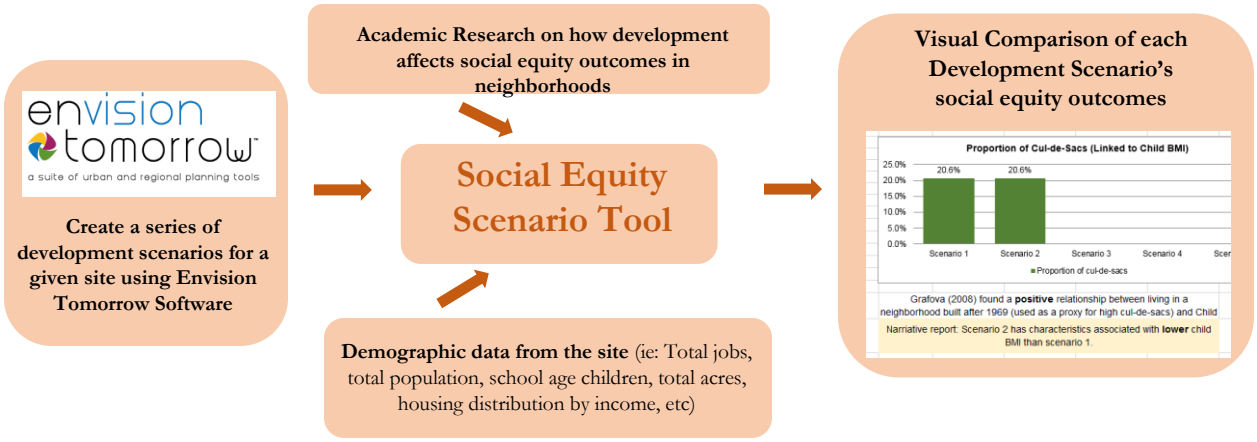
Envision Tomorrow Social Equity Scenario Tool User Guide



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Tool Overview

Imagine … you are a county planner creating your master plan. You trying to decide whether or not to require that all new subdivisions include a certain amount of open space. Area nonprofits support the idea because they argue it will have strong social equity and health outcomes. Politicians are pushing back saying it doesn't make economic sense, nor is there any documented evidence that open space will result in equitable outcomes. You have very little data to back up either argument other than your own intuition and successes you have heard from other communities. How will this particular development affect the surrounding community, given the community's population size, the number of renters in the area, or number of school age children? This tool provides a resource for you to investigate the answer to this question.

Despite wanting to understand how decisions about the built environment affect social equity outcomes – until recently very few planners have had the tools to help demonstrate what the actual effect a development decision will have on the social equity of the residents living near or around a development.

The Social Equity Scenario ET+ app tool attempts to deal with this problem by allowing planners to consider for multiple scenarios the potential future residents and their future wellbeing.

What are the Current Approaches to Social Equity Analysis in Planning? Despite planners' increasing concern over social equity in recent years – approaches that analyze equity often have two weaknesses. First, the relationships between the built environment and the social wellbeing of those living in a neighborhood or city are often vague or assumed. Second, current approaches often highlight inequality without making concrete links to routine planning decisions. This has forced planners to often make value judgments about which developments in a neighborhood or city will result in more equitable outcomes. Several current practices and approaches to social equity analysis in planning exist such as the Kirwan Institute's Opportunity Mapping, PolicyLink's National Equity Atlas, or regional indicator reports such as Metropolitan Area Planning Council's the State of Equity in Metro Boston (to see a full review of each of this current practices, please see Appendix A - *Approaches to Social Equity Analysis in Planning: An Overview of Current Practices*). Unfortunately, each of these practices measure indicators for social wellbeing outcomes based on *current* conditions. In contrast, scenario planning asks for comparison among *future* scenarios. However, existing scenario planning tools and methods such as Envision Tomorrow, CommunityVIZ and INDEX are all design-based land use modeling tools and their forecasted outputs are mostly built environment indicators, which are usually not measures for social well-being and do not currently adequately address equity concerns across scenarios.

What does the Tool do? The Scenario Equity tool takes the growing body of "neighborhood effects" research to construct research-based indicators that link equity to future planning decisions. This approach links the built environment indicators produced by existing scenario planning tools to social well-being outcomes. Assessing the equity of a particular scenario gives planners the ability to compare among alternative scenarios. The Tool also has the potential to facilitate consideration of how positive and negative effects of alternative scenarios are distributed among different groups – and attempts to ground conversations about equity in planning in empirical research. The goal of the Tool is to follow the tradition of other indicators within tools like ET+, and create a tool that allows for existing social science research findings to be translated into planning contexts.

How does the Tool work? The Social Equity Scenario Tool is an extension and analysis module component to the open source *Envision Tomorrow* suite of scenario planning tools. It exists separately from the core scenario painting functionality of Envision Tomorrow, but is included in the core installation files users can access at www.EnvisionTomorrow.org/downloads.

After a user creates a series of development scenarios for a particular site using the Envision Tomorrow toolset – the Social Equity Tool app can be used to compare the relationships between the development in each scenario – and how each affects various measures of social-equity like obesity or upward mobility.

Envision Tomorrow (ET) is an open-access scenario planning package that allows users to analyze how their community's current growth pattern and future decisions impacting growth will impact a range of measures from public health, fiscal resiliency and environmental sustainability. It is a suite of planning tools that includes analysis tools and scenario design tools. The analysis tools allow users to analyze aspects of their current community using commonly accessible GIS data, such as tax assessor parcel data and Census data. The scenario painting tool allows users to "paint" alternative future development scenarios on the landscape, and compare scenario outcomes in real time.

After running each scenario through the Equity Tool – the Tool will produce a series of charts that allow the user to visually see connections between social equity indicators and how variations in the built environment affect the indicators. For example, one of the indicators allows the user to see connections between obesity rates in children, measured by child BMI rates, in comparison to the proportion of cul-de-sacs located within a development. The user can then visually see how these measurements compare between scenarios (see Figure 1) below.

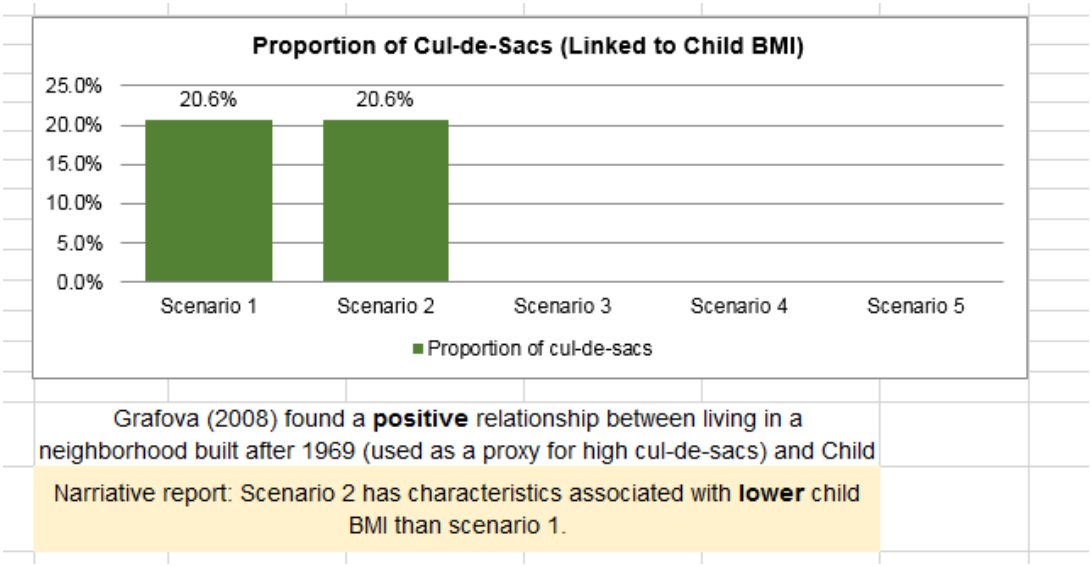


*Figure 1. **Screenshot from Social Equity Scenario Planning Tool.** The above screenshot of the Tool shows two different proposed development scenarios (Scenario 1 and 2). Given each scenario's demographic characteristics, the chart shows the user how the number of cul-de-sacs proposed in each development will have an impact on the obesity rates in children in the area, measured by child BMI rates. This is informed by a study by Grafova (2008) which found a positive relationship between living in a neighborhood with a high number of cul-de-sacs and child BMI rates.*

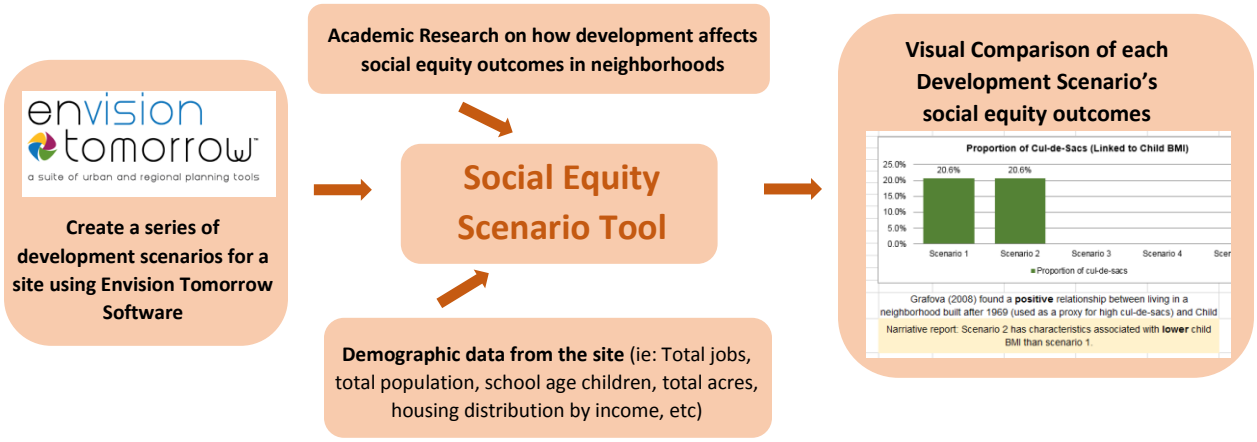


Figure 2. Social Equity Scenario Tool Flow Chart. *The flow chart demonstrates the basic steps the Social Equity Tool uses to produce an outcome.*

Tool Background. The Equity Tool is based on existing social science research findings related to social equity and the built environment. The goal of the tool is to translate these findings into planning contexts. The tool uses three main categories of social wellbeing research to create the indicators used in the model. These include: (1) physical health, (2) economic mobility, and, (3) social capital.

All of the studies used to create this tool are: (1) U.S. specific, (2) broadly applicable in their spatial extent and their study population to other urban areas, (3) relatively recent (in the last 20 years), (4) focus on built environment factors that can be integrated into an existing scenario planning tool, and (5) measure social wellbeing.

Using literature from these three areas – selected *equity indicators* from the literature (Child BMI, Adult BMI, Collective Efficacy of a Community, Upward Mobility, High Blood Pressure, Heart Disease, and Diabetes) were associated with particular *built environment factors* (proportion of cul-de-sacs, land use mix entropy, population density, proportion of open space; population density, intersection density, building square footage, job-population balance, population density, and land area mix). These associations are shown below:

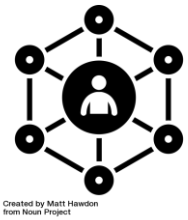
Physical Health


Created by Lance Knadle from Noun Project

- *Child BMI, as a measure of child obesity, as it relates to the proportion of cul-de-sacs*. Grafova (2008) found a positive relationship between living in a neighborhood built after 1969 (used as a proxy for high cul-de-sacs) and Child BMI.

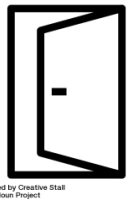
- *Adult BMI, as a measure of adult obesity, as it relates to land use mix entropy and population density*. Rundel et al (2007) found a negative relationship between land use mix and population density and Adult BMI.

Social Capital



- *Collective efficacy, or the perception of mutual trust and willingness within a community to help each other, as it relates to the proportion of open space within a half mile of the development*. Cohen, Inahami, Finch 2008 found a positive relationship between number of parks within a half mile and collective efficacy

Economic/Intergenerational Mobility

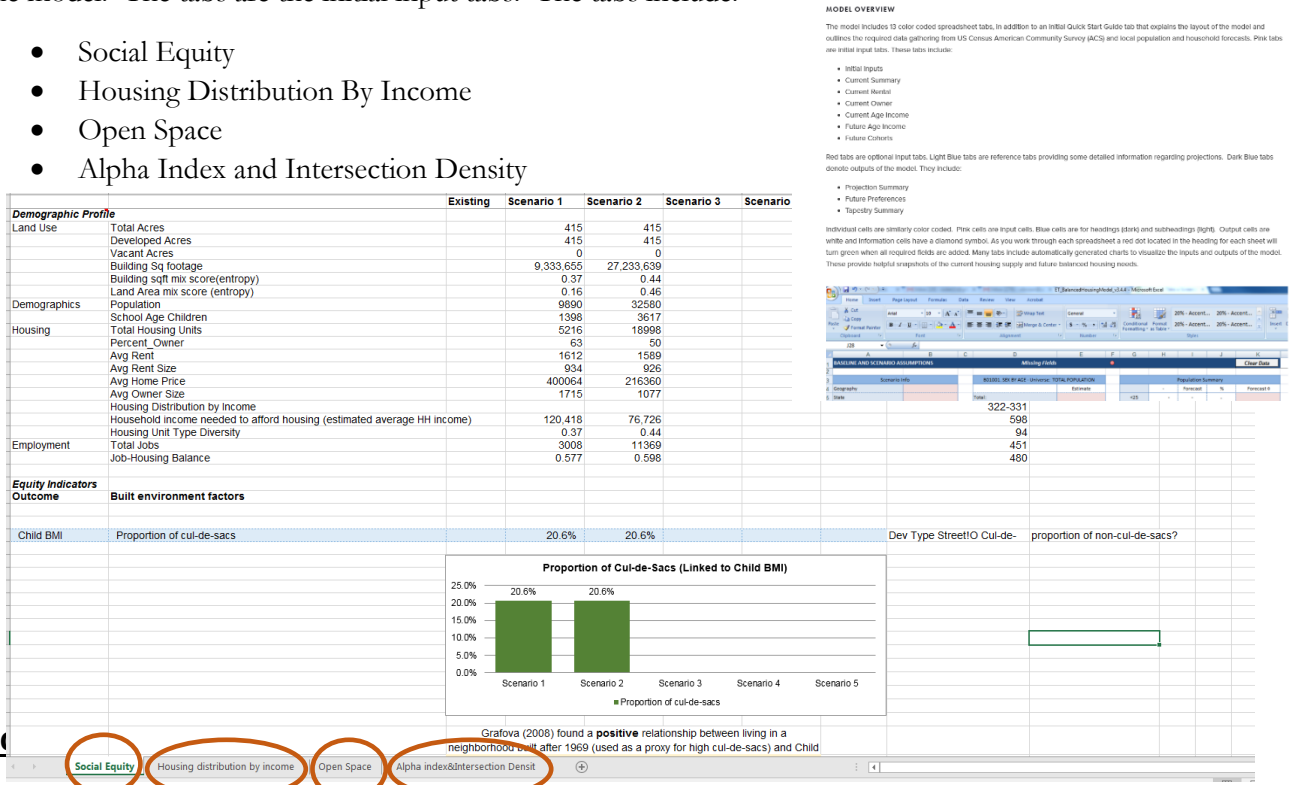


- *Upward Mobility, Adult BMI, High blood pressure, heart disease, diabetes - as it relates to a variety of built environment indicators like population density, intersection density, building square footage, etc*. Ewing, Meakins, and Hamidi (2014) found a negative relationship between a county sprawl index and several outcomes.

While the tool presently includes the above five social wellbeing indicators – it is designed to be adapted over time. In other words, as new empirical research is produced, the tool can be updated to produce more and more accurate predictions of how the effects of urban scenarios are distributed among different groups. The next section of the report contains more details on how the research studies were identified.

Model Overview. The model includes three color-coded spreadsheet tabs, in addition to an initial Quick Start Guide tab that explains the layout of the model and outlines the required data needed to run the model. The tabs are the initial input tabs. The tabs include:

- Social Equity
- Housing Distribution By Income
- Open Space
- Alpha Index and Intersection Density



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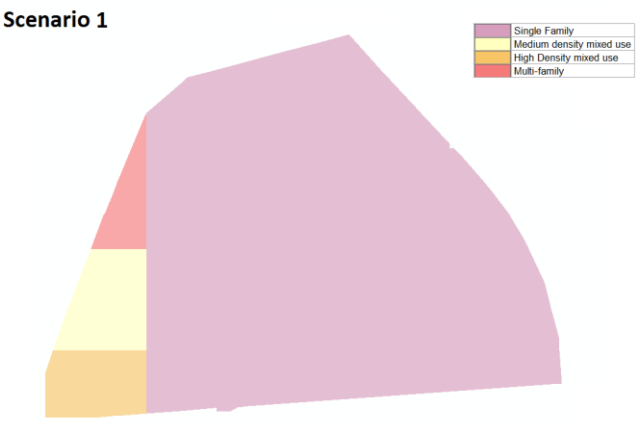
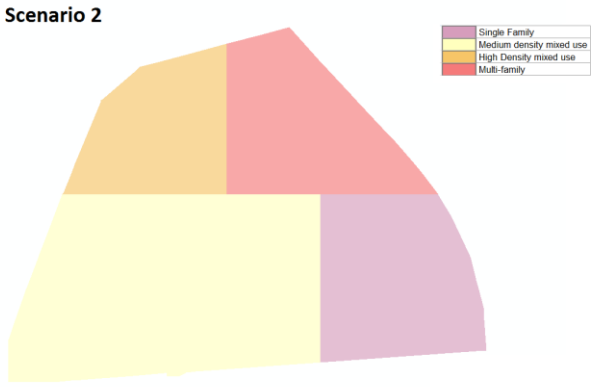
- All of the calculations to create the inputs are in a basic Envision Tomorrow spreadsheet. Basic Envision Tomorrow skills will be needed to complete the process. http://envisiontomorrow.org/

Quick User Start Guide

The following provides a step-by-step guide for using the Envision Tomorrow Social Equity Tool. If you require more information about the basic setup and installation of Envision Tomorrow, please visit www.EnvisionTomorrow.org/user-guide.

STEP 1: You begin with a series of development scenarios for a given site. For example, as shown below, two scenarios for one site might have significantly different makeup of single family and medium density mixed use zoning. You want to know how the built environment of each scenario will impact the society equity outcomes of the residents living on and surrounding the site.





STEP 2: Start by inputting all demographic and site data for each of the selected development scenarios into the basic Envision Tomorrow spreadsheet (see Figure 3 below).

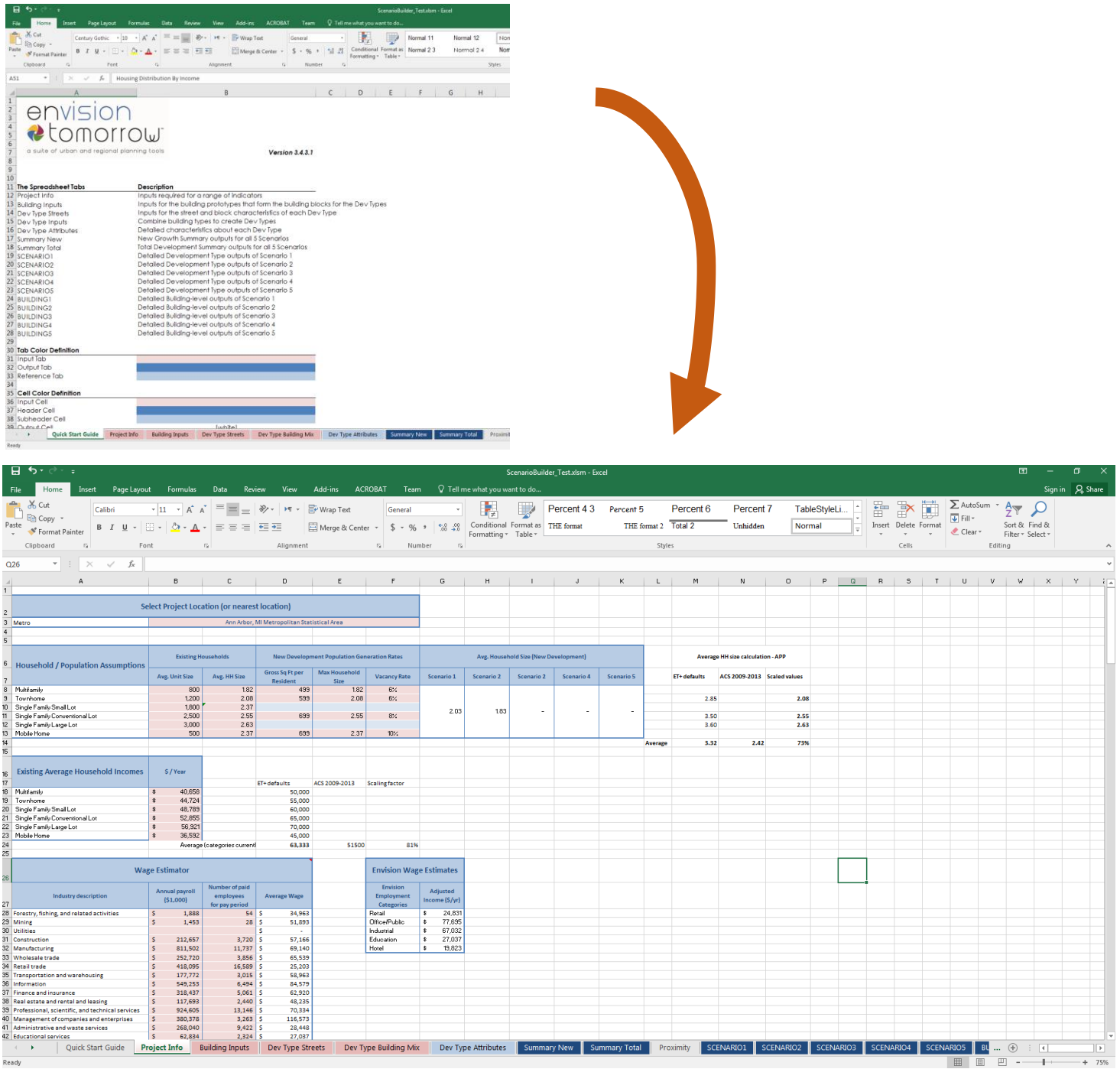


Figure 3. ***Snapshot of Example Envision Tomorrow Spreadsheet****. Before using the Social Equity Scenario Tool, the user first inputs site, project, and demographic data and characteristics into the Envision Tomorrow tool for a variety of development scenarios.*

Note: to ensure the Equity Tool works most effectively, when inputting site data into Envision Tomorrow take care to include each of the following:

- Total Acres
- Developed Acres
- Vacant Acres
- Building Square Footage
- Building Square Foot Mix Score (Entropy)
- Land Area Mix Score (Entropy)
- Population
- School Age Children
- Total Housing Units
- Percent Owner
- Average Rent
- Average Rent Size
- Average Home Price
- Average Owner Size
- Housing Distribution by Income
- Household Income Needed to Afford Housing (estimated average Household Income)
- Household Unit Type Diversity
- Total Jobs
- Job-Housing Balance

STEP 3: Copy scenario attributes as indicated into the Social Equity Scenario Tool.

STEP 4: Housing Distribution by Income

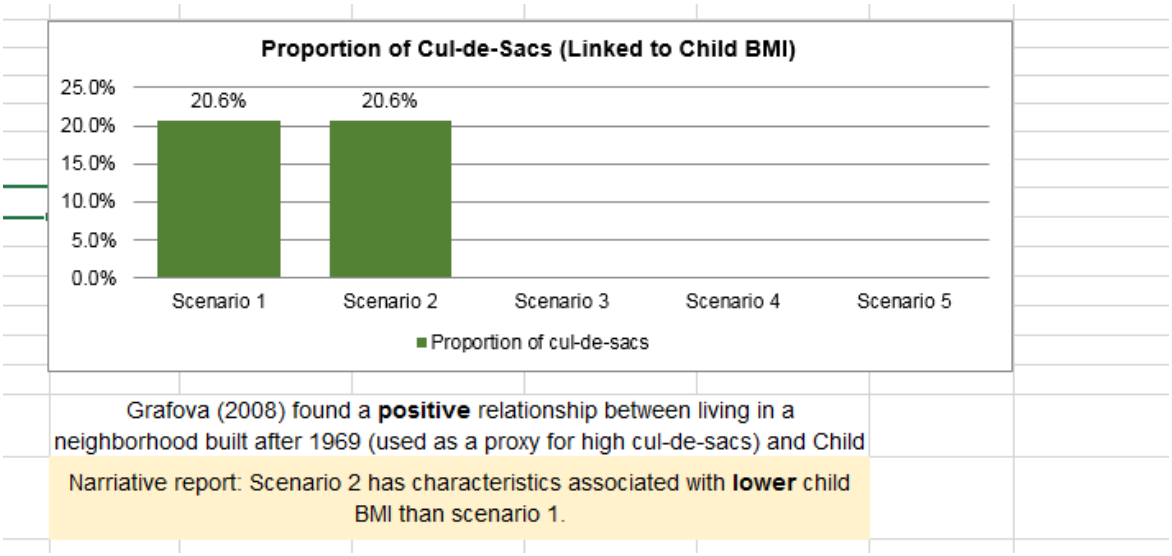
STEP 5: Open Space

STEP 6: Intersection Density

STEP 7: Once all of the data has been entered, the first tab of the spreadsheet should include charts for each of the five social equity indicators. Each of the charts will show how an equity indicator relates to a built environment characteristic. It will include a narrative report below stating what the chart indicates. Below are examples of each of the three areas (1) physical health, (2) social capital, and (3) economic/intergenerational mobility and sample charts demonstrating what the final outcomes might look like for two hypothetical scenarios.

Physical Health

- *Child BMI, as a measure of child obesity, as it relates to the proportion of cul-de-sacs*. Grafova (2008) found a positive relationship between living in a neighborhood built after 1969 (used as a proxy for high cul-de-sacs) and Child BMI.



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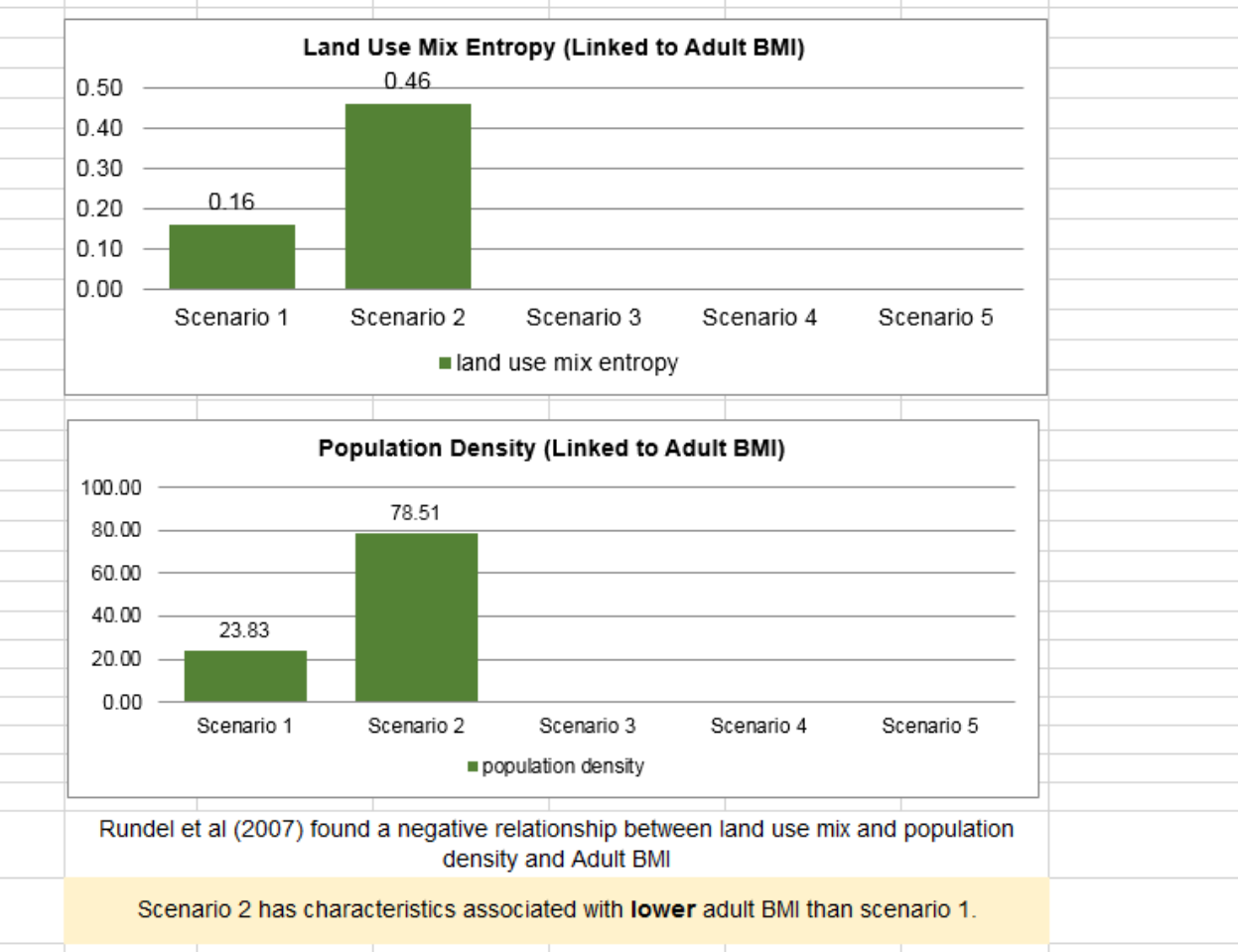
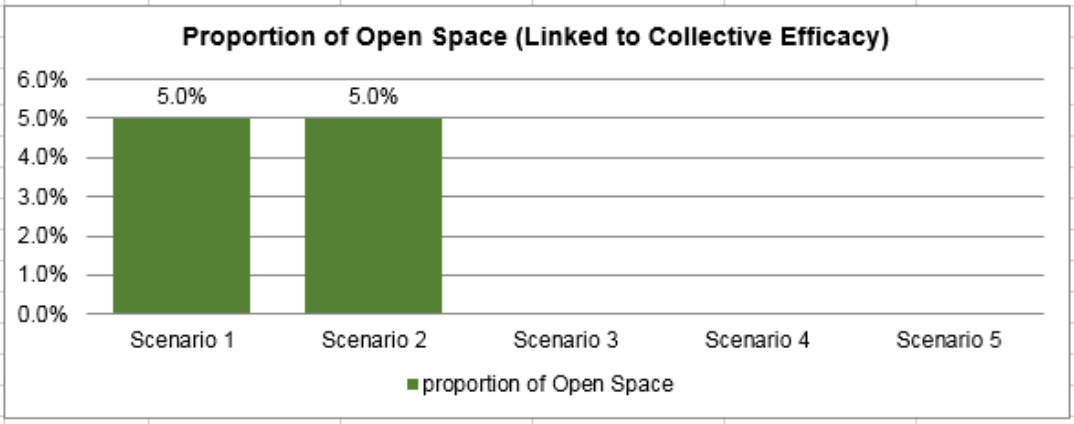


Social Capital

- *Collective efficacy, or the perception of mutual trust and willingness within a community to help each other, as it relates to the proportion of open space within a half mile of the development*. Cohen, Inahami, Finch 2008 found a positive relationship between number of parks within a half mile and collective efficacy

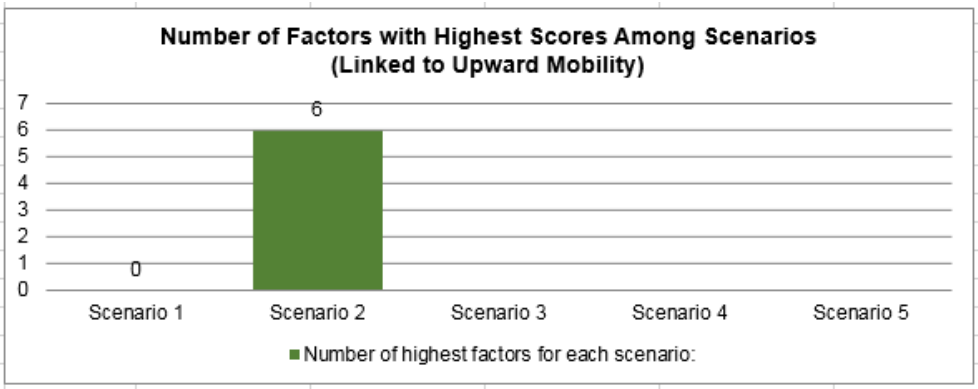


Cohen, Inahami, Finch 2008 found a positive relationship between number of parks within a half mile and collective efficacy

The scenarios **do not differ** on this characteristic linked with collective efficacy.

Economic/Intergenerational Mobility

- *Upward Mobility, Adult BMI, High blood pressure, heart disease, diabetes - as it relates to a variety of built environment indicators like population density, intersection density, building square footage, etc.* Ewing, Meakins, and Hamidi (2014) found a negative relationship between a county sprawl index and several outcomes.



Ewing, Meakins, and Hamidi (2014) found a negative relationship between a county sprawl index and several outcomes

Scenario 2 has characteristics associated with **greater** upward economic mobility.

STEP 8: Use the results from the tool to facilitate discussions on the consideration of how positive and negative effects of alternative scenarios are distributed among different groups – and attempt to ground conversations about equity in planning in empirical research.

Troubleshooting Contact: With questions contact Robert Goodspeed (rgoodspe@umich.edu, 734-615-7254)

Detailed Tool Documentation

Empirical Research on Neighborhood Effects and the Built Environment

Challenges of Using Literature on Neighborhood Effects and Operationalizing them in a Social Equity Tool

By: Sabiha Zainulbhai, Robert Goodspeed, Bonnie Wang, and Jacob Yan

Despite planners' increasing concern over social equity in recent years, existing approaches for analyzing equity remains a challenge. Historically, the relationship between the built environment and social well-being has been vague, forcing planners to resort to normative claims about which neighborhoods will result in more equitable outcomes. As described above, the goal of our project is to develop a tool which can operationalize the growing body of "neighborhood effects" research to construct research-based indicators that link equity to planning decisions. Assessing the equity of a particular scenario will give planners the ability to compare among alternate scenarios. Such a tool has the potential to facilitate consideration of how positive and negative effects of alternate scenarios are distributed among different groups, and in short, will ground conversations about equity in planning in empirical research.

The Built Environment and Neighborhood Effects

If neighborhoods are understood as a package of resources, institutions and socializing agents that play a significant role on the wellbeing of residents, neighborhood effects can broadly be thought of as the influence of neighborhood characteristics on resident's well-being. The built environment of a neighborhood is the factors that are shaped by human-made or modified, including buildings, land use patterns, street connectivity, lighting, etc. For the purposes of this project, we are primarily concerned with research that attempts to isolate the effect of the built environment on various individual outcomes.

A large "neighborhood effects" literature has developed exploring the relationships between neighborhood characteristics and various well-being outcomes, such as mental and physical health, physical activity, social capital, crime and economic mobility. While many well-being outcomes can be explained by individual and neighborhood level factors such as socioeconomic status, race, and family characteristics, neighborhood built environment factors have been found to be statistically significant in a wide range of studies. In an ideal world, there would be consistency in the definitions and measurement of the built environment across studies as well as social outcomes for different populations so that findings could be more easily operationalized in a scenario planning tool. In the absence of the ideal, this memo highlights the relevant and methodologically sound studies found in each category of social well-being which are used in the tool. In addition, it contains a discussion of the challenges of using these findings to estimate the effects of planned development on future residents for the planned area and surrounding areas.

While we did not perform an extensive systematic literature review, we focused our attention on high-quality, well-cited, and peer-reviewed research studies from scholarly journals. Despite the robust literature on neighborhood effects and the built environment, the criteria we have chosen for integrating studies in a social equity tool significantly narrows the literature. For our project, we sought studies that are: U.S. specific; broadly applicable in their spatial extent and their study population to other urban areas; relatively recent (last 20 years); focus on built environment factors that can be integrated into an existing scenario planning tool (Envision Tomorrow +); and measure social well-being in way that corresponds with our approach to analyze equity.

Empirical Research on Neighborhood Effects and the Built Environment

Table 2 provides an overview of the studies found to be relevant for the social equity tool. While the literature is robust, the studies included provide an example of the kind of empirical research that lends itself well to operationalization of a social equity tools in scenario planning.

Category	Social Well-Being Outcome	Built Environment Characteristics[1]	Study
Physical Health	Overweight Status/Obesity	Convenience store density; pedestrian-oriented urban design; physical disorder	Grafova (2008)
		Land use mix; bus and subway stop density; population density and intersection density	Rundle et al (2007)
		Urban Sprawl, using 2010 Metropolitan Compactness Index	Ewing et al (2014); Ewing and Hamidi (2015)
	Physical Activity	Urban Sprawl, using 2010 Metropolitan Compactness Index[3]	Ewing et al (2014)
Economic Mobility	Upward Mobility	Urban Sprawl, using 2010 Metropolitan Compactness Index	Ewing and Hamidi (2015)
Social Capital	Collective Efficacy	Parks, alcohol outlets	Cohen et al (2008)
[1] Only characteristics found to be significantly related to the outcome are shown.			

The following is an overview of each of the studies related to physical health, economic mobility, and social capital - and how their findings were extrapolated to include in the social equity tool.

Physical Health

Research on the built environment and physical health tend to focus on the following outcomes: overweight status, obesity, and physical activity. Since both overweight status and obesity primarily result from an energy imbalance that occurs when caloric intake exceeds energy expenditure (Grafova 2008), a person's weight can be thought of as a complex interaction between diet and physical activity, both of which may be affected by one's environment. Given the rise in obesity rates in recent decades, the concentration of obesity among people of low socioeconomic status and populations of color (Lovasi et al 2009), and the social, physical and mental costs associated with such conditions, discussion has turned to the role of environment in exacerbating this energy imbalance. Recent attention has been paid to what are known as "obesogenic environments," or built environments that promote excessive energy consumption and discourage physical activity (Lovasi et al 2009, Papas et al 2007).

We have identified four studies related to physical health which we use in the tool:

Grafova (2008) examined three dimensions of neighborhood characteristics to assess their relationship to overweight status in children and adolescents: urban sprawl and walkability, the food environment, and social and economic environment characteristics. This study used survey data for nearly 2,500 children aged 5 to 18 from the 2002-2003 waves of the Child Development Survey of the Panel of Study Income Dynamics (PSID). Being overweight in this study was defined as having a Body Mass Index (BMI) above the gender-specific 95th percentile. Grafova found that children and adolescents living in a neighborhood with **higher convenience store density** and **a more modern urban design** (i.e. less pedestrian friendly) were associated with a higher probability of being overweight. Convenience store density is measured by the number of stores per 10,000 people in the county of residence.

Urban design is a measure indicating the median year in which homes in a census tract were built; neighborhoods built after 1970 tend to have a "loops and lollipops" design that is less pedestrian friendly whereas neighborhoods built earlier tend to have a grid-like street pattern that is more conducive to walking. In addition, children living in neighborhoods where physical disorder was not observed were less likely to be overweight. Physical disorder is measured at the street block level. Interviewers recorded their observation on the condition and upkeep of the buildings and street surface on the block, and the amount of garbage, broken glass, drug-related paraphernalia, condoms, beer containers, cigarette butts, etc. in the street and sidewalk using a 4-item Likert-type scale. Built environment characteristics that had **no** association to the overweight status of children and adolescents include: population density; street connectivity; pedestrian danger rates; and restaurant and grocery store density. To assess the impact of the built environment, Grafova used a multinomial logistic regression, controlling for individual, neighborhood and family level confounders, including child age, gender, race, ethnicity, age of household head, number of children in household, region of residence, primary caregiver's highest level of education attained, maternal hours of work, income-to-needs ratio, total family wealth, and mother's BMI.

In contrast to Grafova (2008), Rundle et al (2007) examined the effects of the built environment on underweight status and obesity in a densely populated area: New York City. The authors hypothesize that the relative variation in built environment characteristics may not influence physical activity patterns in such densely populated areas. The authors used the responses of roughly 13,000 adult volunteers (aged 30 and over) recruited from 5 boroughs of New York City between January 2000 and December 2002. Specifically, the researchers looked at four measures of the built environment that are thought to promote pedestrian walking and independence from cars within census tracts: land use mix; bus and subway stop density; population density and intersection density. Each measure was constructed as follows:

- *Land use mix* is the ratio of the building area devoted to commercial use and residential use in each tract. Those ratios are then multiplied and scaled by a factor of four so that the index ranges from zero to one. In a perfectly mixed area that contains equal areas of residential and commercial space, the index equals one. If either kind of residential area dominates, the index tends towards zero.
- *Bus and subway stop density* is measured per km^2 in each census tract.
- *Population density* is measured by residents per km^2.
- *Intersection density* is measured as intersections per km^2. Street intersections that occurred where census tracts bordered each other was assigned to each census tract having a border at the intersection.

When all of the built environment factors were assessed in one model, **land use mix**, **subway density** and **population density** were found to be inversely and statistically related with Body Mass Index (BMI) in New York City. Using a cross-sectional multilevel analysis, the authors controlled for age, gender, race, educational attainment, census tract-level poverty and race/ethnicity. The authors also calculated the percentage of the between-census tract variation in mean BMI and found that 77 percent of the between-census tract variance was explained by individual and census tract-level predictor variables. Interestingly, the model that assessed all built environment factors simultaneously explained 87 percent of the variation between tracts. The primary drawback of this study is its use of New York City, which is unusual compared to other U.S. cities in terms of

density, walkability, transit access, and other factors. However, outlying boroughs do contain areas with more suburban development patterns.

Ewing et al. (2014) examine the relationship between BMI, obesity and a host of other physical health conditions and the compactness of metropolitan areas, using their 2010 Metropolitan Compactness Indices. To assess the level of urban sprawl in metropolitan areas in the U.S., the 2010 Metropolitan Compactness Index presents a single score based on four factors: residential and employment density; neighborhood mix of homes, jobs and services; strength of activity centers and downtowns; and accessibility of the street network. Using principal component analysis, in which a small number of factors that embody the common variance of the original dataset are extracted from a large number of correlated variables. The extracted factors, or principal components, that account for the greatest variance become factors and each factor is given a loading that shows the correlation of the factor with the variable. To arrive at a final index, the principal analysis component is then standardized, with bigger values indicating more compact counties and smaller values indicating more sprawling counties.

After controlling for behavioral and sociodemographic factors, the authors conclude that residents of more **compact counties** have significantly lower BMIs. Of the four individual compactness measures in their indices, a factor indicating **land mix-use** and a factor indicating **density** were negatively and significantly related to BMI and obesity (Ewing et al 2015). The compactness index was not significantly related to physical activity, although this may be because the outcome variable was not broadly defined to include active travel to work and travel to other destinations (Ewing et al 2014).

Economic Mobility

Relative to other developed countries, upward mobility in the U.S. remains low. For many African American communities and middle-income communities, downward mobility is just as common (Ewing et al 2015). Recent empirical research has linked geography to social mobility (Chetty et al 2015; Ewing et al 2015). Further, studies find that the amount of time individuals spends in a place during their childhood is a key determinant of that neighborhood's effects (Chetty et al. 2015). We found one potentially relevant study of this:

Ewing et al (2015) make explicit the connection between social mobility and urban sprawl. They hypothesize that metropolitan sprawl—or areas characterized by low-density, single-use and uncentered development—contributes to low rates of upward mobility for low-income communities. Ewing et al (2015)'s mobility metric is as follows: the probability that a child born to a family in the bottom quintile of the national income distribution reached the top quintile of the national income distribution by age 30. They explore four causal pathways between sprawl and upward mobility: job accessibility; social capital; racial segregation (as measured by black isolation) and income segregation (as measured by segregation of poverty). Of these four, the metropolitan compactness index (MCI) has indirect relationships to upward mobility through black isolation and job accessibility. Using a 2010 **metropolitan compactness index**, they find that the net direct effect of compactness on upward mobility is positive, meaning that mobility is higher in compact rather than sprawling metropolitan areas.

S*ocial Capital/Collective Efficacy*

Social capital is defined as access to resources through connections to a social group (Eicher and Kawachi 2011). Collective efficacy, or the level of mutual trust, the existence of reciprocity, and the perception of collective action among residents, is often used as a measure of neighborhood social capital. The built environment can foster collective efficacy through the creation of shared space where social interaction is encouraged. Mixed-use, pedestrian-friendly neighborhoods which follow New Urbanist design principles are hypothesized to increase social interactions with neighbors, and enhance trust and social capital (Lund 2003). Perceptions of safety, including crime and neighborhood upkeep, are also associated with social capital (Renalds et al. 2010). "Eyes on the street" in the form of architectural features that promote visibility were

associated with social support and reduced psychological distress (Brown et al 2009). We identified two potential studies for this outcome:

Cohen et al. (2008) examined specific land use categories and their association with a self-reported measure of collective efficacy among census tracts in Los Angeles County. Collective efficacy was measured using Sampson's measure of individual perceptions of "social cohesion among neighbors combined with willingness to intervene on behalf of the common good." The five measures of social cohesion include determinations on the following statements: this is a close knit community; people generally do not get along; people willing to help neighbors; people do not share same values; people can be trusted. The informal social control items are: neighbors do something if kids hang out; would do something if kid does graffiti; would scold kid if showing disrespect. Using survey data from the Los Angeles Family and Neighborhood Study of roughly 2,500 adult respondents, the authors found that **parks** were independently and positively associated with collective efficacy, while alcohol outlets were negatively associated with efficacy. Further, they found that fast food outlets and elementary schools were not related to collective efficacy. The authors controlled for neighborhood/tract-level disadvantage, as well as individual variables such as age, college education, annual family income, sex, marital status, employment and race/ethnicity.

The Challenges of Operationalizing Neighborhood Effects Findings

To the extent that perfect studies exist, finding one for each broad category of social well-being is nearly impossible. In the absence of such findings, we scanned the literature to evaluate what empirical research could be operationalized into an already existing planning tool. While individual studies rationalized their use of unique study populations and research designs, we will explore some of the methodological challenges associated with drawing conclusions from empirical findings.

Several researchers (Sampson et al. 2002, Papas et al. 2007) note that isolating neighborhood effects is difficult since individuals traverse neighborhood boundaries frequently during the course of the day. Focusing solely on the neighborhood while seeking to explain environmental factors on individual behaviors can be misleading as individuals may spend more time at their place of work, and thus may be more influenced by the built environment surrounding their workplace. In geography, this problem has been dubbed the uncertain geographic context problem (Kwan 2012).

Furthermore, the lack of consistency across the definition and scale of neighborhoods, as well as the neighborhood-level variables accounted for in various research designs, limits our ability to analyze patterns that emerge. While some studies assess the built environment at the county or metropolitan level—a scale that does not necessarily reflect particular well-being outcomes and does not account for variation within cities—others use spatial units, such as census tracts, that may not be the most appropriate for understanding the interrelations between the built environment and social well-being outcomes. The geography or spatial unit studied is an important consideration when assessing empirical research as certain geographies can misrepresent the area that is relevant for pedestrian activity. For example, if planners assume that people are willing to walk a quarter of a mile, locations within adjacent census tracts may be close enough to be within walking distance; thus, the geography in which they live does not necessarily specify the boundaries of their physical activity.

Lastly, a fairly significant issue in the neighborhood effects literature is the dearth of longitudinal studies. All of the studies explored for use in the tool are cross-sectional, meaning we can explore associations within neighborhoods at a single point in time, but are unable to rule out reverse causation as an explanation for the association. As such, we cannot rule out whether built environment factors cause social well-being outcomes or whether those that are more prone to certain social well-being outcomes choose to live in neighborhoods with certain built environment factors. Without studying populations over time, there is no way to know

whether built environment characteristics may be sorting people into particular neighborhoods (Rundle et al. 2007).[1]

Despite these challenges, the large and diverse body of literature on neighborhood effects allows us to provide a framework for understanding social equity outcomes of planning decisions. As new, empirical research is produced, the tool can be updated so as to produce more and more accurate predictions of how the effects of urban scenarios are distributed among different groups.

[1] One exception is Grafova (2008), who compared whether children in non-mover families lived in the same type of neighborhoods as children in families that moved and whether movers moved into a different type of neighborhood from the ones they originally lived in.

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APPENDIX A: Approaches to Social Equity Analysis in Planning: An Overview of Current Practices

Planners interested in social equity can choose from among several types of equity analysis practices. This handout provides an overview of three commonly used approaches: opportunity mapping, equity indicators reports, and equity impact assessments.

Opportunity Mapping

Definition: The Kirwan Institute at The Ohio State University defines opportunity mapping as a "research tool used to understand the dynamics of 'opportunity' within metropolitan areas. The purpose of opportunity mapping is to illustrate where opportunity rich communities exist (and assess who has access to these communities) and to understand what needs to be remedied in opportunity poor communities." In order to create maps of metropolitan opportunity, this organization typically incorporates dimensions of opportunity including education, housing and neighborhood, employment and economic health, transportation and mobility, and health and environment.

Strengths: Reveals unequal distribution of opportunity across a metropolitan region, often used to compare neighborhood quality for affordable housing

Weaknesses: Indicators of opportunity incorporated are mostly spatial, and therefore omits consideration of individual factors such as discrimination

Online Tools: Kirwan Institute's Opportunity Mapping Tool (http://kirwaninstitute.osu.edu/tag/opportunity-mapping) National Center for Smart Growth's Opportunity Mapping Tool (http://smartgrowth.umd.edu/oppmapinfo.html) PolicyLink's National Equity Atlas (http://nationalequityatlas.org/)

Examples: Kirwan Institute and Puget Sound Regional Council. (2012). Equity, Opportunity, and Sustainability in the Central Puget Sound Region. http://www.psrc.org/assets/7831/EquOppSusReport2.pdf?processed=true
Kirwan Institute. (2010). The Geography of Opportunity: Mapping to Promote Equity Community Development and Fair Housing in King County, WA. http://kirwaninstitute.osu.edu/docs/KingCounty.pdf

Equity Indicators Report

Definition: Equity indicators reports are usually created to evaluate social equity in a neighborhood, city, or region. Community leaders often use equity indicators report to set up community goals, to engage public opinions, and to decide on policies and initiatives addressing equity concerns. An equity indicator report can serve as a baseline to evaluate progress towards achieving community goals.

Strengths: Can easily illustrate disparate outcomes across groups by cross-tabulation; can document trends over time, can be used to draw attention to equity concerns.

Weakness: Requires strong technical capacity and funding, may lack clear links to planning or policy decisions.

Examples: Metropolitan Area Planning Council.(2009). "The State of Equity in Metro Boston." http://equity.regionalindicators.org
Oregon Metro Equity Baseline Workgroup. (2015). "Equity Baseline Report: Part 1: A Framework for Regional Equity." http://www.oregonmetro.gov/sites/default/files/Equity%20Framework%20Report_final%20012715small.pdf

Equity Impact Assessment

Definition: Equity Impact Assessment is a systematic examination of how a proposed action or decision is likely to impact different social groups. Particularly, it focuses on analyzing the unanticipated adverse consequences of policies and programs on socially disadvantaged population. It is closely related to the practice of preparing environmental impact assessments or health impact assessments.

Strength: Directly related to decision-making by examining the equity impact of an individual action or decision, can include diverse locally-relevant analysis

Weakness: Does not account for existing inequality; requires resources to administer, typically instituted as part of a project review requirement

Examples: Energy and Environmental Investment and Consulting Limited Company Ankara – Turkey. (2009). Antalya-Turkey Power Plant Environmental Impact Assessment Report. http://www.agaportal.de/pdf/nachhaltigkeit/eia/eia_tuerkei.pdf
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Other Approaches

Besides these comprehensive approaches, planners might also apply specific analysis techniques to investigate topics such as accessibility to employment and services, housing affordability, public safety, and health disparities. These techniques range from simple Census data analysis to the use of sophisticated urban models. On such form of analysis which holds great promise for the analysis of equity is the analysis of accessibility to employment, parks and natural areas, transportation, food sources, education, health care, and other services and amenities. Accessibility analysis uses GIS to estimate the amount of these amenities and resources accessible from different neighborhoods, given existing transportation options.

However, planners face significant challenges when attempting to apply current social equity analysis techniques to scenario planning projects. These practices measure indicators for social well-being outcomes on current conditions, but scenario planning asks for comparison among future scenarios. Existing scenario planning tools such as Envision Tomorrow, CommunityViz, and INDEX are all design-based land use modelling tools and their forecasted outputs are mostly built environment indicators, which are usually not measures for social well-being and so cannot be directly used to evaluate equity concerns across scenarios. Because of this, Avin et al. (2015) argue that existing scenario planning tools are not designed to address equity questions, and that equity is best addressed through discussions held separate from the use of these tools.[2]

To address this challenge, potentially there are two approaches. First, one could forecast the same indicators for social well-being outcomes on current conditions into the future. For example, to evaluate accessibility to jobs among scenarios, one could forecast the distribution of jobs under each future scenario and compute the accessibility measure respectively. However, conducting such forecasting work is not only daunting but also somewhat meaningless for planners because planners generally lack influence over the driving forces for these outcomes. Where planners have the most potential to influence on are the built environment characteristics. Therefore, we advocate for a second approach: to link the built environment indicators produced by existing scenario planning tools to social well-being outcomes. Such an approach is enabled by an expanding "neighborhood effects" literature that examines the relationships between neighborhood characteristics and various social well-being outcomes. The other handout provides a summary of the insights drawn from recent studies in this area.

[2] Avin. U. et al.. (2015). Equity in Scenario Planning. Open Planning Tools Group Symposium 2015 Conference Paper.

APPENDIX B: Neighborhood Effects on Social Well-Being: Insights from Recent Research

Overview

A large body of literature exists on the "neighborhood effects", or social well-being outcomes, of the built environment. This handout lays out some of the primary empirical evidence on associations between social well-being outcomes (mental health, physical health, intergenerational mobility and social capital) and built environment characteristics.

It is difficult to assess how much the built environment influences social well-being, but evidence from studies that evaluate this influence indicate that a variety of neighborhood characteristics are predictors of social outcomes, in addition to individual factors such as socioeconomic status, race, age, gender and family characteristics. However, these studies are observational, and therefore cannot fully rule out alternative explanations, such as some unseen variable and not the build environment as the cause.

Empirical studies included in this fact sheet were subject to certain criteria. In addition to being from peer-reviewed scholarly journals, these studies are U.S.-specific; broadly applicable in their spatial extent and their study population to other urban areas; relatively recent; and measure social well-being in way that corresponds with our approach to analyze equity.

Social Well-Being Outcomes

MENTAL HEALTH

Created by Arjun Adamson from Noun Project

A study of adults aged 65 and older in the Seattle area found the **walkability** of neighborhoods (measured by self-reported measures of walking and destinations likely to be associated with walking) they live in was positively related with reduced **depressive symptoms** (Berke et al 2007). Further, researchers found that the amount of walking by older residents of Portland, Oregon is associated with density of places of employment, household density, green and open spaces for recreation, and the number of street intersections (Li et al 2004).

PHYSICAL HEALTH

Created by Lance Knadle from Noun Project

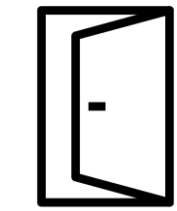
BMI/OBESITY (Child): A national study of children linked **urban design** (neighborhoods built after 1969, i.e. an era of loops and lollipops), greater **physical disorder** and higher **convenience store density** with an increased likelihood to be **overweight** (Grafova 2008). Further, a national study found that a greater number of **physical activity facilities** (i.e. schools, public beaches, pools, tennis courts, youth centers, parks, athletic clubs and gyms, etc.) was negatively related to **overweight status** in adolescents (Gordon-Larsen, Nelson et al 2006).

BMI/OBESITY (Adult): A study of volunteers in New York City between 2000 and 2002 found **mixed land use**, higher **bus stop density** and higher **population density** to be negatively related to **BMI** (Rundle et al 2007). Further, a national study found that those living in more **compact** counties, as measured by a metropolitan compactness index, have lower **BMIs** (Ewing and Hamidi 2014)**.** Similarly, the risk of being

overweight and being obese increased with an increase in **urban sprawl** in a study in 2000 among US adults (Lopez 2004).

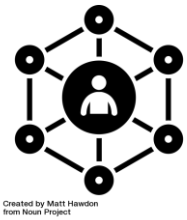
An association between being overweight/obese and the **density of fast-food restaurants** was found in adults age 50 to 75 in Portland (Li et al 2008), and at the state-level in a national study conducted in the early 2000s (Maddock 2004). Another study assessing the local food environment across Mississippi, North Carolina, Maryland and Minnesota found that the **presence of supermarkets** was associated with a lower prevalence of obesity, while the **presence of convenience stores** was associated with a higher prevalence (Morland et al 2006).

ECONOMIC/INTERGENERATIONAL MOBILITY



Based on a metropolitan compactness indices, researchers find that **upward mobility** is significantly higher in **compact areas** than sprawling areas. This occurs directly through better job accessibility and indirectly through less income segregation (Ewing, Hamidi, Grace, Wei 2015).

SOCIAL CAPITAL



A study in LA County finds that the **number of parks** in and around the census tract where individuals live is associated with higher **collective efficacy**, or the perception of mutual trust and and willingness to help each other (Cohen, Inagami, Finch 2008).

A study of Hispanic elders within the City of Miami found that **architectural features of the front entrance** that promote direct observation and interaction among individuals (i.e. porches) are positively associated with **perceived social support**, which is in turn associated with reduced **psychological distress** (Brown et al 2009).

Uncertainty in Scenario Planning

Practitioners looking to draw on the findings of these studies may rightfully investigate the quality of the research: do they document real causal relationships? However this is only one type of uncertainty which should be considered in scenario planning. Planning is a process for changing the future that involves constructing alternate futures (Abbott 2005). But the further out the projected future is, the more uncertainty it creates. The various kinds of uncertainty described by Abbot (2005) include:

1) **Value uncertainty**, or the unpredictability of the actions and intentions of future people involved in the planning process;
2) **External uncertainty**, or the uncertainty about the broader social environment and whether the causal relationships will hold in other contexts,
3) **Chance uncertainty**, or the events that may affect a situation that are impossible to know or even predict;
4) **Causal uncertainty**, or uncertainty about the physical, economic and social situation.

Causal uncertainty is especially relevant when taking into account empirical research, because despite the prevalence of robust demographic controls, applicability to other populations, settings, contexts will always introduce uncertainty. However, just as important may be whether the research applies in a different place and time (external uncertainty) or even whether stakeholders agree on which priorities should be pursued (value uncertainty).

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