INCORPORATING HEALTH CONSIDERATIONS INTO COLLABORATIVE TRANSPORTATION DECISION MAKING

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INCORPORATING HEALTH CONSIDERATIONS INTO COLLABORATIVE TRANSPORTATION DECISION MAKING

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LIST OF ABBREVIATIONS

BART – Bay Area Rapid Transit

BEAT – Bicycling Environmental Audit Tool

CAPE report – Community Assessment, Planning, and Evaluation Report

CDC – Centers for Disease Control and Prevention

CMAP – Chicago Metropolitan Agency for Planning

CPPW – Communities Putting Prevention to Work

DOT – Department of Transportation

EPA – Environmental Protection Agency

FHWA – Federal Highway Administration

FTA – Federal Transit Administration

GDOT – Georgia Department of Transportation

GIS – Geographic Information Systems

HEAT – Healthy Economic Assessment Tool

HIA – Health Impact Assessment

HUD – Housing and Urban Development

MassDOT – Massachusetts Department of Transportation

MnDOT – Minnesota Department of Transportation

MAP-21 - Moving Ahead for Progress in the 21st Century (MAP-21)

MPO – Metropolitan Planning Organization

NCHRP – National Cooperative Highway Research Program

NEPA – National Environmental Policy Act

PCPC – Philadelphia City Planning Commission

PDPH – Philadelphia Department of Public Health

PEQI – Pedestrian Environmental Quality Index

PHILATool – Planning and Health Indicator List and Assessment Tool

PM – Performance Management

PM – Particulate Matter

RTP – Regional Transportation Plan

SANDAG – San Diego Association of Governments

SEMCOG – Southeastern Michigan Council of Governments

SFDPH – San Francisco Department of Public Health

SFMTC – San Francisco Metropolitan Transportation Commission

TERC – Transportation Environment Resource Council

TIP – Transportation Improvement Program

TOD – Transit Oriented Development

UCLA – University of California, Los Angeles

USODT – United States Department of Transportation

VMT – Vehicle Miles Traveled

WAT – Walkability Assessment Tool

WHO – World Health Organization

SUMMARY

Performance measurement and management have been evolving at state Departments of Transportation (DOTs)—and transit agencies to a lesser degree—in recent years, and a variety of performance data is being utilized in different ways to guide decision-making processes. However, health considerations beyond air quality and safety are not yet being incorporated into performance management programs at transportation agencies. Concurrently, Health Impact Assessments (HIAs) and other public health tools have seen increasing use among Metropolitan Planning Organizations (MPOs) and their stakeholders through collaboration with public health professionals. With the 2012 reauthorization of the surface transportation bill - Moving Ahead for Progress in the 21st Century (MAP-21), transportation agencies must formalize their focus on performance measurement and reporting in order to remain competitive for limited federal funding. Among the most important requirements in the act is one that states that Transportation Improvement Programs must describe progress toward national performance goals, one of which is environmental sustainability. Because public health is inextricably linked to environmental sustainability, this requirement provides the opportunity for transportation agencies to lead best practices by considering health proactively in transportation decision making.

This study investigates the possibility for integration between transportation performance measurement and management and the HIA approach, identifying and explaining the linkages between the two previously isolated processes. The study draws from best practices in performance measurement/management at state DOTs and various examples

of health-related activities among MPOs, transit agencies, and other planning entities to inform a suggested approach for incorporating health considerations and metrics in transportation decision making. The suggested approach recognizes common goals of health and transportation agencies, which are well-aligned with national objectives, and emphasizes the role of multidisciplinary interagency collaboration and partnership. This approach is intended to be a resource for state DOTs, MPOs, and transit agencies that are interested in extending their performance measurement/management activities to formally include health considerations, as its collaborative nature can ease many of the implementation issues currently faced when considering broader health impacts of transportation.

CHAPTER 1: Introduction

The purpose of this study is to introduce a way to incorporate health impacts into transportation planning and decision making that utilizes existing processes and procedures at the state Department of Transportation (DOT) and Metropolitan Planning Organization (MPO) level. Performance measurement and performance management have been increasingly popular decision-making tools used by transportation agencies over the last decade. Indeed, a recent Pew Center study (Pew Center on the States 2011) showed that 13 states have integrated performance measures into their decision-making processes for a number of policy areas including safety, jobs and commerce, mobility, access, environmental stewardship, and infrastructure preservation. Performance-based planning has also been encouraged at the federal level, with the most recent transportation reauthorization bill, Moving Ahead for Progress in the 21st Century (MAP-21), explicitly mandating it. MAP-21 requires states to develop a risk-based asset management plan that outlines strategies for achieving national goals (§1106 Pages: 29-34). These goals involve improvements in safety, infrastructure condition, and many other areas, including environmental sustainability (§1203 Pages: 123-126). It could be argued that the human environment and public health are inextricably linked to environmental sustainability through what can be thought of as a "resource conflict" and a "development conflict" The "resource conflict" lies between the environmental and the economic components of sustainability through the consumption of natural resources. The "development conflict" lies between the environmental and the equity components of sustainability through the balance of improving outcomes for the poor and disadvantaged while at the same time practicing growth management (Godschalk 2004). Indeed, quality

of life, which can be considered a function of the various components of social sustainability (Papageorgiou 1976), is identified as part of the scope of the planning process elsewhere in the bill (§1201 Pages: 103-104 2012). Additionally, a 2011 NCHRP report (Zietsman, et al. 2011) included "fostering community health and vitality" as one of the fundamental principles of sustainability.

Several important developments on the federal level have recognized the connection between public health and transportation. In 2009, the U.S. Secretary of Transportation, U.S. Secretary of Housing and Urban Development (HUD) , and U.S. Environmental Protection Agency (EPA) Administrator announced their intention to form the Partnership for Sustainable Communities, which would be a collaboration between the three agencies to improve environmental sustainability and community livability while strengthening the economy (U.S. Department of Transportation 2013). Concurrently, HUD initiated the Sustainable Communities Regional Planning Grant Program, which provides support for metropolitan areas that integrate the planning processes of housing, land use, economic development, transportation and infrastructure (U.S. Department of Housing and Urban Development 2011). Another example is the White House Task Force on Childhood Obesity Report to the President (Executive Office of the President of the United States 2010), which recommended that all local communities consider health impacts of all new developments, and that the Federal government support the development of tools and resources for doing so. Also in 2010, the Affordable Care Act created the National Prevention Strategy (National Prevention Council 2011), which encourages partnerships among various levels of government and the private sector to collaborate for "healthy and safe communities", "the expansion of clinical and

community-based preventive services", "empowering people to make healthy choices", and "eliminating health disparities". The Centers for Disease Control and Prevention (CDC) recently released Recommendations for Improving Health through Transportation Policy in 2010, which suggested a collaborative approach to improving safety, reducing exposure to air pollution, and increasing opportunities for physical fitness through transportation policy (Centers for Disease Control and Prevention 2010). Finally, in a white paper the John A. Volpe National Transportation Systems Center (Lyons, et al. 2012) identified the critical role that DOTs can play in linking public health and transportation planning. The white paper claims that DOTs can support innovative statewide transportation programs that focus on health-related outcomes through helping MPOs within the state work together on health initiatives. These examples of federal recognition of the connection between transportation infrastructure and public health, coupled with the push for transportation agencies to participate in performance-based planning, signify a shift in goals and priorities in transportation planning. Specifically, transportation officials are simultaneously beginning to recognize a) the greater impacts that transportation infrastructure has on society and the human environment, and b) the need to use their financial resources more efficiently by investing in projects that will help them achieve broader goals and objectives. Transportation practitioners who choose to pursue health-related goals, therefore, need a feasible approach to measuring and analyzing the broader potential impacts of proposed transportation projects so that they can allocate limited funding in the most effective and efficient way. Performance management is a process that is well-suited to this task.

To capture the state-of-the-practice regarding transportation performance measurement/management and the extent to which transportation agencies may be beginning to consider health impacts, an extensive literature review and webscan of agency documents was conducted. The webscan led to the identification of several leading agencies that are beginning to measure or consider the health impacts of transportation, and/or who have participated in collaborative activities with public health officials. These leading agencies were contacted for phone interviews to enhance the author's understanding of their health-related activities, partnerships with health professionals, and future plans for considering health impacts of transportation.

CHAPTER 2: Literature Review of Health Impacts of Transportation Infrastructure

2.1 Defining Health

The World Health Organization defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (WHO 1948). Digging further into this definition presents two main perspectives with which to view health: the "tight" view which employs the biomedical model of health, incorporating disease categories and typically quantitative health impact evidence, and the "broad" view which focuses on social health and wellness and typically utilizes qualitative health impact evidence (Harris, et al. 2007). This duality between tight and broad views of health can be connected to health-related activities and interventions through categories of emphasis and application. Figure 1 shows this typology, where one axis represents either a health protection or health promotion emphasis, and the other differentiates between project-level and policy-level application. Finally, there is differentiation between a focus on unintended health consequences of a policy and the intent to produce certain health outcomes through policies (Morgan 2008). These differing policy applications lend to different types of observed health impacts. Health impacts can be described as having direct or indirect causal pathways, or as being an impact that is felt by the transportation system users versus those felt by society as a whole.

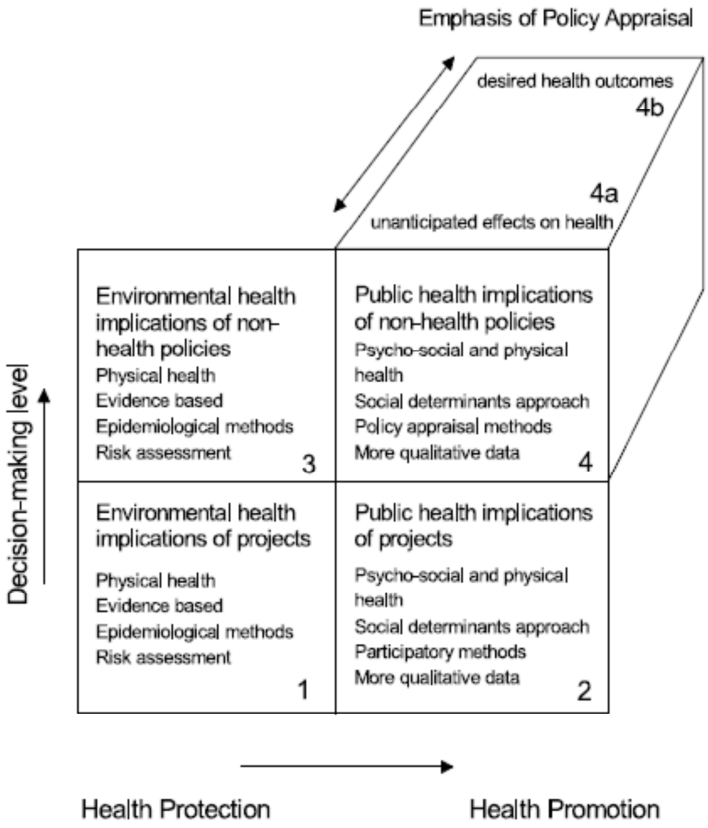


Figure 1: A typology of health interventions (Morgan 2008)

2.1.1 Direct versus Indirect Impacts

Direct impacts are those that affect the health of the population by means of interacting with the transportation system itself, while indirect impacts are those that occur due to the transportation system's interaction with the environment and its related health determinants (Harris, et al. 2007). Impacts on health determinants and their subsequent outcomes can be connected through direct pathways as in those often associated with safety (e.g., sidewalks help prevent pedestrian injuries by separating pedestrians from vehicles) or through less direct pathways such as those associated with obesity (e.g., sidewalks help reduce obesity by creating an opportunity for physical activity). Health impacts associated with transportation lie along a continuum with regards to the

directness of their impact pathways. Along this continuum from direct to indirect, it is often the case that more direct pathways tend to be those that are conventionally considered in transportation planning (i.e. safety) whereas, far fewer mechanisms exist for considering the indirect effects of transportation on health (i.e. obesity).

2.1.2 Societal versus system user impacts

Health impacts associated with transportation infrastructure can include both those observed in system users as well as those observed in society. User impacts are those felt by people who use the transportation system. Societal impacts are those that are felt by the population as a whole, and not necessarily by users of the transportation system only. Both user impacts and societal impacts can vary in their directness. For example, a societal impact of encouraging commuters to walk or bike to work could be a reduction in air pollution emission, which improves the overall air quality (Reynolds, Winters, et al. 2010). This would be considered a direct societal impact of changing commuting habits. However, for the individual walker or bicyclist, participating in active travel may increase their exposure to air pollution, as they are breathing more deeply and do not have the benefit of a motor vehicle's air filtration system (Reynolds, Winters, et al. 2010). This would be considered a less direct impact on a system user. On the other hand, encouraging commuters to walk or bike to work could improve individual commuters' physical health through exercise (Reynolds, Winters, et al. 2010), which would be a direct impact to the system user. This impact could be felt by the society at large in form of decreased health care costs, which would be considered an indirect impact.

2.1.3 Broader health determinants of transportation

A variety of health impacts are discussed in the literature as being associated with transportation. These include, but are not limited to:

- Traffic accidents between all system users (Reynolds, et al. 2009)
- Pollution from motor vehicles (Marshall, Brauer and Frank 2009) (Reynolds, et al. 2010)
- Noise pollution (Dora and Phillips 2000)
- Social and mental well-being (Besser, Marcus and Frumkin 2008) (Samimi and Mohammadian 2010) (Urban Design 4 Health 2010)
- Physical activity (National Research Council 2011) (Samimi and Mohammadian 2010)
- Improved accessibility to employment, goods, and services (Litman 2010) (Geurs, Boon and Wee 2009)

Despite the range of impacts, few transportation agencies in the United States are explicitly analyzing health considerations in their decision-making processes. While a few transportation projects in the United States that have been analyzed for their potential impacts on public health, this is not the norm. When this analysis does occur, a process called Health Impact Assessment (HIA) is often conducted, typically by public health professionals. The next chapter defines and HIA, provides some transportation-related examples, explains the current short-comings of its use in transportation, and demonstrates the need for a more feasible approach.

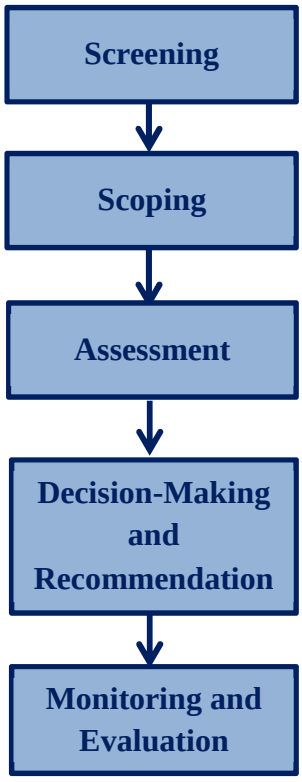
CHAPTER 3: Health Impact Assessment in Transportation

3.1 Defining Health Impact Assessment

While a few transportation projects in the United States that have been analyzed for their potential impacts on public health, this is not the norm. When this analysis does occur, a process called Health Impact Assessment (HIA) is often conducted, typically by public health professionals. HIA is often defined as "a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population" (European Centre for Health Policy 1999). Though there are slight variations, most HIA's incorporate some version of the following five steps: 1) Screening, 2) Scoping, 3) Assessment, 4) Decision making and recommendations, and 5) Evaluation and follow-up (UCLA 2011). Figure 2 summarizes the HIA process[1].

Three HIA's will be used as examples throughout the next few sections to aid in explaining the five steps. The first example HIA is on the Atlanta Beltline, a redevelopment project in Atlanta, Georgia which involves transforming 22 miles of mostly unused freight rail into transit, trails, parks, and residential and commercial redevelopment. The main purpose of the Beltline is to revitalize areas on the outer edges of the city that are in need of economic development, and to promote walkability and infill development (Ross 2007). The second HIA example is on the MacArthur BART Transit Village in Oakland, California, a new heavy rail transit station for Bay Area Rapid Transit (BART), including commercial and residential Transit Oriented

[1] This figure is featured in the yet-to-be published work: (Ingles, et al. 2013)



Screening – Is HIA necessary and/or feasible based on likelihood of significant health impacts, data availability, and available resources?

Scoping – What level of analysis is necessary based on key potential impacts, population affected, temporal and geographical boundaries, and budget?

Assessment – Analysis of quantitative and qualitative data and input from stakeholders drive the creation of a set of prioritized impacts and initial recommendations

Decision-making and Recommendations – Results of the analysis inform a list of action-oriented recommendations, with rationale and justifications for each, including an overview of the supporting evidence.

Monitoring and Evaluation – Evaluate the HIA process and impact on recommendations. Continuously monitor health impacts of the project and compare them to the predicted impacts from the Assessment step.

Figure 2: Health Impact Assessment Process adapted from (UCLA 2011), (Harris, et al. 2007), and (National Prevention Council 2011)

Development (TOD) and pedestrian and bicycle amenities. The vision is to create a mixed-use transit village that promotes walking and is vibrant and safe (University of California Berkeley Health Impact Group 2007). The final HIA example is on the Decatur Community Transportation Plan, which is a citywide transportation plan for Decatur, Georgia and is meant to create places where people of any ability can engage in physical activity through active transportation and by addressing safety, accessibility, and mobility (Center for Quality Growth and Regional Development 2007). The Appendix contains more in-depth information about the steps taken in each of these HIAs.

3.1.1 Screening

The purpose of screening is to determine if HIA is feasible and/or necessary for the project in question (UCLA 2011). This process should involve all relevant stakeholders, including decision-makers who have the power to change the project proposal, project proponents, community leaders, and key health impact experts (Harris, et al. 2007). For example, in the Atlanta Beltline project HIA an advisory committee was formed for this task with members having expertise in at least one of the following areas: HIA, physical activity and public health, transportation planning, city and regional planning, health psychology, architecture and community design, computation and analysis, and quality of life (Ross 2007). Key criteria for determining feasibility of and need for HIA include the likelihood and magnitude of health impacts, potential added value to the policy-making process, data availability, and available financial and human resources. Once each criterion is evaluated for the proposed project, all conclusions should be documented along with the final decision on whether or not to proceed (UCLA 2011). Even if HIA is deemed unnecessary or infeasible, much can be gained from the screening process in the way of opportunities for project improvement with respect to health impacts and potential impact on policy-making through interaction with legislators (Harris, et al. 2007). The Atlanta Beltline Advisory Committee concluded that the project could impact health through noise, injury, physical activity, air quality, social capital, crime, accessibility, and gentrification. However, it was decided that further investigation would be necessary to determine the magnitude and direction of the impacts, and therefore the committee recommended proceeding with HIA. It was also noted that HIA would likely improve the project by identifying impacts on vulnerable populations (Ross 2007).

3.1.2 Scoping

The scoping process is arguably the most important step because it is during this step that a commitment is made to carry out HIA. It is important to ensure a broad range of stakeholder participation during the scoping process; including professionals, key decision-makers, relevant voluntary organizations, and the local population can help to create equity so that any potential to introduce new health inequalities can be mitigated and to avoid the intensification of existing ones (Harris, et al. 2007). It is also during the scoping process that a plan is created for determining potential health impacts of the proposed project. The development of a logical framework for determining impact pathways will help to effectively organize knowledge so that it can easily be communicated to stakeholders (UCLA 2011). Along with potential impact pathways, the following elements must be determined and documented as a result of the scoping process: preliminary key health impacts, population affected, statutory requirements, temporal and geographical boundaries, budget, HIA participants, and timeframe for completion (UCLA 2011). These factors will determine what level of HIA is appropriate: desk-based, rapid, intermediate, or comprehensive. Table 1 describes the differences between each depth level. The depth of the HIA may also depend on public or political interest in the project itself or in HIA in general. Once the appropriate depth level is determined, a project plan is documented which describes the reason for choosing the selected depth level, preliminary plans for identification and assessment of impacts, decision-making and recommendations, and evaluation and follow-up, as well as the agreed timeline and budget (Harris, et al. 2007).

In the MacArthur BART Transit Village HIA the scoping involved developing a set of preliminary questions regarding the project's potential effects on various health determinants. By gathering existing data related to the project area and determining what resources and methods could be employed to help answer the questions, the group was able to estimate the time and financial and human resources necessary and feasible for carrying out the assessment and suggested mitigation actions (University of California Berkeley Health Impact Group 2007).

Table 1: Depth levels of HIA (Harris, et al. 2007)

DESK BASED	RAPID	INTERMEDIATE	COMPREHENSIVE
2-6 weeks for one person full time[1].	6 to 12 weeks for one person full time.	12 weeks to 6 months for one person full time.	6 to 12 months for one person full time.
Provides a broad overview of potential health impacts.	Provides a more detailed overview of potential health impacts.	Provides a more thorough assessment of potential health impacts, and more detail on specific predicted impacts.	Provides a comprehensive assessment of potential health impacts.
Could be used where time and resources are limited.	Could be used where time and resources are limited.	Requires significant time and resources.	Requires significant time and resources.
Is an 'off the shelf' exercise based on collecting and analysing existing accessible data.	Involves collecting and analysing existing data with limited input from experts and key stakeholders	Involves collecting and analysing existing data as well as gathering new qualitative data from stakeholders and key informants.	Involves collecting and analysing data from multiple sources (qualitative and quantitative)
Activities include accessing off the shelf resources and synthesising and appraising information.	Activities include accessing resources, hosting and supporting meetings, and synthesising and appraising information. If capacity does not exist in-house, consideration should be given to commissioning external assessors.	Activities include accessing resources, hosting and supporting meetings, identifying stakeholders and key informants, gathering and analysing qualitative and quantitative data, and synthesising and appraising information. If capacity does not exist in-house, consideration should be given to commissioning external assessors.	Activities include accessing resources, hosting and supporting meetings, identifying stakeholders and key informants, gathering and analysing qualitative and quantitative data, and synthesising and appraising information. If capacity does not exist in-house, consideration should be given to commissioning external assessors.
LESS IMPACTS →			MORE IMPACTS

A successful scoping process is defined by the tools, methods, and resources utilized to determine its outputs. Some relevant health and demographic data is publicly available and can be used in analysis. Table 2 shows some examples of free and public resources. Contacting local, regional, or state public health officials can lead to increased access to data, as well. This information can be used to create a profile of the likely affected communities, which provides a baseline for potential health impacts, and assists in identifying sensitive groups and disparities (UCLA 2011).

Table 2: Data and Analytical Resources

Resource	**Description**
Human Impact Partners	A list of commonly used HIA data sources for baseline profiles of health
National Environmental Public Health Tracking Network Reporting Tool	Interactive mapping tool that uses data from Behavioral Risk Factor Surveillance Survey
Census Transportation Planning Package	A subset from the decennial census demographic surveys designed for transportation planners
National Highway Traffic Administration Fatality Analysis Reporting System	Data on all vehicle crashes in the United States that occur on a public roadway and involve a fatality
Texas Transportation Institute Urban Mobility Report	Annual report of congestion on freeways and major streets in 101 cities in the United States
American Community Survey	A U.S. Census survey that collects demographic and transportation related data on a sample of the population every year
Survey of Income and Program Participation	A U.S. Census survey that collects data on participation in federal programs such as food stamps
Oasis	Interactive suite of online tools that provide access to Georgia Department of Public Health data.
CDC's Behavioral Risk Factor Surveillance Survey	Phone survey that tracks health conditions and risk behaviors associated with asthma, cardiovascular disease, diabetes, exercise, hypertension, overweight and obesity, physical activity
Community Economic Development HOT Report	Compiles census and other data into a graphical format for displaying social and economic indicators for individual counties

Checklists can also be helpful in outlining impact areas, available data, and analysis methods (UCLA 2011). The Healthy Development Measurement Tool created by the San Francisco Department of Public Health is one example of a published checklist that can help HIA teams to identify health impacts of specific attributes of the proposed project (San Francisco Department of Public Health 2006).

3.1.3 Assessment

During the assessment phase is when evidence of effects on health determinants are gathered. Quantitative data can be obtained from published literature or through statistical modeling, while qualitative evidence can be determined using surveys, interviews, focus groups, and workshops with key stakeholders (Harris, et al. 2007). It is important to consider multiple pathways and both positive and negative effects that directly and indirectly impact public health on system users and on society. This is often an iterative process, with input from stakeholders and experts throughout (UCLA 2011). The results expected at the end of the assessment phase include a list of prioritized impacts and initial recommendations to enhance positive impacts and mitigate negative impacts (Harris, et al. 2007).

The Decatur Community Transportation Plan HIA was a rapid HIA (see Table 1 for definition), and therefore only included a community workshop and a literature review on the relationship between built environment and health to assess the potential health impacts of the plan (Center for Quality Growth and Regional Development 2007). In contrast, the MacArthur BART Village HIA performed a comprehensive HIA (see Table 1 for definition), utilizing a literature review, existing data on similar projects, field visits, interviews with stakeholders, experts, and public, mapping tools, environmental data on

noise, air quality, and pedestrian factors, and forecasting models to assess the health impacts of the project (University of California Berkeley Health Impact Group 2007).

3.1.4 Decision making and recommendation

The fourth step involves the creation of a set of concise, action-oriented recommendations, often along with a summary of rationale and justifications. After the recommendations have been determined, a full report of the HIA should be created which includes the recommendations and the summary mentioned above, as well as an overview of the evidence found and the associated assessments (Harris, et al. 2007). The Appendix provides a table of various recommendations from each of the HIA examples referred to in this chapter.

3.1.5 Evaluation and follow-up

The final crucial step in the HIA process is to create a documented evaluation of the HIA experience as felt by the stakeholders involved, using the follow-up plan written during the scoping phase. Obstacles encountered during each previous step in the HIA process should be discussed along with any observations or suggestions that could help to overcome such issues in the future. This is done in order to gauge the success of the project in addressing health impacts, and to provide evidence and guidance for the development of future HIAs. There are three parts to the evaluation: process evaluation, impact evaluation, and outcome evaluation (UCLA 2011).

In order to produce a thorough process evaluation, it is important to include a full report of how the HIA process was carried out, so that a clear connection can be made between

actions and outcomes. The following is a list of suggested questions that may be helpful to consider (European Policy Health Impact Assessment Project Group 2004):

- To what extent was the delivery of the inputs consistent with what was originally planned?
- To what extent were the planned HIA outputs achieved?
- How much time was spent on the HIA?
- What were the associated financial costs?
- Were vulnerable groups or their representatives involved?
- Was routine data on vulnerable groups readily available?
- Did the impacts identify the differential distribution across different population groups, not just impact on vulnerable groups?
- Did recommendations include actions to address any differential distribution of impacts?

The most important point to consider for impact evaluation is whether or not the recommendations were carried out by the decision makers, and why they were or were not. If some were carried out, but others were not, the evaluation report should address what could have been done differently for the ones that were not followed through (UCLA 2011). Some indicators that can be used during the impact evaluation are (Quigley and Taylor 2004):

- Effective partnerships created
- Local representatives/community organizations support garnered
- Health issues were prioritized

- Knowledge among non-health professionals about health impacts of built environment improved
- Recommendations considered by decision makers
- Extent to which recommendations were adopted
- Changes in proposal implemented

Finally, it must be determined whether the recommendations of the HIA resulted in the enhancement of positive health impacts and the mitigation of negative health impacts. For those recommendations that were successful, the evaluation report should describe what can be learned from them and applied to those recommendations that were not successful. Also, it should identify anything that was learned from identified mistakes regarding the failed recommendations (UCLA 2011). It is necessary to create a monitoring plan to assess the actual health outcomes associated with the project or policy. The plan is modified through an iterative process of outcome monitoring and modification of management strategies (Bhatia and Wernham 2008). The monitoring plan should include the following components:

- Performance indicators to assess the success of each of the HIAs recommendations (Harris, et al. 2007)
- Short -term and long-term monitoring goals (Bhatia, Branscomb, et al. 2010)
- Lead individuals or groups responsible for monitoring (Bhatia, Branscomb, et al. 2010)
- Mechanism for reporting to stakeholders and decision-makers (Bhatia, Branscomb, et al. 2010)

- Thresholds for triggering review and/or changes in implementation (Bhatia, Branscomb, et al. 2010)
- Monitoring resources (Bhatia, Branscomb, et al. 2010)

3.2 Challenges of implementing HIA[2]

While the importance of understanding the effectiveness of the HIA process is rarely disputed among its practitioners, extensive monitoring and evaluation of the HIA's impact on decision making and the actual health outcomes associated with projects or policies implemented is uncommon. While a few of the case studies encountered during the literature review and webscan included a process evaluation (Morgan 2011) and perhaps a brief impact evaluation (Mathias 2008) (Ross 2007) the majority of them did not include a formal evaluation of any kind.

This section discusses three commonly cited reasons for not completing an evaluation, as identified in a British study (Quigley and Taylor 2003) (Quigley and Taylor 2004) that looked at five HIAs performed in various fields. The identified barriers are: limited funding, need for baseline data, and attribution issues.

3.2.1 Barriers to health impact evaluation

Limited funding levels and staff resources tend to make it difficult to maintain momentum and interest in the HIA beyond the recommendation phase (Quigley and Taylor 2003) The literature suggests that the HIA recommendations are often viewed as the final outputs of the HIA process, and therefore, once they have been submitted to and

[2] Portions of this section are featured in the yet-to-be-published work: (Ingles, et al. 2013)

considered by decision-makers, the staff members that had been working on the HIA are moved to a new project. This limits the ability of HIA practitioners to evaluate whether or not their recommendations and the methods used to derive them influenced the decision-making process and/or had a positive impact on health outcomes. Evaluation is needed to improve upon the HIA process and identify activities that lead to positive health outcomes.

Another often cited barrier to conducting health outcome evaluations is the fact that early planning is required to collect baseline health data at the beginning of the HIA and prior to implementation of the policy. This is resource-intensive and may not be feasible for a single HIA (Quigley and Taylor 2003) (Quigley and Taylor 2004). Agencies carrying out HIAs do not typically have the resources to continuously monitor a project or policy to determine its outcomes. It is necessary to have before and after data to compare health outcomes over a time period. These data can be used to help determine what impact, if any, the decisions that were made had on health outcomes.

Finally, HIA is still in a developmental phase, and while there is increasing consensus regarding the most effective methods for assessing health impacts, it is still difficult to draw direct causation pathways. Indeed, the HIA participants in the British HIA evaluation study (Quigley and Taylor 2003) (Quigley and Taylor 2004) agreed that health determinants are based on complex and interdependent pathways that can lead to confounding variables, making evaluation of outcomes difficult. Extensive public health data and long-term funding are necessary to support the evaluation of HIAs on a

systematic basis. Consistent evaluation of HIAs will lead to a stronger evidence base, which will help inform future decision making.

3.2.2 Need for a new approach

The lack of extensive evaluation of HIAs in transportation creates a barrier to legitimizing the HIA process and using its evidence to make investment decisions. In order to truly utilize health impact data to inform transportation decision making, an iterative evaluation process must be in place that can tie health impacts back to investment decisions. Potential impacts to conventional human health impacts are covered to some degree by the National Environmental Policy Act (NEPA) Process. For example, NEPA addresses water and air quality, safety, noise, environmental justice, and economic development (Esselman 2012). However, NEPA does not provide a framework for measuring and analyzing a broad range of health impacts identified in the literature mentioned in Chapter 2, and it does not include an iterative monitoring process. Clearly, a new approach to considering health impacts in transportation is necessary. Chapter 4 introduces performance management and identifies its linkages to the HIA processes. It then demonstrates how these linkages make performance management a suitable approach for monitoring health impacts and incorporating their outcomes into transportation planning. Finally Chapter 4 discusses why multidisciplinary, interagency collaboration must be a core component of such an approach.

CHAPTER 4: Proposed Approach for Considering Health in Transportation Decision Making[3]

4.1 Performance Management as a Successful Evaluation Method

Performance measurement is defined in a report by the United States Government Accountability Office (United States Government Accountability Office 2011) as "the ongoing monitoring and reporting of program accomplishments, particularly progress toward pre-established goals." The report goes on to identify the breadth of appropriate measures as those that address the activities conducted, the products and services delivered, and the results (or outcomes) of these products and services. Performance management, as defined in by the Federal Highway Administration (FHWA), is an on-going, strategic, and systematic process that uses system information to allow decision makers to understand the consequences of investment and policy decisions so that this understanding may be used to make future decisions in order to achieve national goals (FHWA 2013).. The distinction between performance measurement and performance management is that the latter encompasses the former and utilizes performance information to make informed decisions regarding a project, program, or policy. This process is summarized in Figure 3.[4] The dashed arrow leading from the bottom to the top indicates that the process is iterative.

[3] Portions of this chapter are featured in the yet-to-be published work: (Ingles, et al. 2013)
[4] This figure is featured in the yet-to-be published work: (Ingles, et al. 2013)

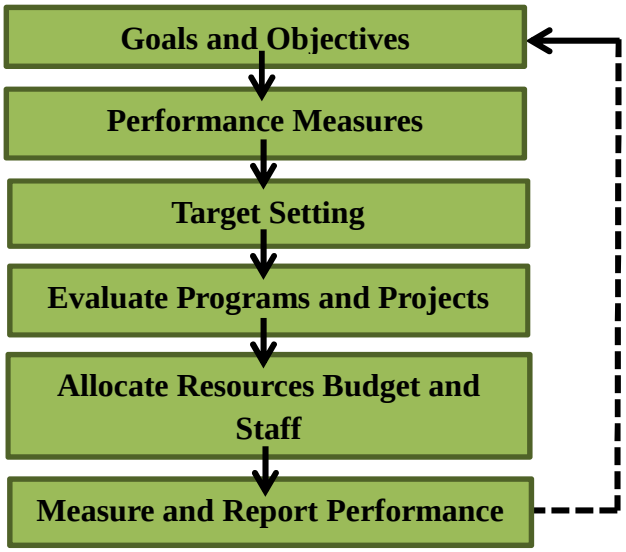


Figure 3: Simplified Performance Management Process adapted from (Cambridge Systematics, Inc. & High Street Consulting Group 2010)

At state DOTs, goals that drive the performance management process often come from strategic plans or long range transportation plans (Pei, Fischer and Amekudzi 2010). This means that the goals and objectives are agency-wide and system-wide. For example, Minnesota DOT has five strategic directions, cited in their strategic plan (MnDOT 2012). These strategic directions are more or less connected to MnDOT's ten policy directions described in the Statewide Transportation Policy Plan. It is to these policy directions that specific performance measures are linked through more specific objectives. Some health-related examples of these policy directions, objectives, and measures are shown below:

- Policy Direction: Traveler safety
    - Objective: Reduce the number of fatalities and serious injuries for all travel modes
        - Measure: Traffic fatalities on all state and local roads

- Policy Direction: Community Development and Transportation
    - Objective: Support local efforts to increase jobs, expand housing, and improve community livability through more coordinated planning, complementary design, and timely communication among land use and transportation authorities
        - Measure: Pedestrian signals that comply with the Americans with Disabilities Act: % of state highway intersections with Accessible Pedestrian Signals
        - Measure: Bike, walk, and transit share of commuter trips in large MN metropolitan areas

Another useful example is Georgia DOT (GDOT). GDOT's strategic plan from 2012 shows twelve strategic objectives that are connected to four strategic goals. Many of these objectives are measureable in some way. Each objective has a champion from the division assigned to it. The champion is responsible for assuming a leadership role in the development of performance measures, collection of data to support performance measures, and reporting of performance (GDOT 2012). Similar practices are used at other agencies (Amekudzi, et al. 2012). In the case that a DOT would include health metrics as performance measures, a public health official from a partner agency could be the champion for the objectives related to these measures.

The literature suggests five distinct categories of performance measures: input, output, process, outcome, and efficiency measures. Input measures refer to the resources used; output measures track any product or service provided; process measures refer to actions

taken; outcome measures are the effects of these actions; and efficiency measures are expressed as a ratio of outputs (or outcomes) to inputs (Wholey, Hatry and Newcomer 2010) (Cambridge Systematics, Inc., PB Consult, Inc., & Texas Transportation Institute 2006) (Otto 1999). Outcome measures are the most relevant to health concerns, however there can be issues with attribution: some outcomes are impacted by a range of factors, some of which are outside of an agency's control, such as human behavior (Cambridge Systematics, Inc., PB Consult, Inc., & Texas Transportation Institute 2006). Despite attribution issues, many DOTs track performance measures that they cannot necessarily link directly to any specific DOT activity. For example, Minnesota DOT tracks the share of commuter trips that are completed by bike, walking, or riding transit. They have an overall desired trend for tracking indicators such as this; however they do not associate them with specific targets (MnDOT 2010).

Regarding target-setting, it is beneficial to have a framework in place for determining targets that are both challenging and achievable. Many factors impact target-setting, including political influence, stakeholder perception, agency experience with performance management and specific performance measures, reporting capabilities, scope of agency control over performance measures, financial resources, and temporal constraints (Cambridge Systematics, Inc., Boston Strategies International, Inc., Gordon Protor and Associates, & Markow, M.J. 2010). With regards to health-related performance measures, input from public health officials and participation from the affected population will likely be a critical component of target-setting. However, targets can be policy-driven, in which they are set by top management or a political authority. They can also be derived from models, through collaborative planning processes among

various stakeholders, or by using a benchmarking approach to compare performance to other transportation agencies (Cambridge Systematics, Inc., Boston Strategies International, Inc., Gordon Protor and Associates, & Markow, M.J. 2010). The City of Alexandria, Virginia outlines several transportation-related targets in its Environmental Action Plan 2030, which were derived with the help of public input (Environmental Policy Commission City of Alexandria & The Urban Affairs and Planning Program of Virginia Polytechnic and State University 2009):

- Beginning in 2012, reduce the number of daily Vehicle Miles Traveled (VMT) on a per capita basis by 5% every five years
- Increase the number of commuters who use public transportation by 25% using 2000 Census data as the baseline
- Create three high capacity transit corridors as set forth in the 2008 Transportation Master Plan
- Increase the number of non-single occupant vehicle commuting trips to 50%

An important part of integrating performance information into decision-making processes is demonstrating the connection between system performance and investment to senior management and other decision makers. According to a FHWA study on performance-based planning, the Southeastern Michigan Council of Governments (SEMCOG) attempts to demonstrate this connection by following a five-step approach: 1) define performance metrics for key program areas; 2) determine relationship between program investment and actual performance; 3) create scenarios based on these relationships that take advantage of investment opportunities; 4) select preferred alternative; and 5) monitor

and compare actual performance to predicted (Louch 2012). Similarly, GDOT uses predicted performance data to do trade-off analysis between different programming scenarios. According to their 2011 Strategic Plan Update (GDOT 2010) the agency also incorporates a feedback loop to make asset management decisions that are based on actual system performance. This is another example of a situation where transportation agencies and public health officials can work together and share data and analysis results to make more informed decisions about the built environment. Through the use of projected and observed public health data and analysis, transportation agencies can compare the baseline health of a community to current or predicted health after a project has been implemented.

One goal often associated with performance-based planning is to integrate performance reporting and decision-making throughout the entire agency. This concept takes two forms: horizontal and vertical integration. Horizontal integration involves communicating performance results and coordinating decisions across various divisions, for multidisciplinary input on decisions. Vertical integration refers to incorporating performance into decision-making at various levels (e.g. strategic planning versus project-level) (Cambridge Systematics, Inc., Boston Strategies International, Inc., Gordon Protor and Associates, & Markow, M.J. 2010). Incorporating health performance data into decision-making and seeking input from public health professionals can help promote horizontal integration by broadening the scope of the evaluation. An example of this kind of horizontal integration is the interagency subcommittee of the Colorado DOT, the Transportation Environmental Resource Council (TERC), which includes members from, Colorado DOT, FHWA, Federal Transit Administration (FTA), regional transit

providers, local and regional government, and public health and environmental groups. The TERC creates a forum for local, state, and federal agencies to discuss initiatives for environmental stewardship (CDOT 2013). The goals of the subcommittee are to share best practices, create a uniform policy for all agencies to use, develop performance measures, and create a sustainability rating system (Zietsman, et al. 2011).

As indicated in Figure 3, the process of performance management is iterative. Performance data collected after investments have been made will help to inform future goals and objectives, adjustments to performance measure suite, target-setting, evaluation processes, and investment decision making.

4.2 Linkages between HIA and Performance Management

While the practice of performance management has grown among transportation agencies over the last decade, none are currently using it to explicitly analyze health impacts. As mentioned in Chapter 3, HIA is the method most often selected for assessing health impacts of transportation, though it is still quite rare. Chapter 3 also identified several serious challenges involved in integrating HIA recommendations into current transportation decision-making processes. Part of HIA's scarce use may be due to the apprehension of transportation officials to introduce a brand new process into their decision making. While HIA may at first seem like a brand new process to most transportation practitioners, a closer look will reveal many similarities between HIA and performance management.

The goal of both HIA and performance management is to utilize the analysis of performance data, whether projected or actual, as an input to feed back into the system

and improve outcomes of a project, program, or policy. Figure 4 shows the linkages between the various steps of HIA and performance management.[5] The yellow arrows on the right side of the figure denote the four major steps that can summarize both HIA and performance management: 1) plan, 2) act, 3) monitor, and 4) evaluate, which come from the concept of adaptive management (Stankey 2005). These linkages are further explained in Table 3.[6]

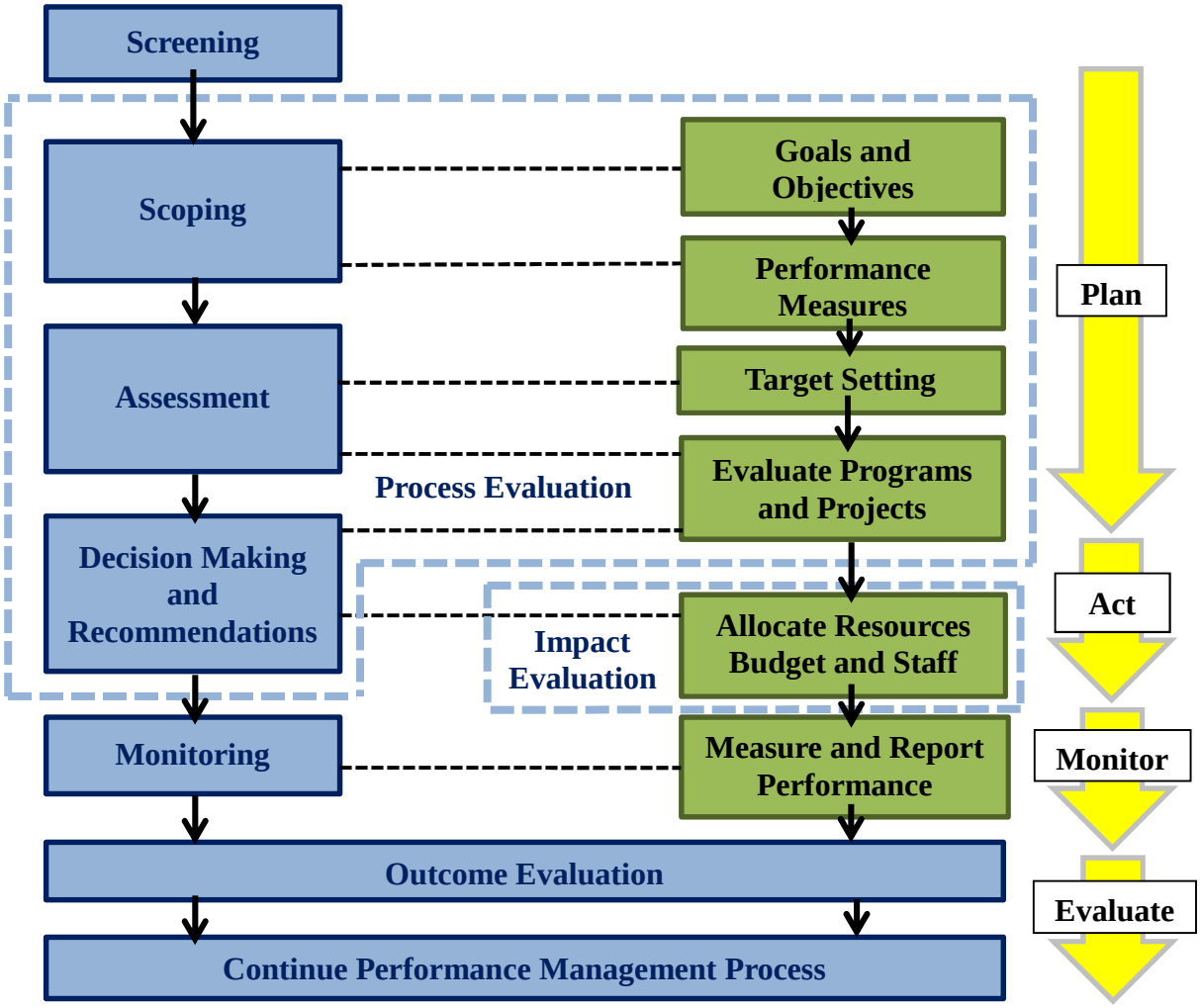


Figure 4: Linkages between Health Impact Assessment and Performance Management

[5] This figure is featured in the yet-to-be published work: (Ingles, et al. 2013)
[6] This table is featured in the yet-to-be published work: (Ingles, et al. 2013)

Table 3: Linkages between Health Impact Assessment and Performance Management (PM)

	HIA	PM	Activities
Plan	Screening		• Consider potential health impacts • Determine whether or not HIA is relevant and feasible
	Scoping*	Goals & Objectives* Performance Measures*	• Develop working knowledge of possible outcomes • Identify health related goals and objectives • Determine performance measures that will indicate progress
	Assessment*	Target Setting* Evaluate Programs & Projects*	• Collect baseline data • Determine potential magnitude and direction of health impacts • Set targets based on available information • Evaluate ability of programs and projects to reach targets
Act	Decision Making & Recommendations*	Allocate Resources, Budget & Staff**	• Recommend actions to decision makers based on evaluation • Allocate resources based on decision makers' feedback
Monitor	Monitoring	Measure & Report Performance	• Measure actual performance and report to stakeholders
Evaluate	Outcome Evaluation		• Assess effectiveness of the program or project at achieving goals and objectives • Utilize performance data to inform changes to system • Analyze performance data to determine next steps in continued cycle of performance management

* Process Evaluation: Evaluate effectiveness and efficiency of the process
** Impact Evaluation: Determine the extent to which the recommendations were carried out

The linkages in the collection, analysis, and utilization of performance data shown in Table 3 suggest that the processes of HIA and performance management can be performed concurrently, and that their activities can complement one another. The linkages also show that, if a full HIA is not feasible, health impacts can still be considered without adopting a brand new process. Through collaboration with public health departments and other relevant organizations, transportation agencies can incorporate health considerations into their existing performance management programs.

4.3 The Role of Collaboration in Ameliorating HIA Implementation Challenges

Multidisciplinary collaboration can help to overcome some of the challenges that HIA has faced when being applied to transportation. With a public health agency conducting the health analysis portion and the transportation agency conducting the planning and engineering analyses, the two disciplines can work together to achieve the best outcomes. In a 2011 report released by the National Research Council, several opportunities for such collaboration were noted (National Research Council 2011):

- Federal agencies dealing with public health issues could form interagency partnerships, such as a working group or task force, to develop guidance for considering health in transportation planning and implementation.
- The National Prevention, Health Promotion, and Public Health Council, formed by the Affordable Care Act of 2009, could determine how HIA might be used to achieve the health objectives also set out in the 2009 legislation.
- State departments of transportation could seek out the participation of public health departments in coordinated planning activities.

- City and county health departments could partner with planning agencies to promote health and use HIA as a tool for collaboration.
- Local public health agencies could diversify their staff expertise by emphasizing the need for experience in non-health sectors.

Additionally, the Volpe Center (Lyons, et al. 2012) suggests that MPOs, DOTs, and public health agencies can help each other by sharing data and model outputs for analysis in each other's fields. Comparatively, transportation agencies are more likely to use proxy measures for health, such as the mode share of active transportation. These proxy measures can be used by public health officials to draw connections between transportation outcomes and health outcomes in the outcome evaluation section of an HIA.

The need for collaboration between transportation and public health officials was also stressed in the keynote address presentation for the Equity in Health and Transportation Conference in Tacoma, Washington, given by USDOT Deputy Assistant Secretary, Elizabeth Osborne (Osborne 2012).

4.3.1 Coping with limited funding through partnerships

As mentioned in Chapter 3, limited funding can cause an HIA to be seen as completed once the recommendations are drawn up. This provides no accountability to decision makers in implementing the recommendations, and provides no resources or mechanism for determining whether or not the recommendations had a positive influence on health outcomes, if they were indeed carried out. This issue can be mitigated through a number of interdisciplinary efforts. An appropriate division of labor can be devised among

transportation and public health officials due to their respective functions. By coordinating health impact assessment and performance management activities, officials can collaboratively contribute to desirable health outcomes through transportation. Collaborating on tasks such as data collection and analysis could lead to shared labor costs between various agencies. Many public agencies have similar goals, so it is more efficient if they are working together to achieve these goals. In a targeted interview about MassDOT's Healthy Transportation Compact, Catherine Cagle stressed the cost-saving benefits of collaboration at the local level, especially. When the multiagency Compact formed, she explained, overlaps were identified and connections were improved at all levels within the cooperating agencies. Ms. Cagle said that streamlining efforts became a top priority with the recent economic downturn (Cagle 2013).

With the combined expertise of transportation and public health officials, truly evidence-based decision-making is within reach. This can be achieved by utilizing all available data sources, both quantitative and qualitative, creating avenues for open communication between disciplines, and diversifying planning and development teams. The CDC supports this type of approach, and has offered its expertise in evaluating transportation programs and policies for their effectiveness at improving health and safety. In return they have requested that transportation agencies support health-related data collection and analysis in the following ways (Centers for Disease Control and Prevention 2010):

- Rework cause-of-injury coding for transportation accidents so that they are more specific to how transportation mode was involved in the accident, vehicle type, and occupant status (i.e. driving alone or with passengers)

- Improved data collection with regards to transportation-related deaths and injuries, including pedestrians and bicyclists
- Systematic counts of bicycle and pedestrian traffic
- Targeted, community level data collection to track impacts of specific projects, policies
- Consider all modes of transportation in demand modeling
- Include health questions in household travel surveys

Additionally, there are several grant programs in place that can help agency partnerships fund health-related activities. The reauthorization of the Older Americans Act in 2006 provides grants to fund transportation projects for the elderly. The CDC also has offered grants or other partnerships with MPOs to promote active transportation initiatives, such as the Community Transformation/Healthy Communities grants. The Partnership for Sustainable Communities runs a grant program for environmental justice issues called the Environmental Justice Small Grants Program. These and several other organizations that provide training on HIAs and incorporating health into planning are explained in greater detail in a 2012 white paper from the Volpe Center (Lyons, et al. 2012).

4.3.2 Broadening scope of assessment through data sharing

Because agencies carrying out HIAs often do not have the resources for continued monitoring of health determinants, this eliminates the motivation to collect baseline data to begin with. This situation creates an opportunity for public health professionals to partner with transportation agencies or planning departments, who may be able to work together to apply for and implement grants for continued monitoring. For example,

Hennepin County, Minnesota planners are working with their Human Services and Public Health Department to implement a Community Transformation Grant from CDC to encourage active living and collect data such as bicycle and pedestrian counts (Nikolai 2013). Any form of innovative planning requires a champion who can harness the political will and technical expertise necessary to perform the task (Slotterback 2011). These champions could be found in local public health departments or other public health officials. Through the data and analysis sharing described above, transportation agencies could have access to health information that can be used in the evaluation.

4.3.3 Building an evidence base

It is true that many transportation agencies currently track indicators over which they do not have full or direct control, such as mode share. However, this information is still valuable for making decisions, and health data should be no different. Proxies for health such as number of people bicycling to work can still be at least partially attributed to agency performance. Also, including health metrics in the whole process of performance management can help to "test" causation pathways by increasing data input and thus improving the evidence base. With health performance data collection and analysis procedures in place, full HIA outcome evaluations can begin to be conducted, which will help validate HIA as a process and hopefully lead to increased funding for health-related activities.

An argument can be made for collecting qualitative data where quantitative data may be lacking or inconclusive. Qualitative analysis effectively allows the public to contribute to the HIA process through surveys, workshops, interviews, etc. Some examples of qualitative impacts include increased social interaction, encouragement of physical

activity, and improved social equity (Dannenberg, et al. 2008). A common critique of qualitative analysis asserts that it produces data that lacks repeatability, is subject to misrepresentation, and is not standardized and therefore not easily compared. The problem with this argument is that is assumes that all data must be repeatable, generalizable, and comparable (Love, et al. 2005).

Integrating health into decision-making does not have to mean a sweeping overhaul of an agency's procedures. Health considerations can be incrementally integrated into decision-making through various approaches. Updating a city's comprehensive plan, for example, can create an opportunity for open public discussion about health issues surrounding the built environment, which can lead to goal-setting activities to drive the comprehensive plan. Specific amendments to the plan can be made with the intention of influencing positive health outcomes (Design for Health 2007). Simply adding a handful of health-related tracking measures and coordinating analysis with the local public health department can lead to a greater understanding of health within the agency. The next section describes some best practices regarding multidisciplinary, interagency collaboration.

4.4 Current Best Practices in Collaborative Health and Transportation Planning

While none have systematically integrated health-related performance information into decision-making processes, several MPOs and a handful of planning departments and DOTs have begun to consider the health impacts of transportation planning activities in a variety of ways, often incorporating interagency collaboration. From the results of the literature review and webscan, seven MPOs were identified as having public-health

related goals in their Regional Transportation Plans (RTPs): Nashville MPO, San Diego Association of Governments (SANDAG), Mid-America Regional Council, Wasatch Front Regional Council, Boston Region MPO, Puget Sound Regional Council, Baltimore Regional Transportation Board, and Sacramento Area Council of Governments. The Boston Region MPO also aligns their Transportation Improvement Program (TIP) with the recent Massachusetts Healthy Transportation Compact, which coordinates public health, land use, and transportation decision making to foster positive health outcomes (National Association of Regional Councils 2012). The Compact is part of transportation reform legislation signed into law in 2009, and is chaired by the Secretary of Transportation and the Secretary of Health and Human Services and including the Secretary of Energy and Environmental Affairs, MassDOT Highway Administrator, MassDOT Transit Administrator, and Commissioner of Public Health (MassDOT 2013). The Nashville MPO created a staff position that focuses on the interaction between transportation infrastructure and health and how that affects the programs, policies, and projects of the MPO. This type of position could be seen more often in regional government as planners become more attuned to public health considerations.

4.4.1 Health-related performance measures

Some MPOs and other agencies have recognized the importance of collecting data on health-related measures. Some are beginning to find a way to use them in transportation decision making. Below are some notable examples:

- **The San Diego Association of Governments** (SANDAG 2010) created a Draft Health and Wellness Policy Framework which includes goals and objectives that incorporate urban form to promote safe, walkable streets; equity in mobility and

access to healthy foods, medical care, recreation, jobs, and schools; social equity and environmental justice; multimodal facilities and amenities; and healthy food and nutrition. Performance measures will be determined as part of the Regional Comprehensive Plan update.

- **Nashville MPO** (Nashville MPO 2013) utilizes a point-based system to score transportation projects in the regional transportation plan based on positive outcomes for air quality, active transportation facilities, multimodal injury reduction, personal health, and equity of transportation facilities in underserved areas. They also incorporated health-related questions into their household travel survey and used this information to make connections between transportation access and mobility and various health and wellness indicators including respiratory illness, physical (in)activity and related diseases, and crashes.
- **Clark County Public Health** in Washington State conducted a comprehensive HIA on the County's bicycle and pedestrian plan, which includes a monitoring and evaluation plan using the Community Assessment, Planning, and Evaluation (CAPE) report (Clark County Public Health (2) 2010), which reports numerous health indicators including physical activity and obesity. The CAPE report compares a wide variety of health metrics across socioeconomic status, race, age of children, gender, and between County and State (Clark County Public Health 2010).

4.4.2 Tools for Analyzing Health Impacts

In analyzing health impacts, a variety of tools have been employed by MPOs and other government entities. Some are developed and owned by the agency, while others are established tools created by outside organizations.

- **The Healthy Communities Atlas** is a collection of maps created by SANDAG that communicate data on current social and physical determinants that affect health outcomes and disparities. Four topics are covered: physical activity and active transportation, injury prevention, nutrition, and air quality. It uses retail floor-area ratio, intersection density, net residential density, and land use mix to determine walkability. Access to parks and greenspace, daycare facilities, libraries, elementary schools, health care facilities, transit stations, healthy food, and non-motorized trails are considered on the block group level. Two composite measures were created: 1) youth physical activity support, which combines access to non-motorized trail access, park access, elementary school access, and sidewalks, and 2) physical activity inhibitors, which combines property crime rate, violent crime rate, vacant parcels, arterial density, and traffic volume density. The atlas is used as a communication tool for engaging with communities on health issues. It is available on the SANDAG website. (Urban Design 4 Health 2012).
- **The Healthy Economic Assessment Tool (HEAT) and the Walkability Assessment Tool (WAT)** were used by the Philadelphia City Planning Commission (PCPC) in partnership with the Philadelphia Department of Public Health (PDPH) as part of a series of HIAs on 18 District Plans that make up the

city's comprehensive plan. HEAT (WHO 2013) was created by the World Health Organization and estimates the monetary value of health benefits accrued. WAT was piloted by the PDPH and allows for the recording of data on a set of indicators shown to affect pedestrian safety (PCPC 2011). PCPC and PDPH also created two other tools part of their Healthy Planning Toolbox (PCPC 2011): The **PHILATool (Planning & Health Indicator List & Assessment Tool)**, which allows for tracking and analysis of dozens of health, demographics, and built environment indicators derived from health-supportive objectives of the Citywide Plan; and the **BEAT (Bicycling Environmental Audit Tool)**: characterizes intersections and street segments by their contribution to a safe and comfortable cycling environment. All are currently available for public use, except the PHILATool, which will soon have an online version available.

- **Pedestrian Environmental Quality Index (PEQI)** (SFDPH 2013) was developed by the San Francisco Department of Public Health (SFDPH) as a project prioritization tool for pedestrian infrastructure. The tool is used by observing the physical environment with regards to indicators in five different categories: intersection safety, traffic, street design, land use, and perceived safety, which are aggregated to a composite index. SFDPH collaborated with various experts including city planners, planning consultants, and pedestrian advocates in the development of indicators and their respective weights and scores. PEQI has been used in many projects in San Francisco as well as in other cities, and is publicly available for free via the SFDPH website.

- **Comprehensive Plan Review Checklists**, created by Design for Health (Design for Health 2013), were utilized by the Minnesota Department of Public Health and the City of St. Louis Park to conduct an HIA on its comprehensive plan. The checklists are comprised of over 100 indicators in five areas: Land Use, Transportation, Water Resources, Parks & Open Space, and Urbanization, Redevelopment, Economic Development (Minnesota Department of Health 2011). A full version of the checklist, as well as separate checklists for the individual indicator areas, is available online.
- **The Walkability Index** (Frank 2009) and the **Housing and Transportation Affordability Index** (Center for Neighborhood Technology 2012) were used by Clark County, Washington in conducting an HIA on their bicycle and pedestrian (Clark County Public Health 2010). The Housing and Transportation Affordability Index is available for public use, but the Walkability Index is not.
- **The Active School Neighborhood Checklist** was created by the Arizona Department of Health Services and Arizona DOT Safe Routes to School Program to assess the walkability, bikeability, and safety of school locations. The tool is intended to be used to identify existing barriers to active transportation in schoolchildren (Arizona DOT & Arizona Department of Health Services 2013). The checklist is available for use by any school upon approval from Arizona Department of Health Services.

4.4.3 Formalized Relationships with Stakeholders

Aside from pursuing technical developments, many transportation agencies found it valuable to work closely with various stakeholders, including the public, and by engaging with public health officials.

- **The Public Health Stakeholders Group** was formed by SANDAG to advise Healthy Works/Communities Putting Prevention to Work (CPPW) projects. The group is comprised of public health professionals, design professionals, land use and transportation planners, engineers, and community stakeholders (SANDAG 2013).
- **Active Living Hennepin County** was created to form a partnership between cities, businesses and nonprofits that would work together to increase opportunities for active living through policy change and infrastructure planning. The partnership is comprised of public health, business, recreation, transportation, community development, and other professionals (Hennepin County 2013).
- **Walk First** is a collaborative effort between the San Francisco Department of Public Health, Municipal Transportation Agency, Planning Department, and County Transportation Authority to improve pedestrian safety in the city and encourage walking for transportation. The project aims to identify key pedestrian streets in the city and develop criteria for prioritizing pedestrian improvements (City and County of San Francisco 2011).

4.5 Working towards Common Goals

MPOs, DOTs, and other levels of government are beginning to recognize the potential role of public health in their planning activities and are responding in a multitude of ways. Through increased collaboration and consistent communication with public health officials regarding performance on a broad range of metrics, transportation agencies can improve progress toward several common goals, which are well-aligned with national objectives set by the U.S. Department of Transportation to improve health outcomes associated with transportation (FHWA 2013): 1) Reduce vehicle miles traveled (VMT) through encouraging alternative modes including active transportation; 2) Improve equity in access to quality transportation options; and 3) Enhance quality of life through the creation of livable, safe, and healthy communities.

4.5.1 Reduce VMT

The reduction of VMT is a common goal of DOTs, MPOs, and local governments. Beyond congestion mitigation and reduction in CO_2 emissions, VMT reduction has many co-benefits associated with public health. Reducing the need to drive can encourage people to use active modes of transportation, which may increase their daily physical activity levels (Ragland 2011). Using health data, researchers within transportation and public health agencies can help transportation officials better understand the relationship between VMT and illness related to air quality and physical activity levels. Health data on diseases associated with poor air quality and/or a sedentary lifestyle such as respiratory disease, cardiovascular disease, diabetes, and high blood pressure could be used to determine if a reduction in VMT causes a measurable change in these health problems over time.

4.5.2 Equity

Equity is a major concern in transportation planning. Access to quality transportation that connects to jobs, medical care, healthy food, and other amenities is a critical component of healthy living. Access to these amenities for vulnerable groups (e.g. transit-dependent, elderly) can be analyzed using mapping tools such as geographic information systems (GIS). This information can be used in planning to determine how projects will impact access for various population groups or communities. Similarly, modeling local air quality effects of a project and mapping potential hot spots in relation to disadvantaged communities can be an effective way to identify environmental justice issues.

4.5.3 Quality of Life

Enhancing quality of life and livability is a goal that has gained popularity among transportation agencies in recent years. Though this is a very broad term, an important element of it can be argued to be the equitable provision of safe and effective infrastructure for non-motorized transportation modes, including connecting these facilities to transit service. Recent studies have suggested that people who use transit, have higher levels of daily physical activity than car commuters (Litman 2010) and experience less stress (Wener and Evans 2011). Initiatives like adopting a complete streets policy can impact investments in order to balance the access to motorized and non-motorized transportation infrastructure. The provision of additional facilities for non-motorized transportation near transit facilities could also help boost transit ridership by providing potential riders with the often neglected “first-mile/last-mile” connection (Ragland 2011). By incorporating health-related questions in travel surveys and conducting longitudinal health studies in areas with new infrastructure for walking and

biking, transportation officials can better understand the impacts of these types of projects on physical activity levels.

4.5.4 Use of Proxy Measures to Enhance Collaborative Performance Management

Health related metrics can be direct health outcomes or proxies for health. Depending on the resources available, the performance objectives, and the scope of influence of the agency, one type may be more appropriate than the other in any given situation. Proxies may be used to represent a health outcome that has many confounding factors, such as using participation in active transportation as a proxy for obesity. Proxies may also be used when the agency is lacking sufficient data for a certain health outcome, such as measuring the days with air quality that goes below a certain threshold as a proxy for asthma flare-ups. The ability to acquire industry-specific data and, in turn, the fidelity of the proxy compared to the actual health outcome will likely be driven by the strength and quality of the interdisciplinary relationships formed between a transportation agency and the relevant public health professionals. Table 4 shows some example measures that represent both health outcomes and proxies for health, which have been taken from various resources.[7]

4.6 Incorporating Health into Different Levels of Performance Management

DOTs are currently practicing performance management at widely varying levels. Four "generations" of performance management were identified in the literature (Amekudzi, et al. 2012), which characterized program maturity by level of organization present in the suite of measures, linkage of measures to strategic goals, development of targets, level of

[7] This table is featured in the yet-to-be published work: (Ingles, et al. 2013)

Table 4: Common Goals and Related Performance Metrics
Linking Health and Transportation
(US EPA 2011), (Lyons, et al. 2012), (CMAP 2013),
(Zietsman, et al. 2011), (National Prevention Council 2011)

GOAL	EXAMPLE METRICS	SUGGESTED ANALYSES	
Reduce VMT	. VMT	Input to air quality models	Thorough Geospatial Analysis ↓
	. Average vehicle occupancy	Estimate person trips	
	. Transit passenger trips	Estimate mode split	
	. Bicycle/pedestrian trips	Estimate physical activity	
Improve Accessibility	. Land use types & intensity, e.g. employment	Analyze opportunity access	Identify Locations of
	. Location and density of transit stops	Analyze level of service by mode	⇒ Health Risks
	. Street connectivity & pedestrian facilities	Analyze modal access	⇒ Safety Risks
	. Social indicators, e.g. disability status	Identify ability-based barriers	⇒ Poor Access
	. Economic indicators, e.g. annual income	Normalize user cost by income	⇒ Low Satisfaction ↓
	. Transportation user costs by mode	Identify cost-based barriers	
Enhance Quality of Life	. Crashes, injuries, and fatalities by mode	Identify common crash causes	↓
	. Travel time by mode, and systematic delay	Identify causes of delay	Identify Inequities
	. Customer satisfaction with system attributes	Identify sources of dissatisfaction	
	. Land consumption by transportation projects	Identify environmental losses	
	. Displacement due to transportation projects	Identify social capital losses	
	. Population in non-attainment areas	Estimate exposure to health risk	
	. Days with poor air quality, e.g. AQI>100		

sophistication in reporting, and use of performance information in decision-making, benchmarking, and trade-off analysis. These last three activities—using performance in decision-making, benchmarking, and trade-off analysis—are commonly regarded as the ultimate goal of a mature performance management program. Consistent flow of information between DOTs, MPOs, and public health agencies can help integrate health performance management at various points in the planning process and eventually can create a feedback loop of performance information that can be used to make planning and programming decisions. At this time no transportation agency has created and implemented such a feedback loop that incorporates public health data. This section references the best practices from previous sections and explains how these practices can be improved upon through the use of collaborative performance management. The various steps of performance management covered earlier are used to guide the reader.

4.6.1 Goals and Objectives

A DOT or MPO can begin by creating a multidisciplinary working group that, through engagement with the public and other stakeholders, develops a set of goals for the region or state. Most transportation agencies have a set of agency-wide goals; however they are often not explicitly derived through multidisciplinary collaboration. This collaboration is necessary to ensure that goals and objectives are realistic and comprehensive. For example, the MnDOT goal of traveler safety mentioned previously and its related objective to reduce fatalities and serious injuries across all modes could be more health and equity focused by breaking the objectives up by mode. Strategies for improving driver safety are often different than those for improving pedestrian safety and thus the

related outcomes of those strategies will be different. Therefore they should be monitored and evaluated separately.

4.6.2 Performance Measures

Next an agency can develop a suite of health-related measures that are related to the goals and objectives set through multidisciplinary collaboration. The agency can monitor the measures over a few years, with analysis from public health officials providing context for the data. Once transportation agencies become more comfortable with the new data, a feedback loop can be created to begin tweaking the measurement suite to more seamlessly tie the measures back to the agency's strategic goals. New health-related goals can even be obtained from trends or deficiencies identified in the performance monitoring process, such as low mode share in active transportation or high VMT. Using MnDOT as an example again, through this kind of monitoring and evaluation process, MnDOT may find that the percentage of state highway intersections with Accessible Pedestrian Signals is not the most useful metric, and should be replaced with an outcome-based measure rather than an input-based measure. Data for such a measure could be obtained by including health determinant questions in household travel surveys, as Nashville MPO has planned to do. Development of a sophisticated and comprehensive suite of performance measures will likely be an iterative process of data collection and analysis, performance measure development, and goal formation, which will eventually lead to a well-defined suite of performance measures directly tied to strategic goals. Along the way, the agency can begin to consider what performance targets might need to be associated with the various measures and how, and to whom, to report performance achievements.

4.6.3 Target Setting

Using tools like the Healthy Communities Atlas mentioned previously, agencies can take the next step from simply monitoring performance measures to setting targets. Using tools that can summarize or communicate performance results in useful way, such as with mapping, allows an agency to understand a comprehensive overview of the current system performance according to the various performance measures. Using this information and the goals and objectives previously determined, the multidisciplinary working group can set reasonable yet challenging targets for health-related measures that will help the agency achieve its goals.

Some examples of health-related targets were provided in Section 4.1 which came from the Environmental Action Plan 2030 of the City of Alexandria, Virginia. Additional examples include:

- Specific mode share for active transportation in daily commutes or of children traveling to school
- Defined number of miles of complete streets
- Majority of households can walk to a grocery store
- Reduction by a certain percentage of:
    - Asthma-related hospital visits
    - Pedestrian injuries
    - Poor air quality days
    - Crime near transit stations

The first three example targets are based on proxies for health, while the last three are directly related to health and safety, but are affected by a number of other factors beyond the transportation system. As explained in Section 4.5.4 and 4.3.3, these types of measures can help transportation agencies gain a fuller understanding of how their system impacts health. Public health officials will likely be monitoring similar measures and attributing them to some non-transportation causes. By coordinating results of these measurements with those of a transportation agency, all parties can gain an understanding of their influence on the measures and set targets for improvement accordingly.

The literature review and webscan did not produce much evidence that transportation agencies are creating health-related targets. San Francisco Metropolitan Transportation Commission (SFMTC) has an equity target as part of their 2035 Regional Transportation Plan (RTP). They aim to "decrease by 10 percent the combined share of low-income and lower-middle-income residents' household income consumed by transportation and housing" as well as several environmental targets related to reducing VMT and the emission of particulate matter (PM) and carbon dioxide (SFMTC 2013). SFMTC then graph the trend of these performance measures against the predicted impact that the RTP will have on it and the trend associated with meeting the targets (Figure 5).

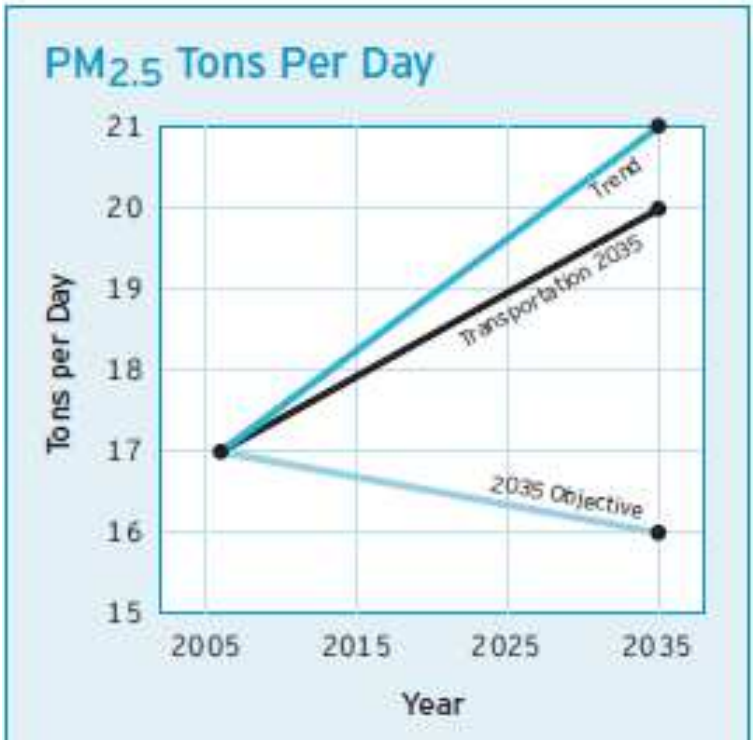


Figure 5: Examples of performance targets compared to actual and predicted trends (SFMTC 2013)

4.6.4 Evaluate Programs and Projects/Allocate Resources, Budget, and Staff

Eventually, when the performance management program has matured, the use of baseline health data on the statewide, regional, and local level can aid in the decision-making process by conducting trade-off analyses. This type of analysis may involve modeling system behavior or using evidence-based case studies to determine what health outcomes may result from different investment scenarios. The Nashville Area MPO currently uses a technique called scenario planning to produce different transportation and land use outcomes that are dependent on modeled investment scenarios. The model is built using software called CommunityViz and uses population, housing, and employment data to determine the growth potential of subareas throughout the region. These growth predictions feed the region's travel demand model (Nashville Area MPO 2013). A similar

approach could be taken using health data to determine how different transportation investment scenarios might impact health. A benefit of scenario planning is that, as the dataset becomes more robust and the evidence base improves, the model outputs become more accurate at making predictions to the point that changes in outcomes can be seen from fundamentally different investment scenarios. These predictions and model outputs can help drive decision making that is driven by health data.

4.6.5 Measure and Report Performance

Public health officials' expertise in collecting health related data is invaluable at this stage. Allowing communication between public health and transportation agencies will ensure that data is accurate and not duplicative. SANDAG is hoping to incorporate health metrics in their next long range plan update. They anticipate that the San Diego County Health and Human Services Agency will assist in providing some health-related data (Vance and Cooper 2013).

Development of an interactive, easy to understand reporting medium, such as a web-based tool, is an important part of communicating performance objectives and achievements to stakeholders. At this point there is opportunity for engagement across various levels of the agency and other decision-makers. It is important to receive feedback from a variety of stakeholders regarding reporting methods. This way data is not accidentally misrepresented.

SANDAG has compiled a broad range of health and infrastructure data to create a series of maps called the Healthy Communities Atlas. The maps depict numerous aspects of physical activity and active transportation, injury prevention, nutrition, and air quality.

Figure 6**Error! Reference source not found.** on the next page is an example of one of the maps from the atlas. It shows the spatial distribution of physical activity inhibitors.

4.6.6 Collaborative Performance Management as an Iterative Process

As mentioned in previous sections, performance management is an iterative process, where performance data is used to inform the next iteration of the cycle. Performance data collected after investments have been made will help to inform future goals and objectives, adjustments to performance measure suite, target-setting, evaluation processes, and investment decision making. It is this performance feedback loop that makes performance management suitable for considering the assessment of health impacts. Health performance data can be measured during and after program/project implementation to assess the effectiveness of the program or project at achieving goals and objectives. In determining the effectiveness of implemented programs/projects, agencies can determine what changes to the system, if any, need to be made in order to achieve better outcomes. Health data on the statewide, regional, and local level can help agencies benchmark progress toward health-related goals between different parts of the state. This type of data can help to identify areas that may be falling behind or leading the pack. More careful analysis of these areas and the projects/programs that have been implemented there can help identify successful health initiatives and relate health outcomes to transportation investments. The distribution of positive and negative health outcomes can be observed through mapping. This will inform agencies of inequity issues that exist in the system.

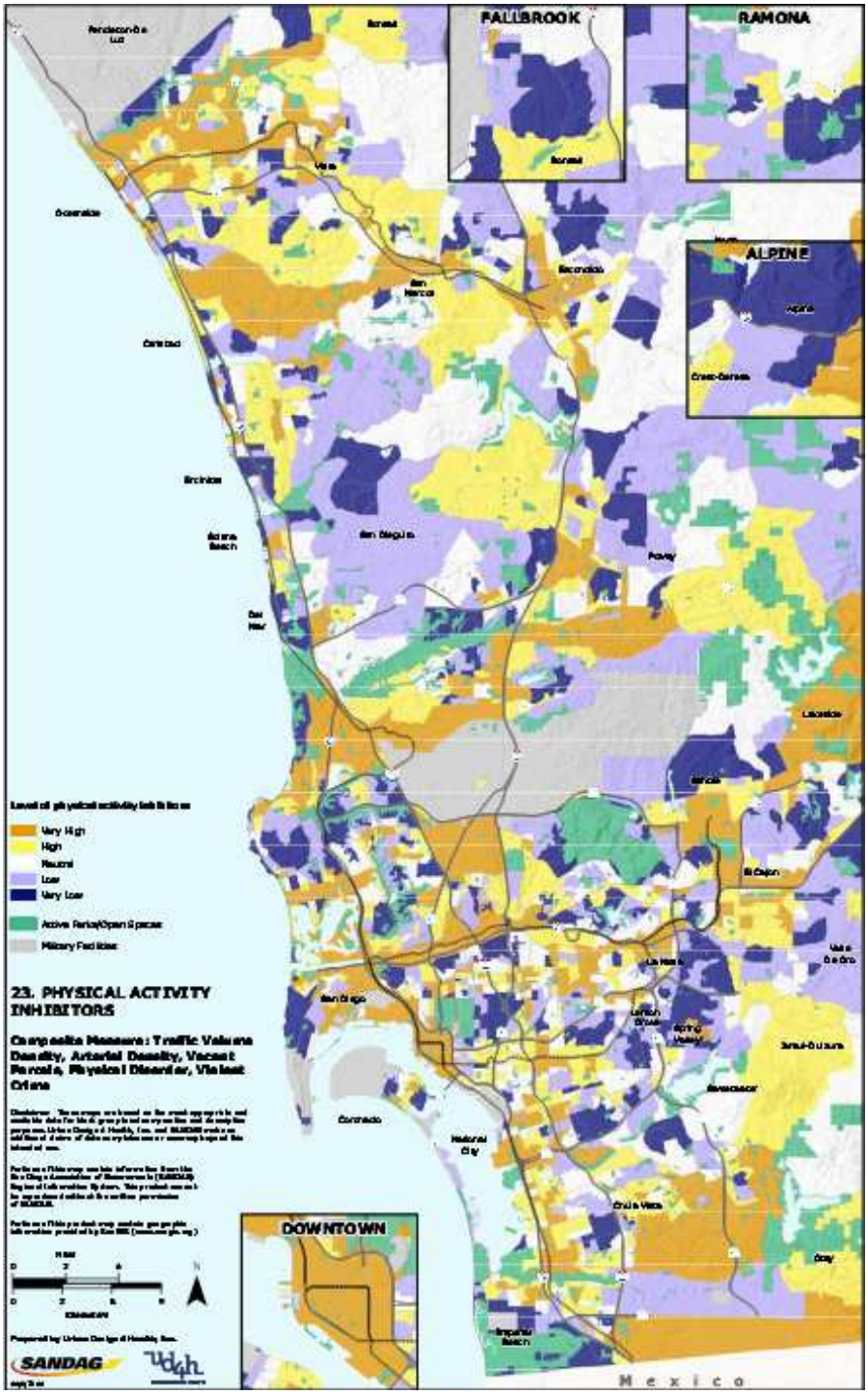


Figure 6: Example of a map from SANDAG's Healthy Communities Atlas (Urban Design 4 Health 2012)

CHAPTER 5: Conclusions

The scope of published literature on the topic of the health impacts of transportation is broad; however the formal use of health data in transportation decision making is rather new and requires continued research, especially with regards to analysis methods and the analysis and use of qualitative and quantitative data. For instance, there is a lack of quantitative forecasting methods for many health-related data inputs (Dannenberg, et al. 2008), and much debate centers on how well these forecasting methods represent the true health impacts, particularly when multiple health determinants are present (O'Connell and Hurley 2009). Indeed, one of the most significant limitations of qualitative health data that needs to be addressed is that there are few risk factors that have a well-defined dose-response relationship (O'Connell and Hurley 2009). These limitations stress the importance of determining the optimal relationship between quantitative and qualitative analysis.

MAP-21 has created a unique opportunity to foster an already increasing awareness of the impacts of transportation infrastructure on public health, which when complemented with open communication between various planning and public health agencies, could bring communities closer to finding solutions to health problems such as obesity and asthma and making roads safer for all users. Because transportation can impact public health in so many ways, a framework is necessary for considering this wide range of impacts. HIA is a useful tool that could satisfy this need; however it is a process that is unfamiliar to most transportation agencies, and is therefore not commonly used. Performance management, on the other hand, is an analysis method that transportation

agencies are more comfortable with, and under close inspection has many parallels with HIA. These parallels suggest that the two processes could be conducted simultaneously by separate agencies (i.e., transportation and public health), or their activities could be combined through collaboration between these agencies to begin incorporating health considerations into decision-making processes at DOTs and MPOs. Similar collaborations have taken place in transportation agencies with the intention of improving public health or at least understanding the role that transportation plays with respect to public health. This element of collaboration is critical to the success of health and transportation initiatives, as each discipline has different strengths that can be used to achieve their numerous common goals, such as reducing VMT, promoting equity, and enhancing quality of life. Data and analysis tools should be shared and discussed to optimize the process and build a unique framework, regardless of the current maturity of an agency's performance management program. This unique framework should speak to the unique goals of the state or region and communicate to the various stakeholders a dedication to achieving these goals. A fully integrated transportation planning process such as this has the potential to improve the understanding among decision makers of the broad impacts of transportation on public health and eventually begin to affect positive changes to the health of the transportation system users.

APPENDIX: Case Studies

The following case studies are a good representation of the level to which some transportation agencies are performing HIA in the United States, in that their strength lies in the screening and scoping phases. Recommendations are made, however there is little, if any, effort to perform the evaluation and follow-up necessary for determining the effectiveness of the HIA. These case studies are based on the following HIAs: Atlanta BeltLine, MacArthur BART Transit Village, and the Decatur Community Transportation Plan.

Screening, Scoping, and Assessment

Table A1 below shows a summary of the results of the first three phases of HIA for each of the case studies, including the health determinants associated with the project, the methods used in the assessment, and the resulting potential health impacts determined though the analysis.

Decision-making and Recommendations

Table A2 shows a summary of final recommendations for each of the HIA case studies. Presenting the recommendations in this form demonstrates the recurring themes associated with transportation projects and their impacts on public health.

Evaluation and Follow-up

Of the three projects presented here, only the Atlanta Beltline included the final phase, Evaluation and Follow-up. The Advisory Committee noted how the HIA provided increased awareness of the impact of major investments on public health, and uncovered

a great need for elected officials, planners, developers, designers, and communities to strive for a common understanding that leads to an open dialogue on HIA in transportation planning. The committee also acknowledged some difficulties encountered. Namely, they found that certain health determinants had no standard for measurement, or for which there was limited availability of evidence-based data. There was also a problem of dealing with the evolution of the definition and scope of the project as the assessment progressed (Ross 2007).

Table A1: Screening, Scoping & Assessment Results
(Ross 2007) (University of California Berkeley Health Impact Group 2007) (Center for Quality Growth and Regional Development 2007)

Project	**Health Determinants**	**Analysis and Assessment Methods**	**Potential Health Impacts**
Atlanta Beltline	• Noise • Injury • Physical activity • Air quality • Social capital • Crime • Accessibility • Gentrification	• Advisory Committee with key experts • Determined current state of health using mortality data and Behavioral Risk Factor Surveillance System (BRFSS) • Analyzed newspaper coverage of project • Developed logical framework for determining health impacts • Public Involvement & Education – presentations, email notices, web pages, newspaper articles, and survey	• Access and Social Equity • Physical activity • Safety (Injury and Crime) • Social Capital • Environment – air quality, water resources, noise, brownfields

Table A1 (continued)

MacArthur BART Transit Village	• Housing • Transportation • Livelihood • Retail goods and public services including food • Education • Parks and natural space • Pedestrian safety • Air quality • Water quality • Noise • Community violence • Social cohesion • Social exclusion	• Literature review • Planning and assessment documents of nearby transportation projects • Field visits • Interviews with stakeholders, experts, and public • Mapping of all secondary data • Environmental data on noise, air quality, and pedestrian environments • Quantitative health effects forecasting models	• Access • Physical activity • Social capital • Safety
Decatur Community Transportation Plan	• Neighborhood environment • Physical activity • Access and Affordability • Environmental threats • Social capital	• Literature review • Community workshops	• Physical activity • Safety and injury • Social capital • Equity and access • Mental health

Table A2: Final Recommendations
(Ross 2007) (University of California Berkeley Health Impact Group 2007) (Center for Quality Growth and Regional Development 2007)

	Beltline	**MacArthur BART Transit Village**	**Decatur Community Transportation Plan**
Prioritize Traffic Safety	X		X
Prioritize Connectivity	X	X	X
Universal Design	X		X
Increase Mobility and Access of Vulnerable Groups	X		X
Promote Physical Activity	X		X
Encourage Safe Routes to School	X		X
Plan for Variety of Modes/Uses	X		X
Improve Safety and Efficiency of Bike Routes	X	X	X
Ensure Equity in Access Across All Nearby Neighborhoods		X	
Promote Measure to Encourage Affordable Housing and Prevent Displacement		X	
Encourage Development Near Transit Stops		X	X
Provide Lighting and Security		X	
Compare Physical Activity Levels Before and After Project Implementation		X	
Institute Maintenance Plan for Facilities		X	
Enhance Public Participation and Transparency		X	

Table A2 (continued)

Implement Safety Education Program		X	
Design for Social Interaction		X	X
Protect and Enhance Natural Land Features		X	
Preserve Neighborhoods		X	
Monitor Particulate Matter Levels		X	
Install Noise Barriers		X	
Use Considerate Construction Practices		X	
Discourage Car Use by Disincentivizing Parking			X
Require Certain Headways for Transit Vehicles			X

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