

基于国外文献综述的社区环境 儿童出行安全评价指标 EVALUATION INDICATORS OF CHILDREN'S MOBILITY SAFETY IN THE COMMUNITY ENVIRONMENT BASED ON ENGLISH LITERATURE REVIEW

1 引言

全球各地在城市化进程中都不可避免地出现了多种社会危机，而中国的城镇化发展具有规模更大、速度更快的特点^[1]，其与儿童发展之间的矛盾更加突出。大量高层住宅与商业建筑的密集开发致使公共游戏场所、绿地系统等锐减，挤压了儿童活动空间；信息化的快速推

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摘要

联合国儿童基金会的“儿童友好型城市倡议”以维护儿童权利为核心，旨在推进有益于儿童发展的城市及社区环境建设，而“安全”是最基本的儿童权利。本文以儿童友好型城市倡议中社会、健康、出行三大层面的安全要求为基础，重点探讨如何在社区环境层面评价儿童的出行安全。研究从41篇国外指标类文献（含18项评价工具）和82篇其他类文献中提取出评价社区环境下儿童出行安全的相关指标，构建含有“机动车交通环境”“步行/骑行环境”“其他指标”三项一级指标的评价指标框架，并根据出行安全的不同维度，将其进一步分为11项二级指标、29项三级指标，以及若干四级指标。这一基于国外语境的出行安全指标框架虽然有待在地性验证，但将有助于对中国现有环境建设规范中出行安全的相关要求进行系统性完善、建立更为精细化的分层指标体系，为项目实践中的各阶段评估应用提供有益参考。

关键词

儿童友好型城市；出行安全；社区环境；步行与骑行；评价指标；文献综述

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ABSTRACT

The Child Friendly Cities Initiative launched by UNICEF aims to protect child rights and promote the establishment of urban and community environment conducive to children development, and safety must be guaranteed first as the precondition of the child rights. Based on social, health, and mobility safety required by the initiative, this paper focuses on how to evaluate children's mobility safety in the community environment. After literature review, 41 indicator articles involving 18 assessment tools and 82 other articles were screened, and safety-related indicators were selected to establish an evaluation indicator framework composed of three first-level indicators, i.e., motor traffic environment, walking / bicycling environment, and other indicators. They were further subdivided into 11 second-level indicators, 29 third-level indicators, and more fourth-level indicators. Although this framework needs localized verification and adaption in Chinese cities, it can help systematically improve the mobility safety requirements of the existing regulations and guidelines of urban environment construction to establish a multi-leveled indicator system and provide references for performance evaluation on related practice at all stages.

KEYWORDS

Child Friendly City; Mobility Safety; Community Environment; Walking and Bicycling; Evaluation Indicators; Literature Review

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① 《儿童安全步行十年倡导报告》显示，2005～2012年间，中国私家车数量与0～14岁儿童人口数量之比从1:8.5增至1:2，增幅达2.25倍。

① According to the Ten-Year Report on Children's Safe Walking, from 2005 to 2012 the ratio between the amount of private cars and children's population aged below 14 in China increased from 1:8.5 to 1:2 by a growth of 2.25-times.

进导致电子媒体改变了儿童游戏生态；城市空间的扩张促使交通基础设施建设量陡增，而私家车保有量的高增长率^①不仅加剧了机动车对路权的绝对控制，还引发了空气污染等一系列公共健康危机，不利于儿童的安全和健康成长；越来越多的中国城市儿童受到肥胖症、视力下降、社交障碍等问题的困扰^②。城镇化带来了城市建成环境的改变，也加剧了儿童群体在环境健康与卫生、安全保护，以及参与方面所面临的制约和挑战^③。其中，“安全”作为最基本的儿童权利，必须首先得到强力保障。

2 儿童友好型城市倡议下的儿童安全

为了应对上述问题，共同创建安全的、能够充分响应儿童需求的包容性城市和社区，联合国儿童基金会（UNICEF）和联合国人类住区规划署于1996年联合发起“儿童友好型城市倡议”（CFCI），并在随后的20余年中陆续发布了一系列官方文件以指导具体行动的实施。本研究围绕“儿童安全”这一基本议题，对官方文件中的纲领性内容进行了梳理，发现CFCI框架下的儿童安全相关内容包括三个方面：社会安全、健康安全，以及出行安全。社会安全是指儿童免于受到剥削、暴力和虐待，以及其他违法犯罪行为的威胁；健康安全是指为儿童提供清洁、无污染、有绿化的环境，必需的卫生设施、安全食品、医疗服务等；而出行安全通常与“独立出行”一词相关联（表1），侧重于交通方面的安全。其中，与城市规划设计学科密切相关的《儿童友好型城市规划手册：为孩子营造美好城市》在强调独立出行目标的基础上，还提出将“步行友好性”作为儿童友好型城市（CFC）的环境特征之一。

儿童安全的三个方面相辅相成，其最终目的均在于为实现儿童的基本权利——生存权、发展权、被保护权和参与权——提供基础保障，使儿童能够平等地参与社会事务、享受城市提供的服务与机会，

1 Introduction

Globally, various social crises have inevitably emerged along with urbanization, especially in China where this process occurs faster in a larger scale^[1], imposing huge threats on children's development. The massive construction of high-density and high-rise residence and commercial buildings results in a sharp reduction of children's activity space such as public playgrounds and green spaces. Booming information technologies have largely influenced children's play with overwhelming electronic media. The urban sprawl results in a surge of transportation infrastructure and a growing number of private cars^①, increasing the dominance of motor vehicles over urban traffic and triggering a series of public health crises (such as air pollution), which harm the safety and health of the children. In addition, an increasing number of children in Chinese cities are suffering from obesity, blurred vision, impaired social interaction, etc.^[2] All of the above manifest that the changing urban built environment has brought more constraints on environment health and hygiene, security, and participation of children^[3]. In response, children's safety must be guaranteed as the first child right.

2 Children Safety under the Child Friendly Cities Initiative

To address the issues above, UNICEF and UN-Habitat co-launched the Child Friendly Cities Initiative (CFCI) in 1996 and have released a series of guidance documents for building safe and inclusive cities and communities for children. Focusing on the safety issue, this paper reviewed these documents and concluded that children's safety under the CFCI framework involves three aspects: social safety, health safety, and mobility safety. Social safety requires to protect children from exploitation, violence, abuse, and other crimes; health safety is to provide clean, unpolluted, and green environments, and necessary health facilities, safe food and medical services; and mobility safety, often correlated with "independent mobility" (Table 1), focuses on traffic safety. In terms of urban planning and design, the Shaping Urbanization for Children: A Handbook on Child-Responsive Urban Planning further proposes "walkability" as one of the environmental characteristics of the Child Friendly Cities (CFC).

The three aspects of children's safety together contribute to providing fundamental guarantee for the basic child rights, i.e., the rights to survive, develop, be protected, and participate, allowing children to involve in social affairs on an equal footing and enjoy the services and opportunities in the city for

表1: UNICEF官方文件中城市环境安全内容与“出行安全”要求
Table 1: Contents about urban environment safety and mobility safety in UNICEF documents

文件名称 File	与儿童“出行安全”相关的内容 Contents about children's mobility safety
《儿童友好型城市规划手册》 ^[4] Shaping Urbanization for Children: A Handbook on Child-Responsive Urban Planning ^[4]	提出10项儿童权利与城市规划原则, 其中第5条原则为: 为儿童和社区发展积极出行和公共交通, 确保他们能独立出行, 让他们有平等、安全的渠道获取城市提供的所有服务和机会。 Adopting 10 Children's Rights and Urban Planning Principles, and Principle 5 is about Transportation Systems – Develop active transportation and public transit systems and ensure independent mobility for children and the community, so they have equal and safe access to all services and opportunities in their city. 提出7个儿童友好型城市环境特征, 包括特征3“可步行”以及特征6“独立出行”。 Proposing seven conceptual standards of child-friendly urban environments, including Standard 3, "walkability" and Standard 6, "independent mobility."
《构建儿童友好城市和社区手册》 ^[5] UNICEF Child Friendly Cities and Communities Handbook ^[5]	附件6“儿童友好型城市倡议的变化理论”提出的20个具体目标之一: 为儿童独立出行提供更完善的保障。 Annex VI "CFCI Theory of Change" comes up with 20 objectives, and one of them is "Improved children's independent mobility."
《创建儿童友好城市行动框架》 ^[6] Building Child Friendly Cities: A Framework for Action ^[6]	提出CFC必须保障儿童的12项权利, 其中第7项为“能够安全、单独地在街道上行走(的权利)”。 Proposing that CFC guarantees 12 rights of every young citizen, and the seventh is "walk safely in the streets on their own."
《儿童友好度社区自测工具包》 ^[7] Child Friendly Community Self- Assessment Tool for Children ^[7]	“安全与保护”板块的测评内容包括“儿童行走及骑车的安全”以及“乘坐公交车和其他公共交通的安全感”。 In the "My Safety & Protection" test section, there are yes / no questions "it is safe for me to walk and cycle in my community" and "I feel safe using buses or other public vehicles."

注

CFCI更关注与儿童体力活动相关的积极出行活动的安全, 而公共交通安全在各类文件中仅侧重于提高儿童的“安全感”, 因此本研究未将公共交通安全纳入考虑范围。

NOTE

CFCI calls for a greater attention to the active mobility safety related to the children's physical activities. Public transportation safety focuses on the improvement of the "sense of safety" and is therefore excluded from this paper.

并得到全面发展。其中, “出行安全”与建成环境设计的关联度最高, 故本文将基于国外文献对其评价指标展开研究。

3 社区环境儿童出行安全评价指标研究概要

3.1 研究对象

家庭、学校、社会是儿童成长的三大环境, 而社区环境^②在其中起着重要的连接作用, 承载着户外游戏、出行、社交等诸多儿童日常行为活动, 故本研究聚焦于社区层面的儿童出行安全。

3.2 研究方法的目的

本文采用文献综述的研究方法, 对与“社区环境”相关的关键词进行归类检索, 并对获取到的有效文献中的出行安全相关指

② 本文中的社区环境是指在一定行政区划范围内的社区户外公共空间环境。

② The community environment in this paper refers to the outdoor public space of a community in an administrative area.

comprehensive development. In the consideration of the close relation between mobility safety and the built environment, this paper focuses on the evaluation indicators of children's mobility safety based on English literature review.

3 Research Synopsis of the Evaluation Indicators on the Community Environment for Children's Mobility Safety

3.1 Research Object

Family, school, and society are the major environments where children grow up. They are bonded by the community environment^②, where most children's daily activities (such as outdoor playing, traveling and social activities) occur. This paper thus focuses on children's mobility safety at the community level.

3.2 Research Methods and Purpose

Based on a review on literature relevant to “community environment,” this paper retrieved indicators of mobility safety

标进行提取和梳理,形成社区环境儿童出行安全指标集。其中,有效文献分为:1)指标类文献:主题词中包含“指标”相关中心词(“index”“indicator”“measurement”等),通常针对特定的社区环境评价工具,可从中直接获取与出行安全相关的指标内容;2)其他类文献:此类文献的主题词不包含“指标”相关中心词,但可根据其研究结果判断从评价工具中提取的安全指标是否合理,以及补充评价工具未包含但与本研究相关的其他指标。研究目的在于通过构建基于国外相关文献的“社区环境儿童出行安全”评价指标框架,为中国开展此类评价指标的研究及应用提供有价值的参考。

4 建立评价指标框架

4.1 文献检索过程及结果

本次文献检索主要基于ScienceDirect期刊数据库,同时辅以谢菲尔德大学StarPlus资源库,以及Web of Science数据库,并将检索结果分为“指标类文献”及“其他类文献”进行进一步研读。

研究首先选取“child”(儿童)、“safety”(安全)、“community”(社区)、“road”(道路)、“walk”(步行)、“mobility”(出行)等作为基本关键词。由于环境的“步行友好性”(walkability)常被用于衡量社区对体力活动以及积极出行相关内容的支持程度^{[8][9]},因此将“walk”的扩展关键词“walkability”(步行友好性)、“walkable”(可步行)、“walking / bicycling suitability”(步行/骑行适宜性)等也纳入检索范围。此外,通学行为是儿童最重要的日常活动之一,而父母对安全因素的考虑往往对儿童能否独立通学以及通学方式的选择有重要影响,因此“CIM”(Children's Independent Mobility,儿童独立活动性)“travel to school”(上学)以及“school commute”(通学)等相关词语也被纳入检索范围。研究最终共确定了44个检索关键词,分为出行行为及其属性、评价环境、面向群体、“指标”相关中心词4个类别(表2),每次选取2~3个不同类别的关键词,进行多次组合检索。检索结果筛选原则如下:1)以2009~2020年间发表的文献为主,结果不足时可追溯;2)必须是经过同行审议的学术类期刊的英文文献。

根据上述检索步骤及原则,最终获取有效文献162篇,其中指标类51篇(包含24项评价工具),其他文献111篇。经过阅读文献,筛选出可提取出行安全指标的文献共计123篇,其中指标类41篇,涉及18项评

in the valid literature, and came up with an indicator set for children's mobility safety in community environment. The valid literature includes: 1) indicator literature: the articles whose topic words include indicator-related core words (index, indicator, measurement, etc.), generally focusing on a certain assessment tool for the community environment and directly providing evaluation indicators about mobility safety; and 2) other literature: the articles do not include any indicator-related topic word but can be used to judge if the indicators retrieved from the assessment tools are valid or not, and to supplement indicators not included in the assessment tools but related to the study. The purpose of this paper is to establish an evaluation indicator framework of children's mobility safety in the community environment among English literature, thus providing references for research and application of such evaluation indicators in China.

4 Establishment of the Evaluation Indicator Framework

4.1 Literature Retrieval Process and Results

The literature retrieval was mainly conducted on ScienceDirect, supplemented by StarPlus of University of Sheffield and Web of Science. The results were divided into indicator literature and other literature .

First, “child,” “safety,” “community,” “road,” “walk,” and “mobility,” etc. were selected as the basic keywords. Second, considering that “walkability” is often used to measure a community's supporting level to physical activities and active travel^{[8][9]}, “walkability,” “walkable,” and “walking / bicycling suitability” were also listed as keywords. School commute is one of the most important activities in children's daily life, but whether and how they can do this independently are highly determined by parents' safety considerations. Therefore, keywords such as “CIM” (Children's Independent Mobility), “travel to school,” and “school commute” were also added. Finally, a total of 44 keywords in four categories (mobility behavior and behavioral attributes, environment assessed, target group, and indicator-related core words) were identified (Table 2). In each retrieval, 2 or 3 keywords from different categories were used together, and the valid articles were screened if they 1) were published between 2009 and 2020, when there was no enough search results, articles published earlier could be included; and 2) were peer-reviewed and published in English academic journals.

Finally, a total of 162 valid articles were obtained, 51 of which were indicator articles (including 24 assessment tools) and 111 were other articles. Then they were all examined and

表2: 文献检索所用的关键词类别
Table 2: Categories of the keywords used for literature search

类别 Category	关键词 Keywords
出行行为及其属性 Mobility behaviors and their attributes	Walk / walkability / walking suitability / bicycling / cycling mobility / independent mobility / CIM / travel to school / school commute / traffic / transport / activity
评价环境 Environment assessed	Neighborhood / community / environment road / street / route / pavement / sidewalk/ walkways / path park / recreation space / recreational space / green space / play space / public space / outdoor
面向群体 Target group	Child / kid / youth / teens / adolescent / pedestrian
“指标”相关中心词 Core words related to “indicator”	Assessment / audit / tool / evaluation / index criteria / measurement / indicator / instrument

1. 文献检索与筛选结果

1. Classify and screen literature retrieval results

价工具, 评价内容主要包括道路安全、步行/骑行等活动及其环境, 以及其他儿童出行目的地三个类别; 其他类文献82篇 (图1)。

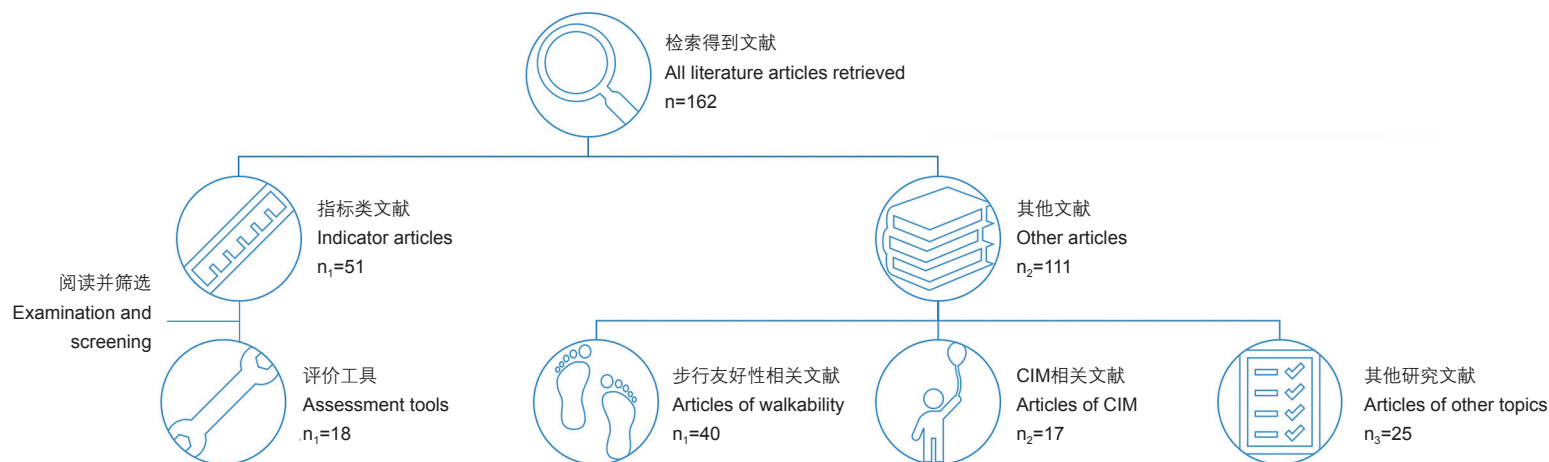
4.2 18项评价工具中出行安全相关指标研究

本研究筛选出的18项评价工具基本信息汇总如表3所示。所有工具皆由欧美学者制定, 其中14项来自美国, 其余4项分别来源于英国、澳大利亚、芬兰和加拿大; 发布时间跨度为1998~2017年, 其中WABSA发布时间最早, 除2007年没有发布任何评价工具、2002年及2015年各发布两项以外, 其他均匀分布于2003~2017年间, 每年发布一项。评价工具中提及儿童群体或包含儿童群体相关具体指标的有14项, 其中完全面向儿童群体的仅有NEWS-Y、MAPS、EWI&MI, 以及PARK4项。

123 of them were kept for collecting evaluation indicators on mobility safety, 41 of which were indicator articles involving 18 assessment tools for road safety, walking / bicycling behaviors and environments, and other destinations of children mobility; and 82 were other articles (Fig. 1).

4.2 Evaluation Indicators for Mobility Safety in 18 Assessment Tools

Table 3 lists the basic information of the 18 assessment tools, 14 of which are from the United States and the other 4 are from Britain, Australia, Finland, and Canada. WABSA, the earliest tool, was published in 1998; from then on there was one tool published each year till 2017, except 2007 (none was published), 2002 and 2005 (two were published respectively). Children and indicators for them are mentioned in 14 tools, among which only NEWS-Y, MAPS, EWI & MI, and PARK focus on



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表3: 18种评价工具基本信息汇总
Table 3: Basic information of the 18 assessment tools

评价工具名称 Name of tool	研究者 Researchers	发布时间 Year of publishing	国家 Country	面向人群 Target group	评价目的 Purpose	评价环境类型 Type of environment assessed		
						机动车交通环境 Motor traffic environment	步行/骑行环境 Walking / bicycling environment	其他儿童户外环境 Other environments for children's outdoor activities
苏格兰步行友好性评价工具 (SWAT) ^[10] Scottish Walkability Assessment Tool (SWAT) ^[10]	凯瑟琳·米林顿等 Catherine Millington et al.	2008	英国 UK	全域龄 All ages	揭示环境特征与体力活动的关联性 To demonstrate the relevance between environmental characteristics and physical activity		●	
邻里环境青少年步行友好性度量表 (NEWS-Y) ^[11] Neighborhood Environment Walkability Scale for Youth (NEWS-Y) ^[11]	多利·罗森伯格等 Dori Rosenberg et al.	2009	美国 USA	12~18岁儿童; 5~18岁儿童的父母 12~18 year-old children; parents of 5~18 year-old children	通过主观感受评估环境与体力活动的关系 To assess the relations between the environment and physical activity through subjective perception		●	
步行及骑行环境系统性评估 (SPACES) ^[12] Systematic Pedestrian and Cycling Environmental Scan (SPACES) ^[12]	泰利·J·皮克拉等 Terry J. Pikora et al.	2002	澳大利亚 Australia	全域龄 (提及儿童) All ages (children are specially mentioned)	测量影响社区内步行和骑行活动的物理环境因素 To measure physical environmental factors affecting walking and cycling in the community		●	
微观步行环境量表 (MAPS) ^[13] Microscale Audit of Pedestrian Streetscapes (MAPS) ^[13]	詹姆斯·F·塞利斯等 James F. Sallis et al.	2015	美国 USA	6~16岁儿童 6~16 year-old children	探究体力活动与微观尺度环境具体指标的关联度 To measure the correlation between physical activity and specific indexes of micro-scale environment		●	
步行与骑行可持续性评估 (WABSA) ^[14] Walkability and Bicycling Suitability Assessment (WABSA) ^[14]	詹姆斯·F·塞利斯等 James F. Sallis et al.	1998	美国 USA	全域龄 (提及儿童) All ages (children are specially mentioned)	评估城市街道的步行及骑行友好性 To assess the walkability and cyclability of urban streets		●	
道路环境量表 (PEAT) ^[15] Path Environment Audit Tool (PEAT) ^[15]	菲利普·J·特罗培德等 Philip J. Troped et al.	2005	美国 USA	全域龄 (提及儿童) All ages (children are specially mentioned)	从物理特性、设计、设施和美观/维护4个维度评估社区步道 To assess community trails from four dimensions: physical characteristics, design, facilities, and aesthetics / maintenance		●	
步行环境指标测度 (PEDS) 工具 ^[14] Pedestrian Environmental Data Scan (PEDS) Tool ^[14]	凯利·J·克里芬等 Kelly J. Clifton et al.	2007	美国 USA	全域龄 All ages	步行环境评估 To assess walking environment		●	
环境对体力活动的支持度问卷 (ESPAQ) ^[17] Environmental Supports for Physical Activity Questionnaire (ESPAQ) ^[17]	芭芭拉·E·安斯沃斯等 Barbara E. Ainsworth et al.	2002	美国 USA	全域龄 All ages	以问卷形式评估环境对体力活动的支持度 To assess environmental support for physical activity with questionnaire		●	
积极生活社区清单 (ANC) ^[18] Active Neighborhood Checklist (ANC) ^[18]	克里斯汀·M·赫纳等 Christine M. Hoehner et al.	2007	美国 USA	全域龄 (提及儿童) All ages (children are specially mentioned)	从街道尺度评估社区环境中与体力活动行为相关的特征 To assess the characteristics associated with physical activities in community environment at street scale		●	
社区公园量表 (CPAT) ^[19] Community Park Audit Tool (CPAT) ^[19]	安德鲁·T·卡钦斯基等 Andrew T. Kaczynski et al.	2010	美国 USA	全域龄 (提及儿童) All ages (children are specially mentioned)	评估社区公园对于体力活动的支持水平 To assess the support level of community park for physical activity			●
公共游憩空间环境评价工具 (EAPRS) ^{[20][21]} Environmental Assessment of Public Recreation Spaces Tool (EAPRS) ^{[20][21]}	布莱恩·E·西伦斯等 Brian E. Saelens et al.	2006	美国 USA	全域龄 (提及儿童) All ages (children are specially mentioned)	公共游憩空间环境综合评价 Comprehensive evaluation of public recreational space			●
道路安全评估 (TARVA) ^[22] TARVA ^[22]	哈利·佩尔托拉等 Harri Peltola et al.	2012	芬兰 Finland	全域龄 All ages	道路安全综合评估 Comprehensive assessment of road safety	●		
步行评分工具 (WS) ^[23] Walking Score (WS) ^[23]	弗里曼·兰斯等 Freeman Lance et al.	2017	美国 USA	全域龄 (提及儿童) All ages (children are specially mentioned)	步行相关指标评分 Walking-related index score		●	
步行友好性指标 (WI) ^[24] Walkability Index (WI) ^[24]	布莱恩·E·西伦斯等 Brian E. Saelens et al.	2003	美国 USA	全域龄 (提及儿童) All ages (children are specially mentioned)	评价可步行性 To evaluate walkability		●	

续表见下页 / Continued

表3: 18种评价工具基本信息汇总
Table 3: Basic information of the 18 assessment tools

评价工具名称 Name of tool	研究者 Researchers	发布时间 Year of publishing	国家 Country	面向人群 Target group	评价目的 Purpose	评价环境类型 Type of environment assessed		
						机动车交通环境 Motor traffic environment	步行/骑行环境 Walking / bicycling environment	其他儿童户外环境 Other environments for children's outdoor activities
步行友好性与可移动性指标 (EWI&MI) ^[25] Environment walkability Index and Moveability Index (EWI & MI) ^[25]	克里斯托弗·巴克等 Christoph Buck et al.	2014	美国 USA	2~9岁儿童 2~9 year-old children	评价与儿童体力活动(步行友好性及可移动性)相关的环境指标 To assess environmental indicators associated with children's physical activity (walkability and moveability)		●	
公园、儿童活动及休闲量表 (PARK) ^[24] The Parks, Activity and Recreation among Kids (PARK) ^[24]	玛德琳·E·伯德等 Madeleine E. Bird et al.	2015	加拿大 Canada	5~18岁儿童 5~18 year-old children	评估与儿童体力活动相关的公园特征 To assess park's characteristics associated with children's physical activity			●
青少年公园质量指标 (QUINPY) ^[27] Quality INdex of Parks for Youth (QUINPY) ^[27]	亚历山德罗·瑞格伦等 Alessandro Rigolon et al.	2016	美国 USA	全域龄(提及儿童) All ages (children are specially mentioned)	从儿童需求及利用角度评估城市公园 To assess city parks from the perspective of children's needs and use			●
游乐空间质量评价工具 (PSQAT) ^[28] Playable Space Quality Assessment Tool (PSQAT) ^[28]	加文·R·詹金斯等 Gavin R. Jenkins et al.	2015	美国 USA	全域龄(提及儿童) All ages (children are specially mentioned)	以游戏价值为切入点, 评估儿童游戏场所 To evaluate children's play place focusing on game value			●

注

- NEWS-Y度量表分为青少年版本和家长版本。
- 研究人员在原MAPS工具(共150个指标)基础上, 开发了针对4个不同年龄组人群的同类工具MAPS-mini, 本文研究的是其中以6~11岁儿童为研究对象的NIK量表以及以12~16岁儿童为研究对象的TEAN量表(各含有15个指标)。

NOTES

- NEWS-Y is published in both adolescent version and parent version.
- Based on the original MAPS (with 150 indicators in total), four MAPS-mini tools were further developed for different age groups. This study reviewed the NIK (Neighborhood Impact on Kids) tool for children between 6 and 11 years old, and the TEAN (Teen Environment and Neighborhood) tool for children between 12 and 16 years old, both with 15 indicators.

评价工具涉及三类环境: 1) 机动车交通环境; 2) 步行/骑行环境; 3) 其他儿童户外环境。

18项评价工具的开发目的、面向人群及所评价的环境各异, 其中仅有SWAT、NEW-Y、CPAT及WS明确将“安全”作为一项独立评价内容并提出了细分指标, 但未能涵盖“安全”问题的所有层面; 其他工具中的安全相关指标则分散于不同层级的框架下。因此, 现有评价工具中尚不存在全面的安全专项指标集, 这正凸显了本研究的重要意义。同时, 各评价工具中对安全类指标的细分程度及分类标准也各有不同。因此, 本研究将所有安全相关指标进行提取, 并初步总结为“机动车交通环境”“步行/骑行环境”“其他指标”三个大类, 依次包含7个、13个以及8个小类(表4), 为建立层级更清晰的指标框架打下基础。

总体来看, 没有任何一项评价工具可以覆盖表4所示全部指标小类。根据表3-4, 虽然本研究中多达66.7%的评价工具涉及对步行/骑行

the children exclusively. Overall, three types of environment were assessed: motor traffic environment, walking / bicycling environment, and other environments for children's outdoor activities.

The 18 tools differ in the development purpose, target group, and type of environment assessed. Only SWAT, NEW-Y, CPAT and WS assess “safety” separately with detailed indicators, which are still not enough for comprehensive evaluation, while safety indicators in other tools scatter unsystematically. Therefore, there is not a safety indicator set in existing English literature. At the same time, the subdivision and classification standard of the safety indicators vary among all the tools. This study therefore re-organized all safety-related indicators into three categories: motor traffic environment (with 7 sub-category indicators), walking / bicycling environment (with 13 sub-category indicators), and other indicators (with 8 sub-category indicators) (Table 4).

There is no tool covering all sub-category indicators shown in Table 4. In Table 3 and 4, although 66.7% of the evaluation

环境的评价,但“步行/骑行环境”大类指标的占表率仅为38.9%;涉及“机动车交通环境”的评价工具较少,但“机动车交通环境”大类指标的占表率却达到21.4%,因此可认为机动车交通环境对儿童出行安全有较为重要的影响。“步行/骑行环境”大类下的各指标小类在不同评价工具间分布相对均匀(图2)。

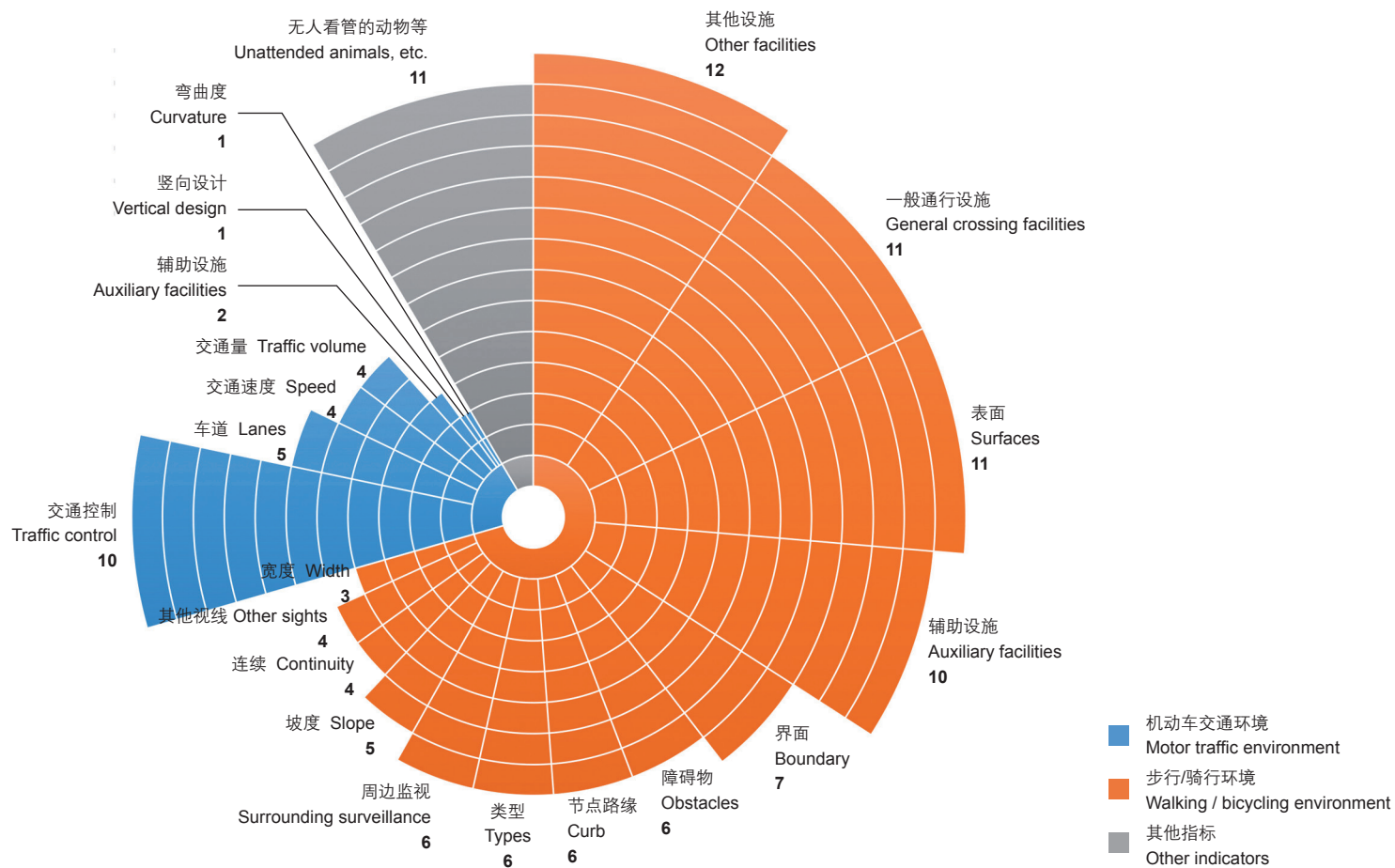
根据对各指标小类的分项统计,机动车交通控制、步行/骑行通行设施、步行/骑行辅助设施、步道/自行车道表面、其他步行/骑行设施

tools have indicators for walking / bicycling environment, the average coverage ratio of the “walking / bicycling environment” category is only 38.9%, while fewer tools involve motor traffic environment assessment but the average coverage ratio of the “motor traffic environment” category is 21.4%. It thus can be concluded that the motor traffic environment has a significant impact on children’s mobility safety. The indicators of the “walking / bicycling environment” category appear quite evenly among the assessment tools (Fig. 2).

Among all the tools, motor traffic control, general walking / bicycling facilities, walking / bicycling auxiliary

表4: 18项评价工具中安全相关指标的初步分类
Table 4: Rough categorization of safety-related indicators in the 18 assessment tools

指标大类 Category	机动车交通环境 Motor traffic environment								步行/骑行环境 Walking / bicycling environment												其他 Other indicators	
	交通控制 Traffic control	辅助设施 Auxiliary facilities	交通量 Traffic volume	交通速度 Speed	车道 Lanes	弯曲度 Curvature	竖向设计 Vertical design	一般通行设施 General crossing facilities	辅助设施 Auxiliary facilities	节点路缘 Curb	坡度 Slope	宽度 Width	连续度 Continuity	类型 Types	表面 Surfaces	界面 Boundary	障碍物 Obstacles	其他设施 Other facilities	周边监视 Surrounding surveillance	其他视线 Other sights		无人看管的动物等8项 Others (in total of 8 items, including unattended animals)
SWAT	√							√	√	√					√	√						
NEWS-Y		√	√	√				√	√										√			√
SPACES	√				√			√	√	√	√	√		√			√	√	√			√
MAPS	√				√			√	√		√			√	√	√	√	√				
WABSA			√	√	√			√	√	√			√		√	√		√			√	
PEAT	√							√	√	√	√			√	√	√	√	√			√	√
PEDS	√			√	√			√	√	√	√	√	√	√	√	√	√	√				
ESPAQ			√												√			√				√
ANC	√				√			√	√	√	√	√		√	√	√	√	√				
CPAT	√							√	√					√	√			√	√			√
EAPRS	√	√	√			√	√	√				√		√	√			√	√	√		√
TARVA	√			√				√	√					√		√	√	√			√	
WS	√														√							√
WI																						√
EWI & MI																						√
PARK																		√	√			
QUINPY																						√
PSQAT																		√	√			√
指标小类出现次数 总计 Count of indicators in the sub-category	10	2	4	4	5	1	1	11	10	6	5	3	4	6	11	7	6	12	6	4	11	
指标大类 出现次数总计 Count of indicators in the category	27								91												11	



2. 各指标小类分布情况
2. The distribution among indicators of the sub-categories

5类在全部工具中出现次数最多（不少于10次）；其次为机动车道情况，步道/自行车道节点路缘、坡度、类型和界面，以及步行/骑行环境中的障碍物及周边监视7类。

另外由表4可知，61%的评价工具涉及“其他指标”大类，包括机动车尾气排放、邻里识别度（易于寻路）、噪音、难闻的气味、邻里信任度/熟知度、无人看管的动物等，与“健康安全”的评价内容有所交叉，有待进一步讨论。

4.3 其他出行安全文献研究

在对指标类文献中的18项评价工具进行梳理之后，本研究又对82篇其他类文献进行了系统性整理。

“步行友好性”相关文献指出，邻里环境的步行友好性的一个标准差变化会导致积极出行增加27.5%，这一点在年轻群体中尤为明显^[5]。另有研究从“安全性”“实用性”“愉悦度”三个方面对步行环境

facilities, footpath / bikeway surfaces, and other walking / bicycling facilities appear the most (at least mentioned in 10 tools). Motor vehicle lanes, and curbs, slope, types, boundary, obstacles, and surrounding surveillance of walking / bicycling environment are the second most mentioned indicators.

According to Table 4, 61% of the tools have the “other indicators,” such as vehicle exhaust, legibility within the neighborhood (easy for wayfinding), noise, odor, neighborhood trust / close-knit, and unattended animals. Some of these indicators are also related to children’s health safety, which need further discussion.

4.3 Study on Other Articles on Mobility Safety

After reviewing the 18 assessment tools in the indicator literature, this study went through the rest 82 articles.

Research on walkability suggests that one standard deviation change in neighborhood walkability was associated with an estimated 27.5% increase in active travel trips, which is especially notable among the young^[5]. Some researchers

进行评价,其中“安全性”权重达到0.4,为三者中最高^[29]。因此从步行友好性评价研究中提取“安全”相关指标是有效且有意义的。

CIM被定义为无父母监管时儿童在邻里环境内的自由活动^[30],安全是其最重要的影响因素,通常包含社会安全与交通安全两类^{[31]-[33]},有研究还特别强调步行安全^[34]。从CIM研究文献中也解析出了若干与步行友好性研究相一致的细化安全指标,例如交通量、交通速度等^{[35]-[39]},但大多属于“机动车交通环境”指标大类,仅有“交通节点穿行保障”等^{[37][39][40]}属于“步行/骑行环境”指标大类。虽然现有评价工具中也包括步行道路状况(如铺装、宽度等)类指标,但青少年群体对社区步行友好性的模糊评价证实,相较于路面质量,公共安全与交通安全对独立出行的影响更大^[41]。除此之外,来自陌生人的攻击、骚扰、欺凌及反社会行为等也是影响儿童独立出行的社会安全因素^{[42]-[44]};“照明”则是一种值得探讨的增加夜晚出行安全感的因素^{[39][40]},可被纳入表4“步行/骑行环境”下的“其他设施”指标小类。值得注意的是,CIM研究对表4中“其他指标”类所涉及的环境因子也较为关注,尤其从儿童独立出行需求的角度探讨了更为广泛的安全问题,例如动物产生的威胁、迷路,以及熟人或关系良好的邻里——他们的视线可形成被动监督,也可以成为儿童寻求帮助的对象,从而为独立出行的儿童带来安全感^{[43][44]},而这些因素在其他研究中往往被忽略,故而对CIM研究文献的检索有效地扩展了本研究的思路,有助于进一步完善评价指标框架。

儿童通学研究也将安全因素作为重点研究内容,涵盖了诸多社会及物理环境因素,如邻里关系、陌生人的威胁、步行设施(包括交通信号灯、步行过街路口、步道数量等)、机动车交通量、街道机动车停放数量,以及道路连续度等。此外,“区域(社区)对道路安全的重视程度”是一项意识层面的新指标。^{[45][46]}

此外,虽然驾驶员及行人的不可预测或不当行为^{[47][48]}也会对儿童出行造成安全威胁,但主要需通过公共安全教育^[49]和严格执法^[50]等非环境设计手段对其进行干预,故本研究不予以考量。

measured the environment's walkability in terms of safety, practicability, and pleasure, while safety enjoyed the highest weight of 0.4^[29]. Therefore, it is effective and meaningful to select safety-related indicators from walkability evaluation research.

Defined as the children's free activities in the neighborhood without parental supervision^[30], CIM is mainly influenced by safety factor, including social safety and traffic safety^{[31]-[33]}, and some CIM studies lay particular emphasis on walking safety^[34]. Detailed safety indicators in CIM literature, such as traffic volume and speed^{[35]-[39]}, are also mentioned in walkability-related studies. However, most of them belong to the category of “motor traffic environment” in Table 4, and only a few of them, such as travel supporting at crossing^{[37][39][40]}, belong to the “walking / bicycling environment” category. Although the path condition (pavement, width, etc.) are also included as safety indicators in the above assessment tools, a fuzzy evaluation on walkability by adolescents proved that it is less important than public safety and traffic safety when it comes to CIM^[41]. In addition, attack, harassment, bullying, and anti-social behaviors of strangers also pose social safety threats to CIM^{[42]-[44]}. Lighting, as an indicator of “other facilities” in “walking / bicycling environment” category, helps increase the safety perception during trips at night^{[39][40]}. It is worth noting that CIM studies also attach greater attention to environmental factors related to the “other indicators” category in Table 4, with wider safety concerns such as threats from animals, getting lost, and acquaintance or friendly neighbors who can provide passive surveillance of sight and assistance in children's independent mobility^{[43][44]} — these factors are often overlooked in other studies. Therefore, CIM literature review provides new perspectives to help set up a more comprehensive indicator framework.

School commute studies also attach much importance to safety factors at social and physical-environment aspects, like neighborhood relationship and threats from strangers, walking facilities (including traffic lights, pedestrian crossings, and the amount of footpaths), motor traffic volume, amount of vehicles parked in the street, and continuity of walking paths. The community's concern about road safety is a new indicator at the awareness level.^{[45][46]}

In addition, this study does not cover unpredictable behaviors and misconducts of drivers or pedestrians^{[47][48]} which also threaten children's mobility safety potentially, since they need to be addressed with public safety education^[49] and strict law enforcement^[50] rather than environmental design.

5 结论

5.1 社区环境儿童出行安全评价指标框架的建立

综上所述,本研究提出基于国外文献的社区环境儿童出行安全评价指标框架,包含一级指标三项,二级指标11项,三级指标29项,四级指标若干(表5)。其中,一级指标中的“机动车交通环境”和“步行/骑行环境”主要从机动车交通控制、步行/骑行通行保障、交通节点穿行保障、视觉保障及提示、其他保障等维度评价儿童的出行安全;“其他指标”则分为社会安全、感知安全、生理健康和安全意识4个层面。

5.2 国外指标的局限性与中国指标的在地性思考

根据上述国外文献综述结果,可知目前有关儿童出行安全的评价指标研究总体数量较少。本研究尝试从4类关键词入手,对既有文献进行挖掘,发现现有指标研究存在明显的趋同现象,例如对儿童活动空间的安全研究大多关注视线内的监督保护、交通连接,以及局部环境的安全因素指标(如照明情况)等,而未考虑儿童活动的连续性^③,因此存在较为明显的局限性。目前虽有一些城市已颁布了相关指导性文件(如纽约市为提升街道安全性而出台的《街道设计手册》和《创造更安全的街道》导则^[51]),也开展了以儿童为主体的多种形式的实践(如澳大利亚墨尔本菲利普港的“绿灯工程”、意大利的“我们独自上学”计划,以及美国、澳大利亚、新西兰等国的“步行校车”计划^{[52][53]}等),但仍缺乏对已知安全影响因子的系统性整合,对其可靠性及实践效果的评估也不足。

此外,本文所述文献及指标工具均非针对中国语境,其文化背景、社区情况、所针对的儿童群体等都存在客观差异,因此表5所示指标框架对中国城市社区环境的适用性有待进行进一步的实证判断和修订。例如,“机动车交通环境”中的“紧急停靠车道或空间”、“步行/骑行环境”中的“路肩”“求助装置”等在中国城市环境中并不常

5 Conclusions

5.1 Evaluation Indicator Framework of the Community Environment for Children's Mobility Safety

Based on English literature review, an evaluation indicator system of the community environment for children's mobility safety is established as shown in Table 5, consisting of 3 first-level indicators, 11 second-level indicators, 29 third-level indicators, and more fourth-level indicators. As the first-level indicators, motor traffic environment and walking / bicycling environment mainly assess children's mobility safety in terms of motor traffic control, walking / bicycling travel supporting, travel support at crossings, good sight and signs, and other guarantees; other indicators range from social safety, perceptive safety, physical health to safety awareness.

5.2 Limitations of Indicators from English Literature and Their Adaption to China's Reality

From the above, it could be concluded that studies on evaluation indicators for children's mobility safety are still insufficient. This study retrieved English literature with four types of keywords and found a convergent trend in the research interests. For instance, existing safety studies on children's activity spaces mainly focus on surveillance and protection by sights, traffic connectivity, and safety factors of local environment (such as lighting) with less considerations on the continuity of children's activities^③. Although several guidelines (e.g., Street Design Manual and Making Safer Streets^[51] in New York City) have been published, and multiform children-oriented projects have been implemented (such as the Greenlight Project in Port Philip, Melbourne City, Australia, We Go to School Alone in Italy, and the Walking School Bus programs in the United States, Australia, and New Zealand^{[52][53]}), none of them have integrated with existing knowledge on diverse safety factors systematically, and little evaluation has been made on their reliability and effectiveness.

The literature articles and the assessment tools discussed above, as well as their cultural backgrounds, situation of communities, and target group (children), are not based on in China's reality. Therefore, the applicability of the indicator framework in Table 5 to Chinese urban community environment needs further verification and adaption. For instance, “emergency stop lane or space” of the “motor traffic environment,” and “road shoulders” and “help-seeking devices” under the “walking / bicycling environment” are not common in Chinese cities and could be removed in practice; The land use pattern, planning approaches, and building layout of Chinese urban communities

③ 随着儿童的成长,其活动半径会逐渐扩大。为了保证儿童随着年龄增长可逐渐实现独立出行,适合儿童活动的各空间点之间应存在连续的安全路径。

③ Children's activity radius gradually expands as they grow up, which requires high continuity of safe paths between various spaces to ensure CIM.

表5: 社区环境儿童出行安全评价指标框架

Table 5: The evaluation indicator framework of children's mobility safety in the community environment

一级指标 First-level indicators (N = 3)	二级指标 Second-level indicators (N = 11)	三级指标 Third-level indicators (N = 29)	四级指标 Fourth-level indicators
机动车交通环境 Motor traffic environment	交通控制 Traffic control	速度控制 ^b Speed control ^b	减速带、减速道、特殊速度区域、环形交叉口 Speed bumps, ramps, special speed zones, roundabout
		交通量 ^a Traffic volume ^a	车道宽度、数量、通行率, 年平均日交通量 Width, amount, and passing rate of lanes; annual average daily traffic (AADT)
	视觉保障及提示 Good sight and signs	标识 ^{ab} Signs ^{ab}	车道划分线, 停止、速度、方向、车道、行人穿行等提示 Lane dividing lines; signs of stop, speed, direction, lanes, pedestrian passing through, etc.
		照明 ^{ab} Lighting ^{ab}	亮灯率、照度 Light working ratio, illumination
		车道弯曲度 ^b Road curvature ^b	是否影响视线、速度控制、转弯危险等 Affect vision or not, speed control, turning danger
	其他保障 Other guarantees	竖向设计 ^b Vertical design ^b	排水设施 Drainage facilities
紧急停靠车道或空间 ^b Emergency stop lane or space ^b		—	
步行/骑行环境 Walking / bicycling environment	通行保障 Travel supporting	通行空间基本特征 Basic characteristics of travel space	数量 ^{ab} Quantity ^{ab}
			坡度 ^{ab} Slope ^{ab}
			宽度 ^a Width ^a
			密度 ^a Density ^a
			长度 ^{ab} (如连续度: 是否有尽端路等) Length ^{ab} (e.g., continuity / connectivity: cul-de-sacs or not)
			类型 ^{ab} [人车混行道、专用自行车道、禁车步行街、非正式环境 (泥路等)、侧边人行道] Type ^{ab} [coexistence of people and vehicles, bikeway, pedestrian street, informal environments like dirt road, sidewalk]
	表面 Surfaces	铺装材质 ^{ab} (防滑路面、透水路面、盲道) Pavement materials ^{ab} (anti-slippery, permeable, sidewalk for the blind)	
		维护情况 ^b (破损、缺失、裂缝等) Maintenance ^b (damaged, missing, cracks, holes, etc.)	
		排水系统 ^{ab} (是否容易积水) Drainage ^{ab} (vulnerable to water-logging or not)	
	路缘 ^{ab} Curb ^{ab}	形式 (延伸)、高度、材质、维护情况 Type (extension), height, materials, maintenance	
	路肩 ^b Road shoulder ^b	躲避、穿行 Dodge, crossing	
	隔离缓冲带 ^{ab} Isolation or buffer zone ^{ab}	高度、宽度、形式 (硬质: 栏杆、树等; 软质: 绿化等) Height, width, type (hard: fence, trees, etc.; soft: greening, etc.)	
	障碍物 ^b Obstacles ^b	永久性 (杆柱、台阶、花坛、树及树池、固定座椅、垃圾桶等) Permanent (poles, steps, flower terraces, trees and planters, fixed seats, garbage cans)	
		临时性 (停放的机动车、碎玻璃、坑洞、临时桌椅、修缮工事) Temporary (motor vehicles parked, broken glass, cracks and holes, temporary tables and chairs, facilities under repair)	
交通节点穿行保障 Travel supporting at the crossing	穿行空间 ^{ab} Crossing spaces ^{ab}	过街人行横道、安全岛、过街天桥/地下通道 Crosswalk, refuge island, overpass / underpass	
	穿行控制 ^b Crossing control ^b	交通信号控制 (视觉、听觉) Traffic control signals (visual and acoustic)	

续表见下页 / Continued

表5: 社区环境儿童出行安全评价指标框架
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步行/骑行环境 Walking / bicycling environment	交通节点穿行保障 Travel supporting at the crossing	路缘 ^b Curb ^b	形式 (延伸) Type [extension]
		标识/铺装 ^b Signs / paving ^b	斑马线、行为提醒标识、儿童易懂的过街标识 Zebra crossings, behavior reminders, crossing signs for children
	视觉保障及提示 Good sight and signs	标识 ^b Signs ^b	警示、方向、规则、步道状况 Warning, direction, regulation, sidewalk conditions
		照明 ^{ab} Lighting ^{ab}	亮灯率、照度、行人尺度、位置 Light working ratio, illumination, pedestrian scale, location
		视线 ^b Sight ^b	视线可达机动车道以及其他道路使用者 (行人、骑行者) Sight to motorways and other pedestrians and bicycle riders
	其他保障 Other guarantees	周边监视 Surrounding surveillance	被动监视 ^{ab} (来自建筑物内及其他行人的视线) Passive surveillance ^{ab} [sights from buildings and other pedestrian]
			主动监视 ^b (摄像头等监控设备, 警察、安全巡逻志愿者) Active surveillance ^b [camera and other monitoring equipment; police and safety patrol volunteers]
求助装置 ^b Help-seeking devices ^b		报警装置、电话 Alarm devices, telephones	
其他指标 Other indicators	社会安全 Social safety	犯罪与威胁控制 ^{ab} Crime and threat control ^{ab}	犯罪率与暴力行为: 攻击、骚扰、欺凌、反社会行为 Crime rate and behaviors: attack, harassment, bullying, antisocial behavior
	感知安全 Perceptive safety	邻里关系 Neighborhood relationship	信任度、熟知度 Trust, close-knit
		特殊环境与暗示 ^b Special environments and hints ^b	交叉路口、机动车道交界处, 涂鸦、恶意破坏、废弃建筑物 Crossroads, junction to motorways; graffiti, vandalism, abandoned buildings
		邻里识别度 Legibility within the neighborhood	易于寻路 Easy for wayfinding
		其他因素 Other factors	陌生人、无人看管的动物 (狗等) ^b Strangers, unwatched animals [dog etc.] ^b
	生理健康 Physical health	空气质量与声环境 Air quality and acoustic environment	机动车尾气排放、难闻的气味、噪音 Vehicle exhaust, odor, noise
	安全意识 Safety awareness	对安全的重视度 Attention to safety	区域 (社区) 对道路安全的重视程度 The attention of an area [community] to road safety

注

1. a表示原文献中明确指出可量化的指标; b表示以“有/无”属性评价的指标; 无标记表示原文献未提及如何评价该指标。
2. 18项评价工具有两项 (SPACES与WABSA) 涉及骑行安全, 其中前者未明确区分步行与骑行环境评估指标, 后者虽将骑行类指标单独列出, 但与其他评价工具中的步行类指标基本完全重合, 包括机动车交通量 (AADT)、机动车数量与速度、最外侧机动车道宽度、自行车道或路肩宽度、路缘、雨水排放格栅, 以及转弯视线等。故本表将步行与骑行环境的评价指标归为一类一级指标。

NOTES

1. The quantitative indicators in the 18 assessment tools are marked with "a;" the qualitative ones that can be only described with "yes / no" are marked with "b;" and those without any mark means that the evaluation methods are not mentioned in the literature.
2. Bicycling safety is only mentioned in SPACES and WABSA among the 18 tools. SPACES does not distinguish indicators for bicycling environment from walking environment; Although WABSA lists bicycling indicators separately, these indicators are almost same with the walking ones in the other tools (such as AADT, amount and speed of vehicles, width of the outermost motorway, bicycle lanes or road shoulders, curbs, rainwater grates, and sight at turns). Therefore, in this table the indicators for these two environments are merged into one first-level category.

④ 如2018年大众汽车集团(中国)与中国妇女发展基金会共同启动的“儿童交通友好社区”项目

④ Such as the Children Mobility Friendly Community co-launched by the Volkswagen Group (China) and the China Women's Development Foundation in 2018

见,因此在实际使用中应酌情剔除;中国城市居住区的用地现状、规划方法和住宅平面布局往往使得“被动监视”难以形成;对以社区为单位的“机动车交通量”的统计有赖于提前建立完善的数据库;“临时性障碍物”属于可变化的因子,作为评价指标具有较大不确定性,可根据社区实际情况选择性使用。其余指标与中国城市社区环境特征较为相符,适合作为儿童出行安全评价指标。

在提升社区环境、促进出行安全方面,当前中国的政策文件以地方政府制定的指导性规范为主,如香港于2000年启动的“行人环境改善计划”、上海市于2016年发布的《街道设计导则》,以及广东省于2017年发布的《步行与自行车交通蓝皮书》^[54]等,这些文件将安全作为目标导向之一,表明了政府层面对全域龄群体出行环境安全的重视,但在科学的出行安全评价指标体系出现之前,其可靠性及全面性均有待评估。除此之外,相关项目实践^④也仍处于探索阶段。因此,本研究基于国外文献梳理出的儿童出行安全评价指标框架,将有助于对现有出行环境建设规范中出行安全的相关要求进行系统性完善、建立更为精细化的分层指标体系,为相关实践项目中的各阶段评估应用提供有益参考。**LAF**

make it difficult to form “passive surveillance;” The assessment of “motor traffic volume” in the community requires a sound built-up database; “Temporary obstacles” are changeable with great uncertainties, which should be an optional indicator. Other indicators are suitable for evaluating the community environment in Chinese cities for children’s mobility safety.

So far, local governments in China have formulated a series of guidelines to enhance mobility safety by improving the community environment, such as the Pedestrian Environment Improvement Scheme launched in Hong Kong since 2000, the Shanghai Street Design Guidelines in 2016, and the Walking and Bicycling Transportation Blueprint issued by Guangdong Province in 2017^[54]. Taking safety as one of the major goals, these guidelines showcase the government’s attention to the mobility safety of urban environment for all age groups. However, their reliability and comprehensiveness require further examination with a scientific indicator system, and related practices^④ are still in the exploratory phase. Therefore, the evaluation indicator framework for children’s mobility safety proposed in this study can help systematically improve the mobility safety requirements of the existing regulations and guidelines to establish a multi-leveled indicator system and provide reference for performance evaluation practice at all stages. **LAF**

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