosswalks, pedestrian paths and bike paths. • Integrating and aligning transit plans with city development and zoning plans.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.
A. Available at http://www.epa.gov/cleandiesel/quantifier/deq-checklist.htm

Source: KHI HIA Transit Project, 2013.

Table D-1 (continued). Key Findings and Recommendations

AREAS	KEY FINDINGS	RECOMMENDATIONS
	The findings were developed based on the literature review, community input and secondary data analysis.	**These recommendations are intended to inform relevant decision-makers' efforts to improve the Wichita Transit System. The recommendations are drawn from the findings and are intended to maximize health benefits while minimizing risks.**
PEDESTRIAN ACCESS	• People who receive an employer-sponsored transit pass are more likely to use transit to get to work and meet physical activity recommendations. • Increases in ridership under Concept A can be expected to translate into additional community health care savings of $76,141 per year due to walking and receiving the recommended physical activity. Concept B would yield similar savings of $72,528 and Concept C would *decrease* the level of current health care savings by $24,231.	**Wichita Employers in collaboration with Wichita Transit should consider:** • Subsidizing the cost of bus passes to encourage ridership over car use and improve health status of employees.*
TRAFFIC VOLUME AND INJURY	• Bus occupants had the least risk of injury as compared to car, motorcycle or bike users, or pedestrians. • Vulnerable populations, such as the elderly or children, are at a greater risk for fatal injuries. • Traffic volume and population density are the main influencers on pedestrian crashes. • A threshold effect shows that as more people walk or bike, the injury rate decreases because drivers are more aware of cyclists and pedestrians. • Wichita would observe annual savings due to reduced traffic injuries for Concept A ($532,000) and Concept B ($513,000). However, for Concept C, the cost of traffic injuries would increase by $172,000.	**Wichita City Council should consider:** • Choosing the concept that will have the largest increase in ridership to reduce motor vehicle-related injuries and deaths. **The Wichita Area Metropolitan Planning Department should consider:** • Continuing to plan and create an infrastructure conducive to walking and biking in order to meet the threshold for reducing pedestrian-related injuries.*
SECONDHAND SMOKE EXPOSURE	• One in five children is exposed to secondhand smoke in cars. Switching from car to bus, where smoking is not allowed, could help decrease children's exposure to secondhand smoke. However, the health impacts will depend on individual's overall exposure to secondhand smoke and their use of transit versus a car.	**Wichita City Council should consider:** • Restricting smoking in bus stops. **Sedgwick County Health Department and health organizations should consider:** • Increasing efforts (e.g., publications, announcements and/or media) to inform car users about the negative health impacts of secondhand smoke exposure in cars on adults and especially children.* • Utilizing ad spaces on buses and shelters to disseminate information to highlight the benefits of transit as a way to reduce exposure to secondhand smoke.

*The HIA Transit Advisory Panel rated the recommendation high in terms of its priority.

Source: KHI HIA Transit Project, 2013.

Table D-1 (continued). Key Findings and Recommendations

AREAS	KEY FINDINGS	RECOMMENDATIONS
	The findings were developed based on the literature review, community input and secondary data analysis.	**These recommendations are intended to inform relevant decision-makers' efforts to improve the Wichita Transit System. The recommendations are drawn from the findings and are intended to maximize health benefits while minimizing risks.**
DISTRACTED DRIVING	• In general, one in six fatal vehicle collisions result from distracted driving. • The HIA team estimates that 80 percent of new transit riders will have switched from driving to public transit. As a result of switching to public transit under: • Concept A, about 0.19 percent fewer individuals would encounter the risk of distracted driving each year. • Concept B, about 0.18 percent fewer individuals would encounter the risk of distracted driving each year. • Concept C, about 0.06 percent more individuals would encounter the risk of distracted driving each year.	**Sedgwick County Health Department and health advocacy organizations should consider:** • Increasing efforts (e.g. , publications, announcements and/or media) to inform car users about the health risks associated with distracted driving. • Utilizing ad spaces on buses and shelters to highlight the benefits of transit as a way to reduce distracted driving.
DISCRETIONARY TIME	• As a result of increased frequency of buses and optimized routes, discretionary time would increase annually under: • Concept A by 34,887 hours, saving $253,000 ($103 per rider) each year. • Concept B by 141,719 hours, saving $1,027,000 ($424 per rider) each year. • There would be no measurable change in discretionary time under Concept C. • Based on these findings, Concept B would likely result in more health benefits than the other two concepts.	**The Wichita City Council should consider:** • Factoring in average travel times, and wait times in particular, when choosing a concept. • Choosing or giving priority to a concept that maximizes populations' discretionary time.
LEGEND	Priority recommendation	* The HIA Transit Advisory Panel rated the recommendation high in terms of its: • Feasibility (cost and political): How realistic is it to implement this recommendation? • Importance: How important is this recommendation to the community? • Implications for vulnerable populations: Does it address the needs of vulnerable populations?

Source: KHI HIA Transit Project, 2013.

Appendix E: Data Sources

Immunize Kansas Kids Clinic Survey: Sedgwick County Clinic Address List

Kansas Association for the Medically Underserved: Community Clinic List

Kansas Department of Health and Environment, Bureau of Air, Air Monitoring and Planning: Air Quality Index and Air Monitoring Data

Kansas Department of Health and Environment, Bureau of Community Health Systems: Regulated Health Care Provider Directory

Kansas Department of Health and Environment, Bureau of Family Health, Nutrition and WIC Services: WIC Retailer Data

Kansas Department of Health and Environment, Bureau of Health Promotion: Behavioral Risk Factor Surveillance System

Kansas Department of Transportation, Bureau of Transportation Planning, Accident Data Unit: Kansas Accident Reporting System Data and Daily Vehicle Miles Traveled

Kansas Farmers Markets: List of Sedgwick County Farmers Markets

Kansas Food Bank, Wichita Metro Area Help Agencies: Emergency Food Resource List

Kansas GIS Data Access & Support Center: Administrative Boundary, and Highway Data

Kansas Health Matters

Kansas State Department of Education: Kansas K–12 Reports, Graduate Reports

Olsson Associates: Wichita Transit Community Outreach Study, Wichita Transit Concepts, Proposed Routes, Operational Characteristics and Estimated Costs

Sedgwick County Health Department: Clinic Location List

Texas Transportation Institute: Traffic Congestion Data

U.S. Census Bureau, Center for Economic Studies, Longitudinal Employer-Household Dynamics: OnTheMap Data

U.S. Census Bureau: 2010 Census, Intercensal Population Estimates and American Community Survey

U.S. Department of Agriculture, Food and Nutrition Service: SNAP Retailer Locator

U.S. Department of Labor, Bureau of Labor Statistics: Consumer Price Index — Urban, All Cities Average

U.S. Department of Labor, Bureau of Labor Statistics: Local Area Unemployment Statistics

U.S. Department of Transportation, Federal Highway Administration: National Household Travel Survey Data

University of Wisconsin, Population Health Institute: County Health Rankings

Wichita Area Metropolitan Planning Organization: 2011 WAMPO Regional Household Travel Survey Data

Wichita Transit: Fixed Route Ridership and Bus Fleet Data

Wichita-Sedgwick County Metropolitan Area Planning Department: Current Transit Routes, Recreation Resources, Park Equipment and Bikeway Location Data

Wichita, 2012.

APPENDIX F: ENDNOTES

1. Vallianatos, M., Shaffer, A., Gottlieb, R. (2002). *Transportation and food: The importance of access.* Los Angeles: Urban and Environmental Policy Institute, Occidental College.
2. U.S. Department of Transportation. *Metropolitan Area Transportation Planning for Healthy Communities*. Retrieved on May 30, 2013, from http://www.planning.dot.gov/documents/Volpe_FHWA_MPOHealth_12122012.pdf
3. United States Census Bureau. (2012). *Population Estimates.* Retrieved on May 30, 2013, from http://quickfacts.census.gov/qfd/states/20/20173.html
4. United States Census Bureau. (2012). *State and County Quick Facts*. Retrieved on May 30, 2013, from http://quickfacts.census.gov/qfd/states/20/2079000.html
5. Kansas State Department of Education. (2013). Kansas K–12 reports: Graduation rate — four-year adjusted cohort formula. Retrieved on May 30, 2013, from http://svapp15586.ksde.org/k12/CountyStatics.aspx?org_no=D0259
6. United States Census Bureau. (2012). *State and County Quick Facts*. Retrieved on May 30, 2013, from http://quickfacts.census.gov/qfd/states/20/2079000.html
7. Ibid.
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55. Specialty hospital — A special hospital is defined as an establishment with an organized medical staff of physicians; with permanent facilities that include inpatient beds; and with medical services, including physician services, and continuous registered professional nursing services for not less than 24 hours every day, to provide diagnosis and treatment for patients who have specific medical conditions. K.S.A. 65-425 (b).

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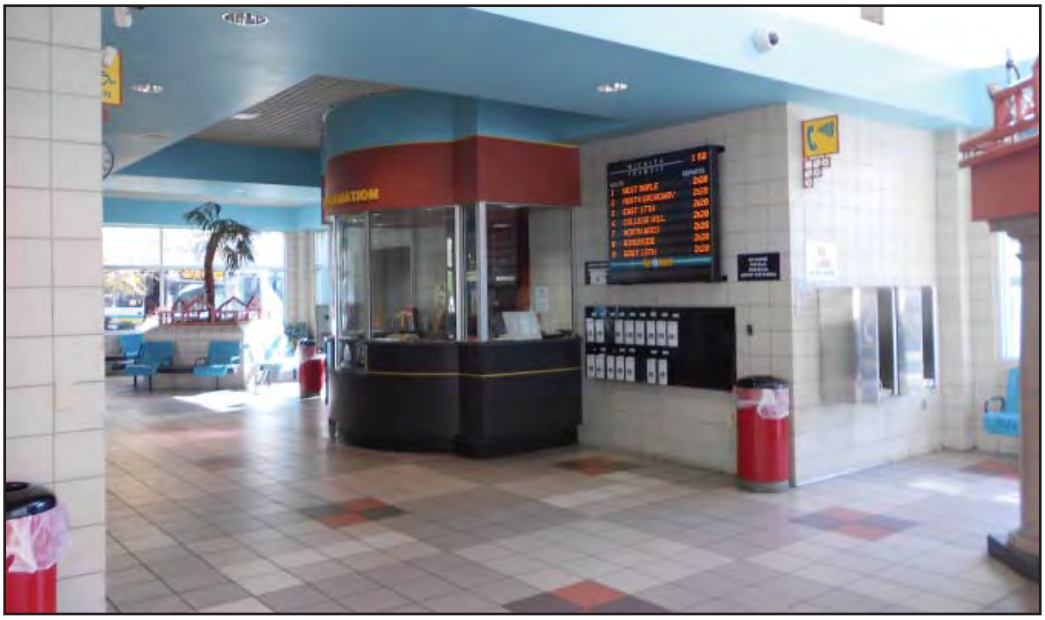

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