Achieving a Healthy Zoning Policy in Baltimore: Results of a Health Impact Assessment of the TransForm Baltimore Zoning Code Rewrite

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ABSTRACT

Objectives. The social determinants of health (SDH) include factors apart from genes and biology that affect population health. Zoning is an urban planning tool that influences neighborhood built environments. We describe the methods and results of a health impact assessment (HIA) of a rezoning effort in Baltimore, Maryland, called TransForm Baltimore. We highlight findings specific to physical activity, violent crime, and obesity.

Methods. We conducted a multistage HIA of TransForm Baltimore using HIA practice guidelines. Key informant interviews identified focus areas for the quantitative assessment. A literature review and a zoning code analysis evaluated potential impacts on neighborhood factors including physical activity, violent crime, and obesity. We estimated potential impacts in high- and low-poverty neighborhoods. The findings resulted in recommendations to improve the health-promoting potential of TransForm Baltimore.

Results. Mixed-use and transit-oriented development were key goals of TransForm Baltimore. Health impacts identified by stakeholders included walkability and healthy communities. For Baltimore residents, we estimated that (*1*) the percentage of people living in districts allowing mixed-use and off-premise alcohol outlets would nearly triple, (*2*) 18% would live in transit-oriented development zones, and (*3*) all residents would live in districts with new lighting and landscaping guidelines. Limiting the concentration of off-premise alcohol outlets represented an opportunity to address health promotion.

Conclusions. Changes to Baltimore's zoning code could improve population health including decreasing violent crime. HIAs are an important platform for applying SDH to public health practice. This HIA specifically linked municipal zoning policy with promoting healthier neighborhoods.

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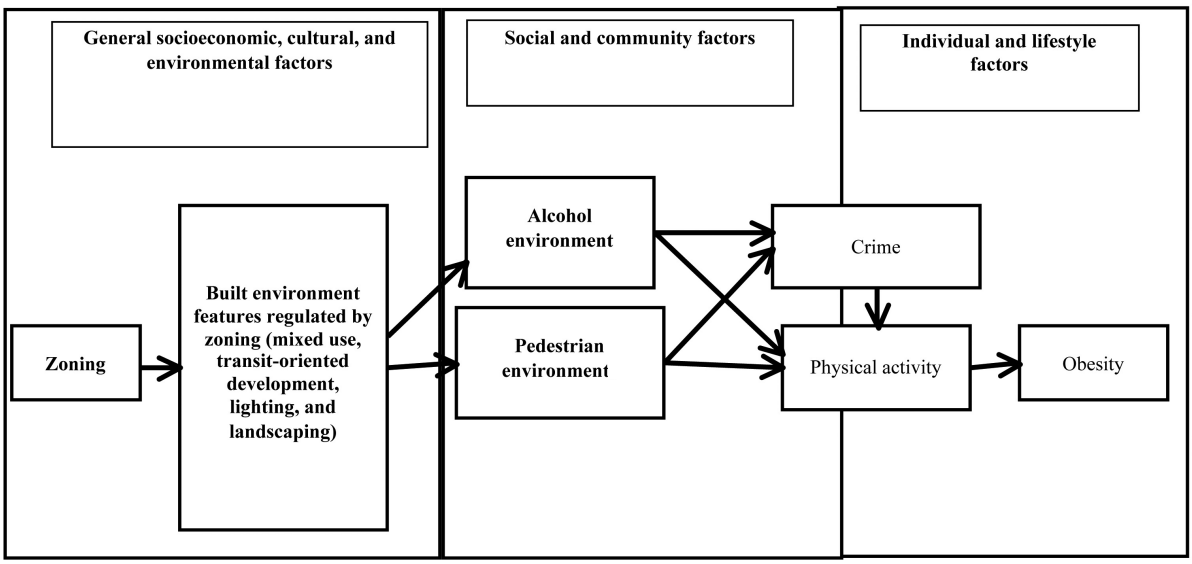
There is a national conversation in the United States regarding how the environments in which we live impact health and the determinants of health.[1] The social determinants of health (SDH) are those factors outside of genes and biology that affect population health and well-being.[2,3] We focus on the built environment—where we live, learn, work, play, worship, and age—which represents one important dimension of SDH.[3] The built environment is the human-made part of the physical environment, including buildings, transportation systems, and open spaces.[4] It is partly shaped by urban planning practices. Interest in using urban planning and community design to create sustainable, healthy communities has increased during the past decade as evidence linking the built environment to health has grown.[5,6] This growing interest in the built environment and the way in which urban planning practices can be used to improve health is reflected, for example, in the "Healthy and Safe Community Environments" chapter of the National Prevention Strategy, which recommends integrating health criteria into decision-making across multiple sectors.[7]

Zoning is an urban planning tool that influences neighborhood environments.[8,9] Historically, zoning was developed to protect the general health, safety, and welfare of citizens; provide certainty about future land use; and designate compatible vs. incompatible land uses in a district.[10] Today, most U.S. cities use zoning to control land redevelopment. Zoning codes influence the built environment by regulating private land through the restriction of land uses and by governing building placement, size, and design.[11] Although zoning provides regulation, local market forces, politics, financing, cultural views of "appropriateness," and enforcement greatly influence what is permitted, desired, and, ultimately, constructed. Additionally, while zoning determines which uses are allowed in a given district, it does not guarantee that the full spectrum of allowable uses will necessarily exist in a given district (i.e., a permitted use does not guarantee the existence of that use). As such, there may be great variability from one zoning district to another. For example, there can be significant differences between commercial zoning districts where the same uses are allowed. As such, one commercially zoned district may have a glut of health food stores while another has a preponderance of fast-food restaurants.

Zoning may affect the health of local residents in a number of ways and may create competing impacts on health (Figure 1).[12–16] Zoning codes may stipulate, for example, that a particular zoning district include a combination of residential and commercial uses, or mixed use. Mixed-use districts may positively impact health by increasing the likelihood that residents walk to daily services (e.g., restaurants, banks, and other retail). Pedestrian-friendly design elements incorporated in the zoning code, such as transparent ground-floor windows, may also positively impact health by creating an environment that is more inviting and safe; as a result, residents may be more likely to be physically active in these areas. Yet, mixed-use areas may also contribute to unanticipated negative health impacts. For example, a mixed-use district may enable the overconcentration of crime-generating uses in one

Figure 1. Pathway diagram relating zoning and health within a social determinants of health framework



neighborhood (e.g., alcohol outlets), thereby increasing exposure to crime. Research suggests that alcohol outlets are associated with increased violent crime locally, in part because potential criminal offenders are attracted to patronize them.[17–21]

Neighborhood crime and safety are potentially important determinants of physical activity among children[22–25] and racial/ethnic minority and low-income adult populations.[26] For example, work by LaVeist and colleagues demonstrates that low-income neighborhoods have a significant overconcentration of alcohol outlets and that racially segregated, predominantly African American neighborhoods suffer the most disproportionate overconcentration of such outlets compared with predominantly white neighborhoods in Baltimore, Maryland.[27]

Periodic revision of zoning codes is essential to maintain a modern and useful land-use pattern.[28] Baltimore City began a zoning code rewrite,[29] entitled TransForm Baltimore, with several major goals in mind: simplification and standardization; preservation of neighborhood character;[30] addressing changing land needs; and incorporating transit-oriented development (TOD), sustainability, and walkability. Realizing the rewrite as a potential mechanism to address SDH, a team of public health, epidemiology, urban planning, zoning law, and criminology researchers conducted a health impact assessment (HIA) of the first comprehensive draft of TransForm Baltimore, which was publicly released in April 2010.

HIA is a process for systematically examining health impacts of a proposed non-health policy, program, or project to inform decision makers and improve their ability to ensure that the policy, program, or project promotes public health.[31,32] HIA was an ideal methodology for informing decision makers of the ways in which TransForm Baltimore might impact key health outcomes in Baltimore and, in particular, how it might impact health inequities. Addressing socially patterned health inequities was a particularly salient goal at the inception of the HIA project (in spring 2009) in light of a report released by the Baltimore City Health Department in fall 2008, which demonstrated a 20-year difference in life expectancy among Baltimore City neighborhoods.[33] As such, the TransForm Baltimore HIA highlighted important aspects of SDH to the decision makers involved in drafting and implementing the TransForm Baltimore comprehensive zoning code revision. Baltimore's comprehensive revised zoning code ordinance was introduced to the Baltimore City Council on October 22, 2012, for consideration and ratification.

We describe the methods and results of the HIA, with particular emphasis on physical activity-, violent crime-, and obesity-related impacts. The HIA focused on three proposed changes: increasing mixed-use development, expanding TOD, and enhancing pedestrian-oriented design. Each change is a leverage point in the pathway linking zoning to changes in the built environment that can impact physical activity, violent crime, and obesity (Figure 1). We used a mixed-methods approach including quantitative and qualitative analyses and produced recommendations aimed at maximizing the health-promoting potential of TransForm Baltimore while mitigating unanticipated negative health consequences. There are proscriptive guidelines and toolkits for writing health-promoting aspects of zoning codes.[34] For example, zoning codes allow multiple designations for uses based on their perceived appropriateness in a given location. As such, a use is permitted "by right" when it is included in the list of permitted uses for a particular zoning district; pursuing such a use does not require a public hearing for approval. "Conditional" uses require a public hearing and, if approval is granted, are usually subject to the fulfillment of certain conditions by the developer. An "accessory" use is an activity or structure that is incidental to the main use of a site (e.g., a small convenience shop in a large apartment complex). And an overlay zone is a set of zoning requirements that is superimposed upon a base zone; in these particular geographic areas, overlays can allow uses in addition to what the base zoning allows.

There are also case studies addressing the impacts of zoning on particular outcomes over time; however, this is the first study of which we are aware that has assessed health impacts prospectively across a range of health outcomes.[14] Although not the focus of this article, the HIA did consider additional potential health impacts of the proposed zoning code rewrite, including its potential impacts on cardiovascular disease risk, pedestrian injury, and access to fresh and healthy foods for city residents.[35]

METHODS

The TransForm Baltimore HIA evaluated the potential of Baltimore's comprehensive zoning code rewrite to affect multiple health outcomes, including physical activity, violent crime, and obesity. The HIA was conducted based on best practice guidelines[36] and included the typical five phases of an HIA: screening, scoping, assessment, dissemination, and monitoring.[31,37]

In the screening phase, the zoning code rewrite was identified as a policy proposal with significant potential to impact population health and health inequities in Baltimore. In addition, the research team determined

that estimating potential health impacts would contribute new information that decision makers were not already considering as part of the zoning code rewrite process. We also determined that the multiyear timeline of TransForm Baltimore would allow enough time for the results of a comprehensive HIA to be timely.

This article focuses on findings from the scoping and assessment phases and from early in the monitoring phase. The scoping phase focused on understanding the history of the rewrite, the major contributors, the change the city was likely to experience, the perceived connections between zoning and health from the perspective of key zoning rewrite stakeholders and decision makers, and whether population health might be impacted by zoning. Findings from the scoping phase in-depth interviews are described in the qualitative analysis section.

The assessment phase focused on three key areas: (*1*) identifying relationships between zoning-related built environment features and health outcomes described in the public health research through a literature review; (*2*) identifying differences between the city's current zoning code and TransForm Baltimore (April 2010 draft), with particular attention to health-related zoning features through a zoning code analysis; and (*3*) quantifying the potential effect of the proposed zoning code changes on population health through a quantitative impact assessment.

The dissemination phase focused on informing decision makers and stakeholders of the findings from the assessment phase through a report and presentations. The monitoring phase is ongoing and focuses on assessing the extent to which the HIA findings have influenced the zoning code rewrite decision-making process. Early findings from monitoring, including the analysis of public meeting observations, are described with the qualitative findings from the scoping phase.

Setting

Baltimore was founded in 1729 and became a city with a mixed-use character (i.e., shops and commercial establishments co-located near housing). In 1910, Baltimore earned the dubious distinction of being the first city to enact a residential segregation ordinance that kept black families from moving to predominantly white blocks (and vice versa).[38] While not zoning, this ordinance sets an important social context for the city. Baltimore's first zoning ordinance or code was approved in 1923. Similar to many cities, the code emphasized the separation of uses (e.g., commercial, residential, or industrial) for future development. While there were adaptations during subsequent years, the first zoning code rewrite began in 1950 and was adopted in 1971. In 2006, a Comprehensive Master Plan for Baltimore City called for a zoning code rewrite to modernize an outdated code.[29]

TransForm Baltimore was undertaken in a city that suffers from poor health outcomes overall and vast within-city health inequities among neighborhoods. Significant health disparities exist between Baltimore residents and other populations in Maryland. Compared with Maryland residents overall, Baltimore City residents suffer worse health outcomes. For example, based on data from 2006–2008, city residents were 34% more likely to die in a given year than other Marylanders.[39] In that time period, cardiovascular disease and violent crime (specifically homicide) contributed 23% and 10%, respectively, toward excess deaths in Baltimore compared with Maryland. One-third of Baltimore's adult population and 20% of high school students reported weight and height that classified them as obese.[40] Within Baltimore, there are significant health inequities among neighborhoods. In 2008, life expectancy varied by 20 years (Figure 2), death from homicide varied by a factor of 36 (Figure 3), and heart disease mortality varied by a factor of two (Figure 4) when comparing the lowest and highest rates for neighborhoods.[33] These variations in health were strongly related to neighborhood poverty (Figure 5) as well as racial composition of neighborhoods.[35]

Qualitative analysis

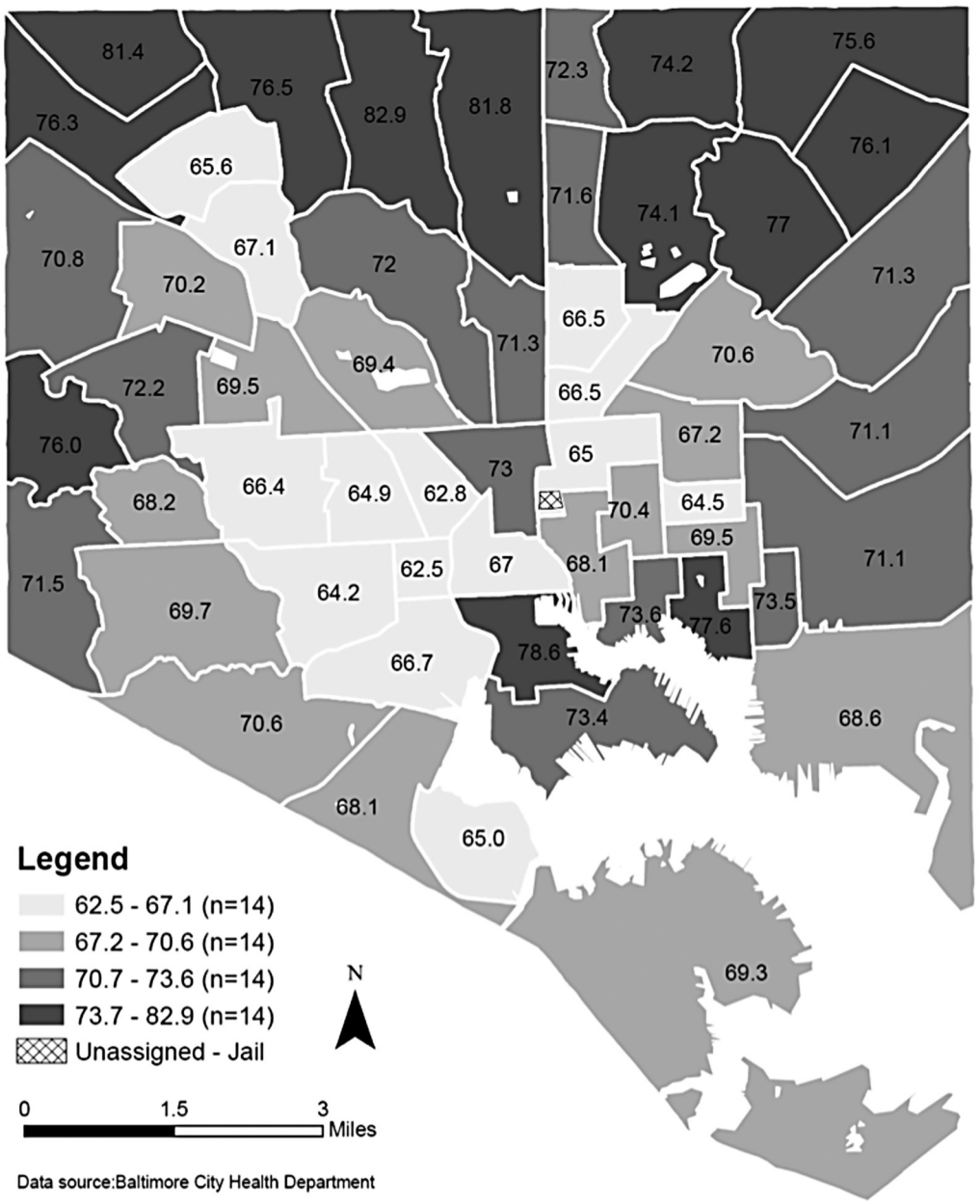
In-depth stakeholder interviews with Department of Planning representatives, city officials (elected and appointed), and other stakeholders formed the basis of scoping. In this phase, we gathered information about health-relevant aspects of the zoning code text that might change, evaluated perceptions of the potential implications of TransForm Baltimore for the built environment and for health, and assessed the extent to which health served as a rationale for the comprehensive zoning code rewrite. Interview participants were identified based on their role in drafting, informing, voting on, or implementing the TransForm Baltimore zoning ordinance. Although the first draft of TransForm Baltimore was released in spring 2010, interviews began in fall 2009 to establish baseline perceptions. As part of monitoring, we attended and transcribed public meetings following the release of the April 2010 draft to assess discussions of health.

Literature review

A literature review identified relationships between zoning-related built environment features and health outcomes of interest. While we did review grey literature and Baltimore-specific documents to better

understand the policy context for the proposed zoning code rewrite, we relied solely on peer-reviewed literature to establish the connections between zoning-related built environment features and health. This literature review was a key component of the HIA assessment. The findings described herein focus on the literature linking specific mixed-use-related features (i.e., off- and on-premise alcohol outlets, TOD, and pedestrian-oriented design) that could be influenced by zoning and might be associated with physical activity, violent crime, or obesity. Searches were conducted in Web of Knowledge, PubMed, and PsychInfo. Research

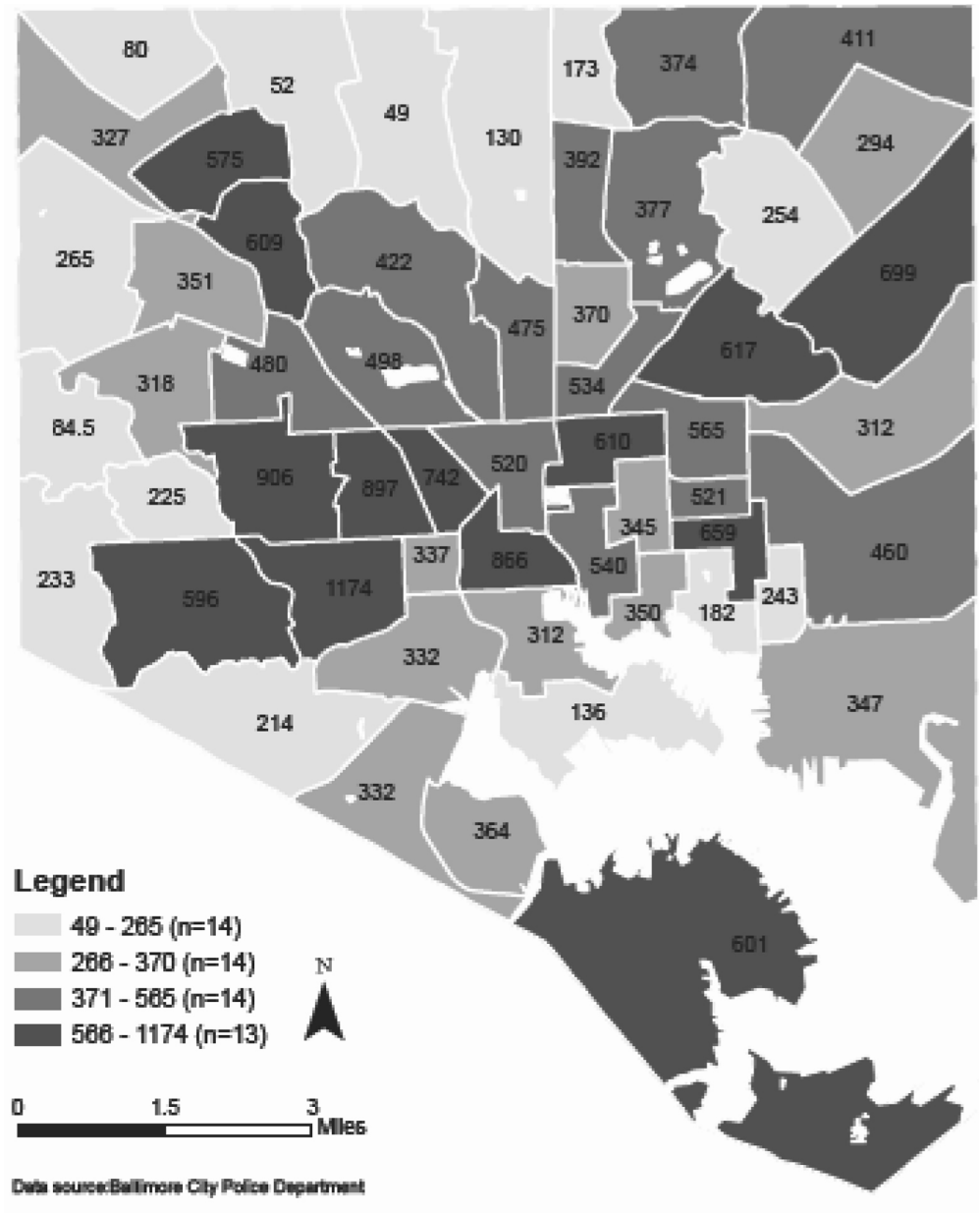
Figure 2. Estimated life expectancy in years by community statistical area:[a] Baltimore City, Maryland, 2002–2006 average



[a]Community statistical areas (CSAs) are clusters of neighborhoods organized around U.S. Census tract boundaries. In some cases, CSA boundaries may cross neighborhood boundaries. There are 55 CSAs in Baltimore City. Image courtesy of Baltimore Neighborhood Indicators Alliance.

on the relationship of off-premise alcohol outlets and crime was further explored with a criminologist (Ralph B. Taylor) who served as a consultant to the HIA team. Studies were included if they provided quantitative estimates, studied an urban U.S. population, were in English, and included a relationship between built environment features regulated by zoning and one or more of the health outcomes of interest. A quality review of included papers based on adequacy of analytic methods, controlling for confounding by socioeconomic status, and use of externally measured variables (vs. self-reported variables) was used to categorize papers

Figure 3. Number of violent crimes per community statistical area:[a] Baltimore City, Maryland, 2004–2005 average



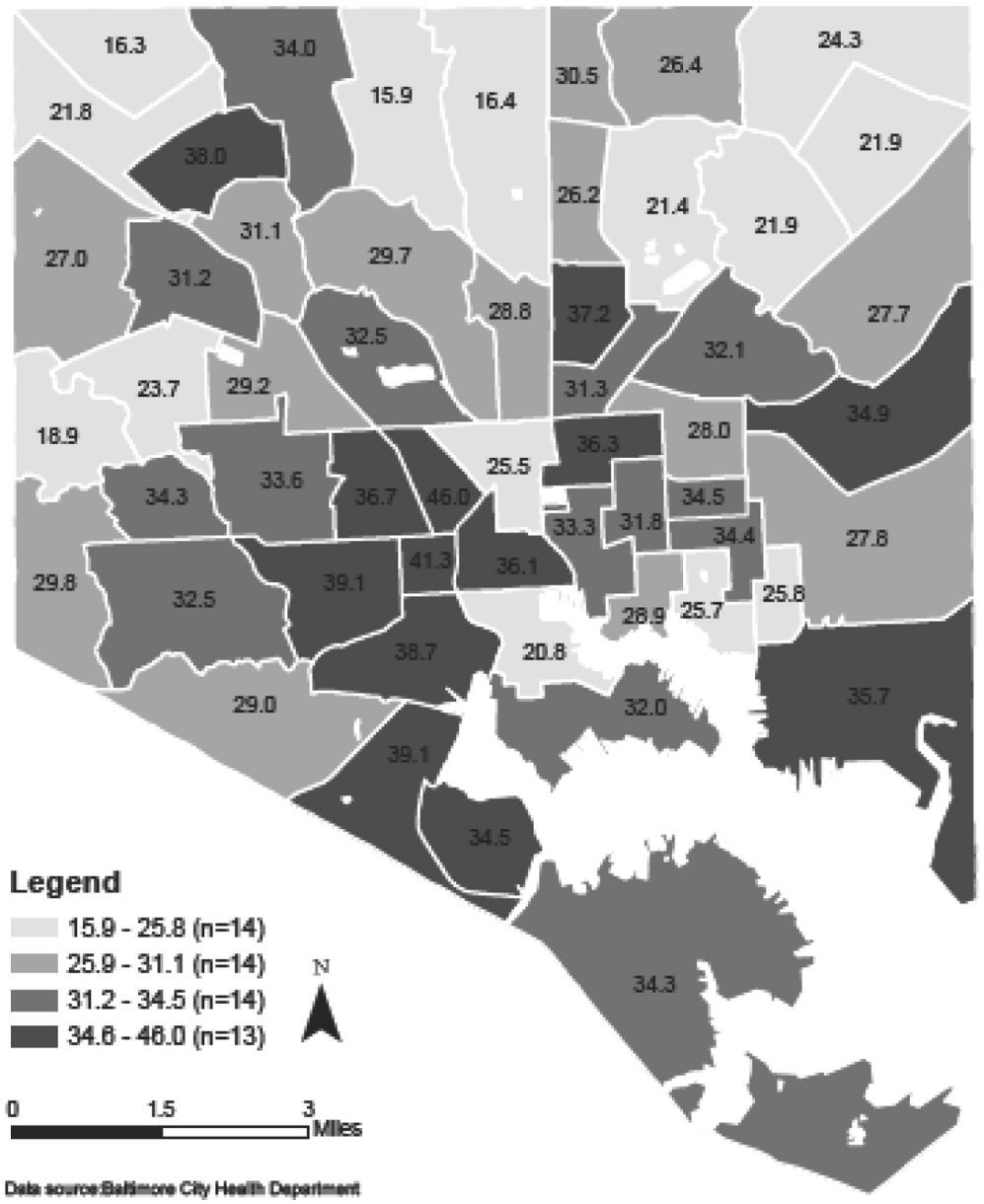
[a]Community statistical areas (CSAs) are clusters of neighborhoods organized around U.S. Census tract boundaries. In some cases, CSA boundaries may cross neighborhood boundaries. There are 55 CSAs in Baltimore City. Image courtesy of Baltimore Neighborhood Indicators Alliance.

as "good" (i.e. articles meeting all three criteria), "fair" (i.e., articles meeting two out of the three criteria), or "poor" (i.e., articles meeting one criterion or none).

Zoning code analysis

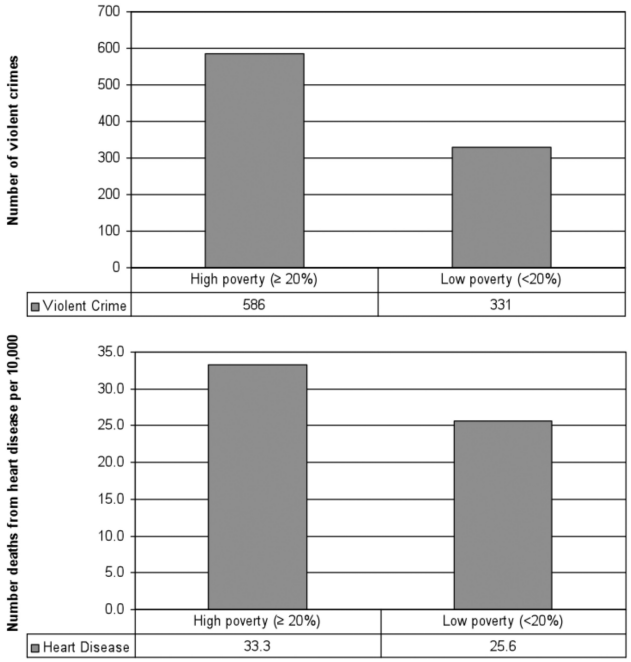
The zoning code analysis identified differences between the current code and TransForm Baltimore (April 2010 draft) with respect to health-related zoning features that were identified through the literature review as being related to physical activity, violent crime, and obesity. Features included mixed-use (including off- and on-premise alcohol outlets and TOD) and pedestrian-oriented design. We reviewed each chapter of the current code to assess the presence of these features. We

Figure 4. Heart disease mortality rate per 10,000 population by community statistical area:[a] Baltimore City, Maryland, 2004–2006 average



[a]Community statistical areas (CSAs) are clusters of neighborhoods organized around U.S. Census tract boundaries. In some cases, CSA boundaries may cross neighborhood boundaries. There are 55 CSAs in Baltimore City. Image courtesy of Baltimore Neighborhood Indicators Alliance.

Figure 5. Average number of violent crimes (2004–2005)[a] and average heart disease mortality rate (2004–2006)[b] per CSA[c] by CSA poverty: Baltimore City, Maryland



[a]Source: Baltimore City Police Department and U.S. Census

[b]Source: Baltimore City 2008 neighborhood health profiles and U.S. Census

[c]CSAs are clusters of neighborhoods organized around U.S. Census tract boundaries. In some cases, CSA boundaries may cross neighborhood boundaries. There are 55 CSAs in Baltimore City.

CSA = community statistical area

then created a matrix identifying in which districts the features were allowed and under what circumstances (i.e., by right, temporary, conditional, accessory, or as part of an overlay zone)[34] in the current code and the TransForm Baltimore draft. We used this matrix in the quantitative impact assessment to estimate the impacts of the changes between the current code and the April 2010 draft of the proposed new zoning code. In some cases, the codes had clearly defined use categories matching the built environment features of interest; in others, we found the best match.

Quantitative impact assessment

To quantify the potential effect of proposed zoning code changes on health, we assumed that (*1*) the current zoning code was an accurate representation of the built environment in Baltimore, (*2*) any changes proposed in TransForm Baltimore would eventually result in changes to the built environment, and (*3*) populations were homogenously distributed within census block groups (CBGs). To estimate impacts, we calculated the percentage of the population living in zoning districts with the identified health-related zoning features under the current zoning code and under TransForm Baltimore (April 2010 draft). Estimates were derived using geographic information systems software (ArcGIS®)[41] to calculate what proportions of CBGs fell within each zoning district. We attributed that fraction of the CBG's population to the zoning district using 2000 U.S. Census data.[42]

Given the significant association between worse health outcomes and living in high-poverty neighborhoods, and given the evidence that the built environment differs in high- vs. low-poverty neighborhoods,[27,43] we assessed whether potential impacts of TransForm Baltimore differed based on neighborhood poverty rate. Similarly to other research studies,[42,44] we defined high-poverty neighborhoods as CBGs with ≥20% of their population living below the federal poverty level (FPL) and low-poverty neighborhoods as CBGs with <20% of their population living below the FPL. CBGs were split into sub-parcels along zoning district boundaries. Sub-parcels were assigned the CBG-level poverty rate from the CBG within which they fell and were then treated as the unit of analysis. CBG population estimates and poverty data were based on the 2000 U.S. Census data, which were the most recent CBG-level data available at the time of analysis.

RESULTS

Qualitative analysis

Many city officials and the expert consultants most involved with TransForm Baltimore did not consider health promotion a main goal, although some emphasized their interest in increasing access to healthy food and walkable, safe, and healthy communities. Still, several health-relevant zoning changes were priorities, including expanding mixed-use developments, enhancing pedestrian-friendly environments, and enabling TOD. Some interview participants were quickly able to link zoning and health because of zoning's role in creating walkable neighborhoods with better access to daily services. For many, however, these links were difficult to establish. The possibility that zoning might influence crime did not emerge.

Many participants were accustomed to discussing zoning in terms of its impacts on the physical arrangement of buildings, not its human or social impacts. For these participants, linking zoning to health was unfamiliar and, at times, uncomfortable. The rewrite was initially guided by the city's Comprehensive Master Plan, and improved health was not an established goal

for TransForm Baltimore at the outset. The overwhelming scope and complexity of the rewrite likely also focused efforts on more concrete challenges.

Based on the interviews, a variety of economic and other non-health goals provided explicit motivation for TransForm Baltimore. Health was not an active consideration for those who were most intimately involved in the zoning code rewrite process. Inattention to health impacts among key informants was not necessarily a deliberate omission; rather, it was a consequence of competing priorities and lack of expertise. Furthermore, doubt about the extent to which the zoning rewrite could influence health was a consistent theme. Respondents noted that many contributors other than zoning impacted the built environment, particularly in distressed neighborhoods, and that a change in zoning may not lead to a change "on the ground."

The public meetings were held in various locations around Baltimore City to elicit concerns from residents living in different types of neighborhoods with distinct demographic characteristics and land-use concerns. Public participation in this phase of the process had limitations, and it was evident that meeting participants did not fully reflect the diversity of Baltimore residents likely to be affected by TransForm Baltimore. Residents used additional methods (including online comments, letters, and e-mails) to provide feedback to the Department of Planning; however, these comments are not included in the monitoring phase findings described herein.

The public meetings demonstrated some increased attention to health on the part of city officials, in part due to press coverage[45] of how the zoning rewrite might influence walkability and urban agriculture. Much of the city's and residents' attention was focused on how new zoning regulations might impact the location of residential treatment centers. Interest groups (e.g., the Public Health Working Group) highlighted health, equity, alcohol outlets, housing, and sustainability.[46] The HIA's focus on violent crime addressed a serious health issue for Baltimore that was not being raised in the interviews or public meetings about the rewrite. Figure 6 provides exemplary quotes illustrating these findings. While it was outside the scope of this HIA to assess participation in the rewrite process, forthcoming scholarly work will address this aspect and concerns about barriers to meaningful participation in such complex land-use processes.

Literature review

The literature search sought to identify relationships between zoning-related built environment features and health outcomes of interest. The studies supported an association between mixed-use developments and increased physical activity,[47–51] as well as decreased obesity and obesity-related illnesses.[26,47,48,50,52,53] While these associations were consistent across studies, additional evidence from this literature suggests that these associations may be stronger for socioeconomically advantaged vs. disadvantaged populations.[26] This literature also suggests that increased mixed-use developments can be associated with increased crime.[54] In particular, two of the studies provide evidence that closer proximity to and higher density of alcohol sales outlets is associated with an increased risk of violent crime.[55,56] These results are consistent with a recent review of the literature published in 2009, as well as other previous reviews.[57–59] This evidence was most consistent for off-premise alcohol sales outlets.

Zoning code analysis

The zoning rewrite represents a full-scale reshaping of the existing zoning code in a several-hundred-page document. This summary discusses only a few of the key health-related changes of interest for the HIA. We found that mixed-use developments would increase across zoning districts. For alcohol outlets specifically, TransForm Baltimore (April 2010 draft) would increase the number of zoning districts where alcohol-serving establishments (i.e., restaurants serving alcohol, bars, taverns, and liquor stores) would be allowed (Figure 7). Off-premise liquor outlets would be allowed by right or conditionally in new "special-purpose" districts, such as TODs, that included or were near residential uses. Special-purpose districts are those that combine a variety of uses that do not fit into traditional residential, industrial, or commercial designations. Pedestrian-oriented design standards were added to several zoning districts, and new TOD zones would allow varying types of mixed-use developments (Figure 7). Other uses and features of interest—pedestrian-oriented design, bike parking, TOD, community gardens, and urban agriculture—would also be permitted more widely throughout the city, as would food outlets (e.g., supermarkets, corner stores, and restaurants).

Quantitative impact assessment

Approximately half of city residents live in high-poverty neighborhoods and half live in low-poverty neighborhoods. Based on the zoning code analysis, we estimated that the percentage of the population living in districts that allowed both residential and commercial uses would increase from 32% to 80%, the percentage of the population living in districts that allowed mixed-use developments would increase from 46% to 91% in low-poverty neighborhoods, and the percentage of

Figure 6. Results from scoping interviews with key zoning rewrite participants prior to releasing the first draft of the proposed TransForm Baltimore comprehensive zoning code: Baltimore City, Maryland, 2009–2010[a]

Topic	*Quotes*
Relevance of zoning	"I really think if we had a way to engage people in this conversation about what does a healthy neighborhood look like, I think you would get more people talking about it [zoning] because so much of this is all policy and theory, and a lot of people don't feel like it matters to them in their day to day." (City Council member, interview)
Role of health in zoning	"It's about making sure that kids live in healthy places, and [that] involves being able to go to a park or walk safely. So that's what I hope is the biggest thing that comes out of this: that we get healthier environments for anybody in the city to live. And that goes across any market ... I think there are some parts of the zoning code that could really help with that." (Baltimore City official, interview)
	"There are public health issues that you deal with in doing the zoning code. But they don't, sort of, leap off the page and hit me in the face as the first issues that I would think of." (Baltimore City official, interview)
	"It's not that you don't think about [health when doing a rewrite], because you're writing to implement the police power [to address] health, safety, and welfare. So you're thinking about that, and the origins of zoning had to do with health in terms of light and air. So that's there, but nobody's come back and said, 'Well, can we think about specifically how the actions we're taking are affecting the individuals' health?'" (Zoning consulting firm staff, interview)
Zoning's impact on health	"If it's a broader discussion about building neighborhoods that encourage people to walk and that encourage access to a broad array of amenities and services within the neighborhood, then zoning's pretty important." (Developer, interview)
	"Who saw 'Zoning for Zucchini' in the [*Baltimore*] *Sun* yesterday? It talks about public health benefits and how the zoning code can reinforce that. Most people don't think of this link." (Baltimore City official, public meeting)
	"[I]n many respects, a lot of the initial health issues that drove zoning have been resolved because we have better heating and ventilating approaches, and we've figured out how to reduce pollution in the cities generally. So the need to separate uses so that you're not, you know, living in a dunghill, we've kind of dealt with that ... the interpretation of what health, safety, and welfare is has changed." (Zoning consulting firm staff, interview)
	"The vast majority of Baltimore is not going to change. It's a 300-year-old city. It's not going to change even in the next 20 years. Ninety percent of the land is not going to change, and the zoning code is not meant to really change 90% of the land." (Baltimore City official, interview)
Concerns about zoning	"One of the things we heard from neighborhoods is they're very cautious about mixed use and commercial in their neighborhood. I understand they may be burned out by it, but I think the benefits of having a little bit more commercial in their neighborhood would probably help." (Baltimore City official, interview)

[a]Interviews and observations were conducted as part of a health impact assessment of the TransForm Baltimore comprehensive zoning code rewrite to understand the perceptions and role of health considerations in the rewrite process.

the population living in districts that allowed mixed-use developments would increase from 18% to 70% in high-poverty neighborhoods. As a component of mixed-use development, we estimated that the percentage of Baltimore residents living in neighborhoods allowing off-premise alcohol sales outlets (e.g., liquor stores), by right or conditionally, would triple from 9% to 27%, and that residents of high-poverty communities would be 50% more likely than residents of low-poverty communities to live in such neighborhoods (33% vs. 20%).

Furthermore, the percentage of residents living in neighborhoods allowing on-premise alcohol sales outlets, including bars, taverns, or alcohol-serving restaurants, by right or conditionally, would increase dramatically from 34% to 81%. Residents of high-poverty communities would be somewhat more likely than residents of low-poverty communities to live in neighborhoods that allow on-premise alcohol sales outlets (94% vs. 70%, respectively). Finally, adoption of the draft new code was estimated to increase the percentage of city residents living in neighborhoods with zoning regulations mentioning pedestrian-oriented design from 1% to 24%, with residents of high-poverty communities being almost twice as likely as residents in low-poverty communities to live in such neighborhoods (31% vs. 17%).

Figure 7. Excerpt of zoning code analysis comparing mixed use, focusing on alcohol outlets, pedestrian-oriented design, and location of residential uses in the current zoning code with the April 2010 draft of TransForm Baltimore[a]

		Current zoning code (1971–2009)										*Zoning districts*							
		Lower-density residential				*Higher-density residential*			*Highest-density residential*			*Business districts*					*Special-purpose districts and industrial/manufacturing districts*		
Mixed-use topic	*Use category*	*R1*	*R2*	*R3*	*R4*	*R5*	*R6*	*R7*	*R8*	*R9*	*R10*	*B1*	*B2*	*B3*	*B4*	*B5*	*OR*	*M1*	*M2*
Alcohol outlets	Restaurant	N	N	N	N	N	N	N	N	N	N	C	P	P	P	P	N	N	N
	Tavern	N	N	N	N	N	N	N	N	N	N	N	P	P	P	P	N	N	N
	Cocktail lounge	N	N	N	N	N	N	N	A	A	A	N	N	N	N	N	A	N	N
	Liquor store	N	N	N	N	N	N	N	N	N	N	N	P	P	P	P	N	N	N
Residential uses	Any kind of housing	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	N	N
Pedestrian-oriented design	Pedestrian features mentioned	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

continued on p. 98

Figure 7 (continued). Excerpt of zoning code analysis comparing mixed use, focusing on alcohol outlets, pedestrian-oriented design, and location of residential uses in the current zoning code with the April 2010 draft of TransForm Baltimore[a]

		Proposed zoning code (draft April 2010)										*Zoning districts*											
		Lower-density residential				*Higher-density residential*			*Highest-density residential*			*Business districts*					*Special-purpose, TOD, and industrial/manufacturing districts*							
Mixed-use topic	*Use category*	*R1*	*R2*	*R3*	*R4*	*R5*	*R6*	*R7*	*R8*	*R9*	*R10*	*B1*	*B2*	*B3*	*B4*	*B5*	*OR*	*BI*	*OIP*	*BIOS*	*I-MU*	*LI*	*TOD 1*	*TOD 2*
Alcohol outlets	Restaurant, standard	N	N	N	N	O	O	O	O	O	O	P	P	P	P	P	N	P	P	P	P	C	P	P
	Tavern	N	N	N	N	N	N	N	N	N	N	C	P	P	P	P	N	P	P	P	P	C	P	P
	Retail—alcohol	N	N	N	N	N	N	N	N	N	N	N	P	P	P	P	N	C	C	P	P	C	P	P
	Neighborhood commercial establishment	N	N	N	N	C	C	C	C	C	C	N	N	N	N	N	C	N	N	N	N	N	N	N
Residential uses	Any housing	P	P	P	P	P	P	P	P	P	P	P	P	P	C	P	P	P	N	P	P	C	P	P
Pedestrian-oriented design	Pedestrian features mentioned	N	N	N	N	X	X	X	X	X	X	X	X	X	N	X	X	N	N	N	N	N	X	X

[a]Zoning districts appear in columns and uses appear in rows. For the residential districts, increasing numbers align with increasing permitted density (R1 has the lowest density, R10 has the greatest density). For the business districts, the larger the number, the more intense the allowable uses. From the existing version to current version, new district types are added, the use categories change, and certain uses are allowed in districts where they were previously prohibited. New TOD and new industrial districts are highlighted in gray.

R = residential (ordered from lowest density [i.e., detached homes, larger lots] to highest density [i.e., attached homes or smaller detached homes on smaller lots])

B = business (ordered from more pedestrian oriented to more auto oriented)

OR = office residential (mix of offices and residential uses; maintains more of a residential character)

M = manufacturing (used only in previous versions of code; ordered from lower-intensity uses to higher-intensity uses)

N = not permitted (use is not permitted in district)

C = conditional use (use is permitted after approval by zoning board and certain conditions are met)

P = permitted by right (underlying zoning allows particular use without additional permissions)

A = accessory use (use is allowed but is not the primary use of the property)

TOD = transit-oriented development

BI = business industrial (light industrial uses; no outside impact that is compatible with certain commercial uses)

OIP = office industrial park (office structures, research and development, and/or light industrial)

BIOS = bioscience (integrated manufacturing, office, residential, research and development, or retail)

I-MU = industrial mixed use (light industrial surrounded by non-industrial uses such as live/work dwellings, higher-density residential, commercial, and limited institutional uses)

L-I = light industrial (light manufacturing, fabricating, processing, wholesale distributing, and warehousing uses)

O = overlay zone (set of special land-use permissions that are applied over a geographic area but do not change the base zoning; such zones may permit uses that would not usually be part of the base zoning)

X = topic mentioned

DISCUSSION

The TransForm Baltimore HIA identified mixed-use development as an important mechanism for impacting health through zoning via potential impacts on physical activity, violent crime, and obesity. Mixed-use developments can have competing impacts on these outcomes. Mixed-use developments and TOD may create incentives for physical activity by providing amenities within walking distance and increasing access to daily services near transit stops. Many mixed-use and TOD districts proposed in TransForm Baltimore (April 2010 draft) also allowed alcohol outlets. Although alcohol outlets can be a part of vibrant neighborhoods, they can also play a role in destabilizing neighborhoods by generating crime.[54,55,60] The increased exposure to violent crime that can be associated with alcohol outlets may also inhibit physical activity among area residents who are afraid to walk in their neighborhood because of these crime-generating alcohol outlets.

Our analyses helped translate proposed zoning changes into estimates of city residents' exposure to positive and negative potential health impacts of mixed-use developments. Based on our analysis, zoning districts encompassing high-poverty neighborhoods with expanded mixed-use developments would be 50% more likely than low-poverty neighborhoods to allow alcohol outlets.

Our HIA report commended the Department of Planning for its commitment to expanding mixed-use developments, TOD, and pedestrian-oriented design given their potential for producing positive impacts on physical activity. But it also argued for careful attention to the composition of allowable uses in mixed-use districts. Given evidence that alcohol outlets are concentrated in high-poverty neighborhoods in Baltimore,[27] we recommended that the draft new code be revised to ensure that crime-generating uses such as off-premise alcohol outlets not be permitted to further concentrate in these areas. Figure 8 summarizes mixed-use, TOD, and pedestrian-oriented-design-related recommendations based on the HIA. The final version of the proposed new zoning code that was introduced to the Baltimore City Council on October 22, 2012, included a dispersal zoning provision recommended in the TransForm Baltimore HIA. The HIA recommended including this provision, which would prohibit the location of new alcohol outlets within 300 feet of existing outlets.

Strengths and limitations

The TransForm Baltimore HIA represents an innovative approach to applying SDH in public health practice. By identifying potential health implications of TransForm Baltimore, public health researchers and city health officials provided evidence-based recommendations intended to modify a non-health policy. These recommendations may increase the health-promoting potential of TransForm Baltimore and mitigate unintended negative health consequences. Not long after the TransForm Baltimore HIA report was published, Philadelphia released Phila2035, its comprehensive plan that addresses public health issues explicitly, and a companion report, "Philadelphia2035: Planning and Zoning for a Healthier City."[61] This plan speaks directly to integrating zoning and public health as the new zoning code is implemented and the need arises for HIAs in this process.[62] Despite their significance, most of the TransForm Baltimore HIA recommendations are limited in their potential to achieve health promotion goals because they focus primarily on new rather than existing alcohol outlets. Existing uses are generally grandfathered into a new zoning code.[63]

Our quantitative impact assessment was also limited because of its potential to result in overestimates of new exposure to alcohol outlets. The current code does not accurately reflect existing land uses and likely underestimates the population currently living in close proximity to alcohol outlets. Also, the allowance of a particular land use in a district does not mean that use will exist. There may be locations where alcohol outlets are allowed but do not exist.

Many steps exist between changing a zoning code and changing the built environment. TransForm Baltimore will only result in built environment changes when sites are (re)developed or owners elect to change the use of a property. Much time could elapse between passage of the code, development, and health impacts; and factors apart from zoning could also impact health in the same place where a zoning change was made. One of the issues addressed during the interviews and meeting observation was that of enforcement and the extent to which zoning regulations, whether health-related or not, are able to be effectively enforced. For a zoning code to have its intended effect, its implementation must include effective enforcement. At the time of interviews and observation, the model of enforcement was complaint-based, although interest exists in making the enforcement system more proactive. We did not have any information available that established an association between zoning enforcement and health outcomes of interest in Baltimore. One enforcement issue relevant to alcohol outlets outside of the jurisdiction of zoning is the enforcement activities of the liquor licensing board. Concern, including health concerns, exists in Baltimore about the extent to which the liquor board enforces its regulations.[64]

Figure 8. HIA recommendations pertaining to mixed use, TOD, alcohol sales outlets, and pedestrian-oriented design submitted during the TransForm Baltimore public comment period: April 2010 draft

		Evidence		*Expert opinion*		
HIA recommendations	*Already included in TransForm Baltimore*[a]	*Supported by literature review*	*Supported by impact assessment*	*Supported by interviews*	*Supported by observation of TransForm process*	*Supported by other cities' initiatives or model ordinances*
Mixed use and TOD						
Create TOD zones.	X	X	X	X		X
Establish first-floor transparency and other design standards.	X	X	X	X		X
Create row house mixed-use overlay.		X	X	X		
Create neighborhood commercial establishment.[b]	X	X		X		
New off-premise alcohol outlets						
Use a dispersal model to prevent concentration of off-premise alcohol sales outlets in districts that currently allow retail alcohol sales by right (particularly in TOD, industrial mixed-use, and other areas slated for change).		X	X			X
If such dispersal/spacing standards are created, tracking the location of proposed and existing outlets through business license applications and approvals would be necessary.[b]		X	X	X	X	
Allow off-premise alcohol outlets conditionally rather than by right.		X	X			X
Existing off-premise alcohol outlets						
Pursue opportunities outside the scope of the zoning code rewrite to address challenges concerning existing off-premise alcohol sales outlets in Baltimore. Strategies may involve a zoning component but would require a large planning effort and interagency collaboration.		X	X			X
Such strategies could include addressing problematic off-premise alcohol sales outlets via a "deemed approved" process that holds grandfathered uses to new standards.		X	X			X
New and existing alcohol outlets						
Create a separate use definition for all alcohol sales outlets (liquor stores, bars, and taverns) that aligns with the Baltimore City Liquor Board's license classes.[b]		X	X	X		X
Pedestrian-oriented design						
Create pedestrian corridors.	X	X	X	X	X	X
Apply pedestrian-oriented goals to the following zones: office residential, office industrial park, bioscience, and special-purpose districts.		X	X		X	X
Define "pedestrian-oriented."[b]		X	X	X		X
Include principles of crime prevention through environmental design in landscape ordinance.		X	X			X

[a]In addition to recommending changes, the HIA included endorsement of health-promoting elements already included in the TransForm Baltimore April 2010 draft.

[b]These recommendations are for changes that are thought to be necessary to facilitate related evidence-based recommendations.

HIA = health impact assessment

TOD = transit-oriented development

Finally, there have been significant modifications to the draft code since the HIA report was published. As of this writing, after its third revision, the TransForm Baltimore zoning code ordinance was introduced to the Baltimore City Council on October 22, 2012. While the dispersal zoning ordinance recommended in the HIA is among the alcohol-related elements included in the proposed new zoning code, the zoning code ordinance is still subject to further changes during the City Council deliberations and ratification process, and health-promoting elements may not necessarily survive into the ratified version.

CONCLUSIONS

TransForm Baltimore provided a unique opportunity to highlight health-relevant aspects of zoning that are unlikely to have been considered otherwise. To our knowledge, this is the first HIA of a zoning code in the U.S. and has generated transferable knowledge that could inform similar efforts in other jurisdictions. By identifying how zoning can influence where alcohol outlets locate, such work may be a particularly important platform for evidence-based policy advocacy aimed at improving access to safe neighborhoods and responding to the many drivers influencing physical activity and obesity risk. Our HIA influenced the broader conversation regarding the role of zoning in addressing health, particularly regarding the link between alcohol outlets and violent crime. The HIA specifically opened up communication among health, planning, and other city officials regarding the links between urban policy decisions and health. The Department of Planning cited the HIA as a contributor to policy decisions regarding the alcohol-related elements of the proposed new zoning code.[65]

While we believe that the TransForm Baltimore HIA has resulted in increased awareness of the potential for urban policies in Baltimore to impact health, uncertainty remains regarding whether Baltimore's proposed new zoning code will ultimately include provisions that are likely to improve the health-promoting potential of Baltimore City neighborhoods. The proposed new code must be ratified by the City Council and is likely to face political challenges to ratification. Furthermore, although the HIA uses the best available public health research to project what the potential health benefits of the proposed new code are likely to be, there is a critical need for long-term evaluation of the final ratified code to prospectively assess how changes to Baltimore's zoning code regulations ultimately impact neighborhoods and population health.

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