

THE URBAN HEALTH INDEX

A HANDBOOK FOR ITS CALCULATION AND USE

**A VERSATILE APPROACH TO MEASURING
AND MAPPING HEALTH INEQUALITIES**

THE URBAN HEALTH INDEX

A HANDBOOK FOR ITS CALCULATION AND USE

WHO Library Cataloguing-in-Publication Data

The Urban Health Index: A Handbook for its Calculation and Use
I. World Health Organization.

ISBN 978 92 4 150780 6

Subject headings are available from WHO institutional repository

© World Health Organization 2014

All rights reserved. Publications of the World Health Organization are available on the WHO web site (www.who.int) or can be purchased from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: bookorders@who.int).

Requests for permission to reproduce or translate WHO publications –whether for sale or for non-commercial distribution– should be addressed to WHO Press through the WHO website (http://www.who.int/about/licensing/copyright_form/en/index.html).

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use.

The named authors alone are responsible for the views expressed in this publication.

Prepared for:
World Health Organization Centre for Health Development
Kobe, Japan

Authors:
Georgia State University, Atlanta, United States of America
Scott R. Weaver, Ph.D.
Research Assistant Professor, Division of Epidemiology and Biostatistics, School of Public Health
Director, Data and Research Services, Center of Excellence on Health Disparities Research, School of Public Health
Dajun Dai, Ph.D.
Assistant Professor, Department of Geosciences
Christine Stauber, Ph.D.
Assistant Professor, Division of Environmental Health, School of Public Health
Ruiyan Luo, Ph.D.
Assistant Professor, Division of Epidemiology and Biostatistics, School of Public Health
Richard Rothenberg, M.D., M.P.H.
Regents' Professor, Division of Epidemiology and Biostatistics, School of Public Health
Director, Research Core, Center of Excellence on Health Disparities Research, School of Public Health

Design by Phoenix Aid Design, Denmark.
Printed in Japan.

Suggested citation:
The Urban Health Index: A handbook for its calculation and use. Kobe, Japan: World Health Organization; 2014.

TABLE OF CONTENTS

TABLE OF FIGURES	VI
ACKNOWLEDGEMENTS	VII
INTRODUCTION TO THE URBAN HEALTH INDEX AND THIS HANDBOOK	2
WHAT IS THE URBAN HEALTH INDEX?	2
WHO SHOULD READ THIS HANDBOOK?	3
HOW IS THIS HANDBOOK ORGANIZED?	3
OVERVIEW OF THE PROCESS FOR CONSTRUCTING THE URBAN HEALTH INDEX (UHI)	4
SELECTING INDICATORS FOR THE URBAN HEALTH INDEX	5
SELECTION OF INDICATORS: A FRAMEWORK	6
RATIONALE FOR INDICATOR SELECTION	6
EXAMPLES OF DATA SOURCES	9
SELECTING A GEOGRAPHIC UNIT OF ANALYSIS	10
AN ILLUSTRATION: SELECTING INDICATORS FOR AN APPLICATION OF THE URBAN HEALTH INDEX FOR SALVADOR, BAHIA, BRAZIL	11
STEPS FOR CONSTRUCTING THE URBAN HEALTH INDEX	13
1. PREPARING THE DATA	13
2. CALCULATING THE URBAN HEALTH INDEX	15
Standardization of the Indicators	15
Amalgamation of the Standardized Indicators	17
3. CALCULATING THE ERROR VARIANCE OF THE URBAN HEALTH INDEX	17
4. CALCULATING SUMMARY STATISTICS FOR THE URBAN HEALTH INDEX	18
5. CREATING AN INDEX PLOT OF THE URBAN HEALTH INDEX	19
6. QUANTIFYING GEOGRAPHIC DISPARITIES USING THE URBAN HEALTH INDEX	20
Assessing Disparities Among Areas in the Middle Range of the UHI: The Disparity Gradient	20
Assessing the Extent of Disparity between the Outer UHI Quantiles: The Disparity Difference and Ratio	21
MAPPING THE URBAN HEALTH INDEX	22
ANALYSIS AND REPORT WRITING	26
THE ONE PAGE SUMMARY	26
THE DETAILED REPORT	27
LIMITATIONS AND CONDITIONS FOR INTERPRETATION OF THE URBAN HEALTH INDEX	30
RELIABILITY AND VALIDITY OF INDICATORS	30
CONSISTENCY OF INDICATORS	32
UHI: RELATIVE VERSUS ABSOLUTE INTERPRETATIONS	33
AVOID EXTRAPOLATING BEYOND THE INDICATORS	33
INTERACTIONS WITH PLANNERS AND DECISION MAKERS—USING THE URBAN HEALTH INDEX TO SET PRIORITIES AND GOALS FOR POLICY CHANGE	34
APPENDIX	36
APPENDIX A: GUIDE TO AN EXCEL-BASED TOOL (V. 1) FOR CALCULATION AND VISUALIZATION OF THE URBAN HEALTH INDEX	36
Tools and Capabilities	36
Instructions for Using the Tool	37
APPENDIX B: GUIDANCE FOR A WEIGHTED URBAN HEALTH INDEX	39
APPENDIX C: DERIVATION OF THE VARIANCE FOR THE URBAN HEALTH INDEX	41
Derivation of the Variance for UHI: Without Assuming Normality	41
Derivation of the Variance for UHI: With Assumed Normality	42
APPENDIX D: GUIDANCE AND ILLUSTRATION OF MAPPING THE URBAN HEALTH INDEX WITH QGIS AND ARCGIS	45
Using ArcGIS for Mapping the UHI	45
Using QGIS for Mapping the Urban Health Index	50
APPENDIX E: A VISUAL SUMMARY FOR COMMUNICATING THE URBAN HEALTH INDEX	60
APPENDIX F: A POWERPOINT TEMPLATE FOR COMMUNICATING THE URBAN HEALTH INDEX RESULTS	62

TABLE OF FIGURES

Figure 1: Flow Diagram for Construction of an Urban Health Index	3
Figure 2: Framework for Classifying Measures of Urban Health.	6
Figure 3: Health Indicator Data for Tokyo Prefecture, Japan (2003-2007) in Spreadsheet Format	12
Figure 4: Illustrating the Calculation of Using the Sample Minimum as the Lower Goalpost.	15
Figure 5: Illustrating the Calculation of Using Zero as the Lower Goalpost.	15
Figure 6: Illustrating the Calculation of the UHI	16
Figure 7: Example UHI Index Plot for Tokyo Prefecture, Japan	18
Figure 8: Flowchart of Steps for Mapping the UHI.	22
Figure 9: An Example: Mapping the UHI in Atlanta, Georgia.. . . .	23
Figure 10: The UHI Representation Using Point (left) and Surface (right) After Smoothing	24
Figure 11: Results of the Weighting Simulations	39
Figure 12: Illustrated Calculation of the Weighted Geometric Mean.	40
Figure 13: The User Interface of ArcMap to add a Shapefile (left) and the Resulting Screen After the Shapefile is Added (right).	44
Figure 14: The User Interface to Open an Attribute Table (left) and the Resulting Attribute Table (right)	45
Figure 15: The UHI Excel file Imported into ArcMap (left) and the ArcMap Table of Contents (right).. . . .	46
Figure 16: Concept Model of the Join Function in ArcMap	46
Figure 17: Process to Select the Join Function (left), and the Join Data window (right)	47
Figure 18: Symbology Setting (left) and the Choropleth Map (right)	47
Figure 19: Flip Option in Layer Properties Window (left) and the Map after Flipping Map Colors (right).	48
Figure 20: Insert Menu to Add Map Elements (left) and the Final Map (right).. . . .	48
Figure 21: QGIS Interface of Adding Data (left) and the Browser Tree (right)	49
Figure 22: Plugins Interface.	50
Figure 23: Interface for the Layers Window.	50
Figure 24: Checking the Data Type for UHI Values When Joining UHI Data to the Shapefile	51
Figure 25: Joining the UHI File in CSV Format to a Boundary Shapefile.	51
Figure 26: Viewing Fields in the Layer Properties Window.	52
Figure 27: Changing Layer Properties.	52
Figure 28: Add Column Window.	53
Figure 29: Layer Properties Window after the New Column is Added	53
Figure 30: Field Calculator Window.	54
Figure 31: Attribute Table Window UHI Data.	55
Figure 32: Creating a Choropleth Map in the Layer Properties Window.	55
Figure 33: UHI Results in a Choropleth Map	56
Figure 34: Paper and Quality Set-Up in Print Composer Window	57
Figure 35: Add, Select, and Move a Map in the Print Composer Window	57
Figure 36: Item Properties in the Print Composer Window	58
Figure 37: Selecting Map Elements to Print in the Composer Window	58

ACKNOWLEDGEMENTS

This handbook was written and developed by Scott R. Weaver, Dajun Dai, Christine Stauber, Ruiyan Luo, and Richard Rothenberg of Georgia State University (GSU) in Atlanta, Georgia, United States of America. It is a product of collaboration since 2010 between the GSU research team based in the School of Public Health, and the World Health Organization Centre for Health Development, or WHO Kobe Centre (WKC), to develop the Urban Health Index. It also reflects inputs from a broad group of experts over the course of this collaboration from both within the two collaborating institutions and beyond.

Funding for the development of this handbook was provided by the WKC. Megumi Kano (WKC) commissioned the work and provided overall technical guidance. Amit Prasad (WKC) provided technical inputs and contributed to earlier drafts of this handbook. Hui Eva Liang (GSU) provided technical assistance. Martin Bortz (University of Heidelberg) applied the Urban Health Index in Rio de Janeiro, Brazil, and produced the results and figures presented in Appendix E. Members of the GHIFT collaborative contributed technical inputs. Michael Eriksen, Founding Dean of the Georgia State University School of Public Health, provided technical and moral support. Kathleen Sartori (GSU) performed copy editing. Matthew Simmonds (GSU) developed the graphic design. Sophia Banton, Byungwoo Cho and Kumiko Miyake (GSU) assisted in the translation, data management, and analysis.

INTRODUCTION TO THE URBAN HEALTH INDEX AND THIS HANDBOOK

The Urban Health Index (UHI) is a single metric that can be used to measure and map the disparities in health determinants and outcomes in urban areas. This Handbook is primarily intended for those who want to calculate the UHI for a particular geographic area of interest.

What is the Urban Health Index?

The UHI provides a flexible approach to selection, amalgamation, and presentation of health data. Its purpose is to furnish visual, graphical, and statistical insight into various health indicators and health determinants within particular geographic boundaries and health disparities with a focus on capturing intra-urban health disparities. The UHI may be used by public health workers, evaluators, statisticians, program managers, academic researchers, and decision makers to examine the current status of urban areas, to assess change and the effect of program interventions, and to plan for urban improvements.

The UHI was developed through a set of papers and consultations commissioned by the World Health Organization Centre for Health Development (WHO Kobe Centre). The original motivating question was whether or not a single urban metric was feasible and could capture critical information about an urban area. The decision from these discussions was that a single metric—by default a composite statistic—would not serve the many purposes demanded of it, and a multipurpose tool was likely to be more advantageous. The WHO Kobe Centre and its consultants envision a method that could be applied to health indicators and health determinants, would have built-in measures for disparities, and would lend itself to geographic visualization.

The tool that emerged was not predicated on new methods, but rather built on a methodology that has been under development for many years. A review of extant indicator databases and current approaches to the formation of indices revealed diversity in terminology but considerable concordance in the types of indicators used.¹ Numerous indices have been proposed, most predicated on the inclusion of specific indicators, and many employing arbitrary weighting schemes. The UHI described here builds on the considerable correlation among indicators of the same type (for example, total mortality and its subsets), and eschews weighting in favor of different indicator combinations.² The method for the UHI construction has drawn on the approach used by the Human Development Index (HDI)³ that standardizes indicators by converting them to a proportion of their range, and combines them using the geometric mean. The UHIs for contiguous areas are rank ordered. A *disparity ratio* is calculated from the extremes of the distribution, and a *disparity slope* is calculated by the angle of increase. UHIs for contiguous areas are mapped to provide an immediate visual grasp of the extent and distribution of disparities.

-
- 1 Rothenberg R, Stauber C, Weaver SR, Dai D, Prasad A, Kano M. Review and commentary: urban health indicators and indices – current status. Unpublished work.
 - 2 Rothenberg R, Weaver SR, Dai D, Stauber C, Prasad A, Kano M. A flexible Urban Health Index of small area disparities. J Urban Health. 2014. doi:10.1007/s11524-014-9867-6.
 - 3 United Nations Development Programme (UNDP). Human Development Report 2011. Sustainability and equity: A better future for all. New York: Palgrave Macmillan; 2011 (http://hdr.undp.org/sites/default/files/reports/271/hdr_2011_en_complete.pdf, accessed 11 September 2014).

This approach permits freedom to choose the scale (from small area estimates to national comparisons), the indicators (largely dependent on data availability), and the mode of presentation. The following chapters outline the method in detail, provide examples of prior and potential use, and furnish resources for further development and applications. Building on existing work provides connections to the considerable ongoing efforts in this field, and offers pathways to evaluation and innovation in a specific geographic locale.

Who should read this handbook?

This handbook is written for a diverse audience. Its primary target audiences are the public health workers and policy analysts who require a method for quantifying urban health disparities and then presenting such information to policy planners and decision makers. However, research and academic communities may also have an interest. In its Appendices, the handbook offers a rigorous approach to the statistical aspects and visualization of the UHI. Finally, the UHI may prove to be a cogent tool for the media to reach a lay audience concerned with health inequalities.

How is this handbook organized?

The sections of this handbook are organized to guide the reader through the step-by-step calculation of the UHI, from choosing health indicators and determinants to communicating with decision makers and others about the index. Throughout the handbook, actual applications of the UHI in Atlanta (USA), Tokyo (Japan), Shanghai (China), and Rio de Janeiro (Brazil) are provided as illustrative examples.

We begin with a brief Overview of the process for constructing a UHI. Initial considerations involved in this construction are described in the next section, Selecting Indicators for the Urban Health Index. This section also provides guidance for selecting and gathering data for valid and reliable measures of selected indicators and determinants at the desired level of measurement or unit of analysis. Next, the primary steps of calculating the UHI values for an urban area of interest are described and illustrated. This section includes: (1) the preparation and examination of the selected indicator and determinant variables; (2) the use of statistical or spreadsheet software programs to standardize, then aggregate the indicators into the UHI; and (3) the plotting and statistical summation of UHI values for capturing the extent of health disparities within an urban area or among urban areas.

Next, we describe the geographic information systems (GIS) tools for mapping and analyzing the UHI. These GIS tools complement and greatly expand upon the more simplified tools described in the previous section. The UHI and the graphs and statistics computed from it can be used by policy makers and

预览已结束，完整报告链接和二维码如下：

https://www.yunbaogao.cn/report/index/report?reportId=5_27977

