# Healthcare Delivery in the Information Age

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# Perspectives of Knowledge Management in Urban Health

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*This series is dedicated to Leo Cussen: learned scholar, colleague extraordinare and good friend.*

# Foreword

The twenty-first century is being shaped by the same powerful forces, namely the financial crises, food shortages, climate change and health security. Public health has been battered by multiple global crises from multiple fronts. Historically clinical, genetic, biologic and to a lesser degree psychological factors have been considered the major determinants of ill health and disease. In recent times, it is increasingly recognized that sociobehavioral and environmental factors are also important health outcome and health care determinants. In this century, the driving forces of health are demographic ageing, rapid urbanization, and the globalization of unhealthy lifestyles. Perhaps this reality is most easily understood in the context of Urban Health.

In 1990, fewer than four in ten of the world's population lived in cities. Today, more than half live in cities, and by 2050, seven out of every ten persons will live in urban areas. This phenomenon needs to be understood and factored in as an actionable determinant that impacts on public health and public policy. Urban Health problems exist in a complex interaction of socioeconomic behavioral, environmental, and biologic factors that are related to race, ethnicity and geography. In addition, these determinants coexist in coactive and at times synergistic dynamic systems, which at the population level, often lead to intractable health inequalities and healthcare disparities. Given this reality, an integrated and comprehensive understanding of health and disease in the urban environment requires the collection, analysis and interpretation of diverse types of data that necessitates transdisciplinary analytic approaches. The challenge of Urban Health is further heightened by the fact that we live in an age where continuous monitoring, due to data availability, of almost anything is possible. Thus vast amounts of data about any number of things can be collected within very short periods of time. However, validation of data, pragmatic analytical interpretation, and realistic actions are in general lacking. Health scientists and health care practitioners are ill equipped to collect the necessary information, much less analyze, integratively interpret and then act upon vast amounts of data sources in a timely fashion. Thus many knowledge gaps exist in the field of Urban Health. Some of these gaps exist because science has not yet standardized the data needed for adequate urban health knowledge. We may indeed have vast amounts of data, yet little of this information is in the form of useable

knowledge upon which policy makers, clinical and public health practitioners can act to prevent disease or protect health.

Knowledge management comprises a range of practices typically used by large and complex organizations to facilitate the identification, creation, representation or adoption of critical insights and experiences. These insights and experiences are collectively referred to as knowledge and may either be the insights of individuals or the experiences of the organizations themselves. The magnitude and complexity of comprehensively understanding urban health problems or crafting effective solutions in the urban environment strongly suggests the need for systematic tools and methodologies to facilitate advances in the science and practice of Urban Health. The urban environment is an exceedingly complex system in which illness and disease defy simple linear causes existing at one level only. Therefore appropriate solutions will demand the integration of knowledge derived from several and perhaps even many diverse parts of the "system" "organization" or "environment" use.

Given that the majority of the world's population now lives in cities, this book will be of interest to clinicians, public health practitioners and academic scientists as well as other urban health stakeholders in industrialized nations and in the developing world. This book is academically-grounded whilst remaining practically relevant. The chapters put together in this book provide the basis for garnering sound public health evidence and taking actions based on such knowledge. Applying urban health knowledge management into practice will ensure efficiency and fairness of health care services, health delivery, and health outcomes for our people.

Dr. Jacob Kumaresan

# Preface

For the better part of the twentieth century, and now into the twenty-first century, the United States has been recognized as having one of the world's best healthcare systems in terms of its use of leading edge techniques, technologies and application of the latest medical findings to healthcare delivery (Starr, 1982; Kongstvedt, 1994). Looking at the miraculous cures, incredible surgical feats, control of infectious disease, and other aspects of American medicine, it is difficult to dispute the claim. But there is another story when one looks at the health of the nation's urban poor. The healthcare system in the United States seems to hardly touch many of the most vulnerable individuals and communities. Additionally, when medical care is delivered, it is often inadequate to meet the complex health, social, economic, educational, and environmental needs of inner-city urban residents.

The paradox of the modern American medical system is that, although it has an unparalleled capacity to treat and repair (particularly with regard to trauma and infectious disease), it is often ill-prepared to prevent illness, especially within the complex context of the urban environment. Although this contradiction has implications for the entire American population, its impact is greatest for those with the fewest resources, including, and oftentimes most especially, the urban poor. For inner-city residents who often live close to large academic health centres, the paradox is all the more acute. Even though the "best care in the world" may literally be right next door, poor urban residents experience some of the worst health conditions, live in some of the least-healthy environments, and have some of the worst health indices of any population group in the nation - in some instances comparable to those found in developing nations.

It is important to stress that such problems are not restricted to the USA – the issues are replicated in countries throughout the world (the *International Conference on Urban Health* held in Baltimore (31 Oct–2 Nov 2007)) testifies to this. Quality care of patients requires the evaluation of considerable amounts of data at the right time and right place and in the correct context. These clinical, administrative and operational sources of data are typically kept in separate and disparate operational repositories. With the advent of the electronic health record, these data warehouses will provide data and information at the point of care and provide for a continuous learning environment in which lessons learned can provide updates to clinical, administrative and financial processes. What becomes crucial in such a context is

the identification of relevant data, pertinent information and germane knowledge to support rapid and superior healthcare decision making (Wickramasinghe et al., 2009). Given the advancement of the information tools and techniques of today's knowledge economy, it is imperative that these tools and techniques be appropriately utilized to enable and facilitate the identification and evaluation of these knowledge assets. To do this effectively and efficiently it is imperative that healthcare incorporates the principles of Knowledge Management (KM).

This book then, serves to explore and explain the nature of essential KM principles in a manner applicable to the problems of urban health. Accessibility and usability in this manner would be of use to both students and professionals wishing to learn more about the key aspects of urban health knowledge as they pertain to effecting superior healthcare delivery.The book provides readers with an understanding of approaches to knowledge and knowledge management by examining the purpose and nature of its key components. The rationale of the text is the first demystify the KM field by explaining in an accessible manner the key concepts of KM tools, strategies and techniques, and then clearly identify the benefits of incorporating KM into contemporary urban health issues. The text will demonstrate how, with practice and understanding, its key precepts can be appropriately applied to the domain of urban healthcare.

Many KM texts suffer from pitching theoretical issues at too technical or high a level, or from presenting a theoretical prescriptive treatment of knowledge or KM modelling "problems". It is hard to find a text that approaches the topic from the more versatile "twin" perspectives of both academia and practitioner. The market needs a book which is sensitive to such issues and which can provide readers with approaches to managing and developing KM that is underpinned by theory and research, which is integrative in nature and which addresses softer approaches in manifesting and recognising knowledge. Moreover, given that urban healthcare professionals are incredibly busy people, what is essential for them is to have a book that provides the essence of KM for superior urban health delivery. This will enable them to grasp the key points quickly and more importantly be able to implement effective KM strategies and techniques into urban health operations. Examples of such strategies and techniques include:

(a) Diagnosing complex diseases and then deciding upon an appropriate treatment strategy: the urban health professional must sort though multi-spectral data and various information sources. By incorporating the various tools of KM, eg. sorting and searching tools as well as decision-making tools, it is possible to search large databases and electronic repositories to access the relevant information and pertinent data required to make a more informed and thus better decision after careful evaluation of critical knowledge

(b) A computerised medical record represents a document that provides the user: typically an urban health professional, with specific and important information pertaining to a patient from which (s)he can then make further healthcare treatment recommendations. By incorporating various KM tools and techniques (including drill down, connectivity to a healthcare portal as well as searching),

it is possible to transform a relatively static computerised medical record into an intelligent knowledge repository from which the urban health provider can make better decisions pertaining to treatment issues.

(c) Developing appropriate utilisation usage criteria which impact on reimbursement for urban health funds and urban health professionals, it is necessary to process large amounts of disparate data and analyse trends. In order to develop accurate utilisation levels, it is of paramount importance that the tools and techniques offered by KM are applied.

The format for the book is as follows:

## Part I: KM and Urban Health

The first part of this book attempts to introduce and underscore the major challenges that one is confronted with in an urban health context and how the tools, technologies, tactics and techniques of KM might facilitate successful and superior healthcare delivery in such a challenging environment.

Chapter 1: Knowledge Management for the Urban Health Context by Gibbons, Bali and Wickramasinghe serves to introduce the key challenges faced in urban healthcare and how and why the tools, techniques, tactics and technologies of knowledge management might facilitate superior healthcare delivery for urban healthcare.

Chapter 2: Healthcare Knowledge Management: Incorporating the Tools, Technologies, Strategies and Processes of KM to Effect Superior Healthcare Delivery by Wickramasinghe provides a comprehensive coverage of all the major areas within KM and how they can be harnessed to facilitate superior healthcare delivery. The chapter provides case vignettes to highlight key issues.

Chapter 3: Knowledge Management in the Urban Health Context: Moving Towards Tacit-to-Tacit Knowledge Transfer by Bali, Baskaran and Naguib focuses attention most especially to overcoming knowledge gaps in urban healthcare settings with tacit-to-tacit knowledge transfer.

## Part II: Incorporating KM Principles into Urban Health Contexts

This second part serves to provide the reader with a miscellany of chapters that discuss numerous instances in which incorporating KM principles into an urban health context has indeed enabled superior healthcare delivery. Of particular note, is that these chapters cover instances in different countries be it Australia or US, countries in Europe, Asia and Africa as well as a variety of different urban populations ranging from children to the elderly. In so doing, we try to emphasise both the

breadth of urban health contexts and the universal benefits of KM principles when applied in any of these contexts.

Chapter 4: A Childhood/Adolescent Knowledge Management System for Urban Area Health Programs in the District of Columbia by Popovich and Zhang. This chapter focuses on the benefits of incorporating a knowledge framework to support urban health care objectives in the District of Columbia with a particular focus on children and adolescent populations.

Chapter 5: Urban Health in Developing Countries by Agarwal, Srivastava and Kumar. The need and benefit of appropriate KM systems to ameliorate the numerous challenges and problems in urban health settings in developing countries is the central theme of this chapter.

Chapter 6: A Pervasive Wireless Knowledge Management Solution to Address Urban Health Inequalities with Indigenous Australians by Wickramasinghe, Troshani and Goldberg. By incorporating a knowledge based solution the authors outline, in this chapter, how urban health inequalities and disparities can be addressed and resolved.

Chapter 7: The Development of a Framework to Evaluate the Management of HIV/AIDS Programmes in Rural and Urban South Africa by Sassman, Lehaney, Bali. Naguib and Marshall. This chapter discusses the development of a framework grounded in the principles of KM to address the HIV/AIDS crisis in South Africa.

Chapter 8: The Potential of Serious Games for Combating Health Inequalities by Gibbons, Bali, Marshall, Naguib and Wickramasinghe. He use of games to facilitate education and understanding of healthcare issues for various groups from the very young to the very old in an urban context is the focus of this chapter. While KM is not explicitly stated throughout the chapter, without the tools techniques, tactics and technologies of KM it would not be possible to design and develop appropriate games nor would it be possible to effect the necessary knowledge transfer. Hence KM is an integral key success factor in this context.

## Part III: Measures and Metrics for KM and Urban Health

This final part of the book attempts to develop and discuss possible measures and metrics. Improvement is only possible if we can objectively examine the current situation, extract appropriate lessons and apply these to the future state. By attempting to develop possible measures and metrics we are attempting to ensure that continuous improvement is also supported and fostered. Continuous improvement and learning are central themes in KM and we believe that if these themes are transferred into applications of KM principles in Urban Health settings we will indeed realise superior healthcare delivery in these instances.

Chapter 9: A Scalable and Viable Strategy for Managing Organizing: Typology for Intervening into Complex Healthcare Environments for Enhancing Continual Development by Saito. This chapter presents an approach for classifying, modelling and managing complex urban healthcare environments.

Chapter 10: Amplifying Resonance in Organizational Learning Process: Knowledge Sharing for Overcoming Cognitive Barriers and for Assuring Positive Action by Saito. This chapter serves to model critical learning process in urban healthcare environments and by doing so noting how to overcome numerous cognitive barriers.

Chapter 11: Developing New Urban Health Metrics to Reduce the Know-Do Gap in Public Health by Castillo-Salgado and Gibbons. This chapter delineates how KM is integral in the development of new and superior metrics to facilitate superior public health delivery.

Chapter 12: Recommendations on Evaluation and Development of Useful Metrics for Urban Health by Castillo-Salgado and Gibbons. The development of useful metrics for evaluating and enhancing urban communities is the central focus in this chapter.

Chapter 13: Making Sense of Urban Health Knowledge by Bali, Baskaran, Gibbons and Wickramasinghe. The final chapter of this book provides a summary of the role for the principles of KM in Urban Health contexts and how we should move forward when we try to incorporate these KM principles to whatever Urban Health context may confront us.

After extensive discussions and focus groups with public and urban health professionals, students (past and present), conference and workshop delegates, business managers and leading academics, it is apparent that there is a need for an accessible yet functional text in this area, one that incorporates valuable insights from all stakeholders. We have endeavoured to meet this need with our book Urban Health Knowledge Management and hope that our readers will find the following pages useful and beneficial as they attempt to address the challenges in Urban Health Contexts.

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|---|---|
| Baltimore, MD | Michael Christopher Gibbons |
| Coventry, UK | Rajeev Bali |
| Melbourne, Australia | Nilmini Wickramasinghe |

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# Acknowledgements

*For our families*

# Contents

# Author Biographies

## The Editors

**Rajeev K. Bali**, BSc(Hons), MSc, PhD, PgC, SMIEEE is a Reader in Healthcare Knowledge Management at Coventry University (UK). He is an invited contributor and reviewer for various international journals and conferences and is often called upon to deliver invited presentations and keynotes at international conferences, workshops and symposia. He is a Senior Member of the IEEE and the founder and Head of the Knowledge Management for Healthcare (KARMAH) research sub-group, Biomedical Computing and Engineering Technologies (BIOCORE) Applied Research Group, based in the Health and Design Technology Institute (HDTI) at Coventry University. He has a biographical entry in Who's Who in the World and Who's Who in Business and Finance. He is the (co-)author and (co-)editor of several books including Knowledge Management Primer, Routledge:USA (2009), Healthcare Knowledge Management Primer,Routledge:USA (2009), Clinical Knowledge Management: Opportunities and Challenges, IGP:USA (2005), Healthcare Knowledge Management: Issues, Advances and Successes, Springer:USA (2006) and The Small Book of Big Presentation Skills, Lexden:UK (2006).

**Dr. Michael Chris Gibbons**, MD, MPH is an Associate Director of the Johns Hopkins Urban Health Institute and is on the faculty at the Johns Hopkins' Schools of Medicine and Public Health. Dr. Gibbons' expertise is in the area of Behavioral interventions and Consumer Health informatics where he focuses on using Information and Communications Technologies to improve healthcare disparities.

He is an advisor and expert consultant to several state and federal agencies and policymakers in the areas of eHealth, minority health and healthcare disparities. Dr. Gibbons is a member of the National Academy of Science's Committee on the Role of Human Factors in Home healthcare and has been named a Health Disparities Scholar by the National Center for Minority Health and Health Disparities at the National Institutes of Health. Dr. Gibbon's has recently authored the book entitled "eHealth Solutions for Healthcare Disparities" and is the author of the healthcare Disparities Solutions Blog. Dr. Gibbons work is leading the development of the emerging fields of Populomics and Culturally Informed Technology Design.

Dr. Gibbons obtained his medical degree from the University of Alabama. He then completed residency training in Preventive Medicine, a molecular oncology research fellowship and earned a Master of Public Health degree focusing in health promotion among urban and disadvantaged populations all from Johns Hopkins.

**Professor Nilmini Wickramasinghe** (PhD, MBA, GradDipMgtSt, BSc, Amus.A (violin), Amus.A (piano)) of RMIT University, Australia, is an internationally renowned scholar who researches and teaches within the information systems domain with particular focus on the applications of these areas to healthcare and thereby effecting superior healthcare delivery. She is well published in all these areas with more than 100 referred scholarly articles, several books and an encycloapedia. She has been instrumental in bringing from idea to realization numerous e-health projects with leading healthcare organizations in the US such as The Cleveland Clinic, North Western Memorial Hospital and Johns Hopkins and her funded projects have received awards and recognition by State and Federal administrations on multiple dimensions, as well as working with leading authorities in Europe, as they forge new developments such as the German e-health card, and the UK.. In addition, she regularly presents her work throughout North America, as well as in Europe and Australasia. Professor Wickramasinghe is the U.S. representative of the Health Care Technology Management Association, and the editor-in-chief of two scholarly journals published by InderScience.

## The Authors

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His research interests revolve around viable applications of the KM paradigm for healthcare applications. His special interest in developing HL7 messaging and healthcare informatics has provided opportunities in excelling in these fields. He is a member of HL7 in both UK and Canada. His current activities overlap KM, e-health, AI and healthcare Informatics. Prior to his academic career, he was actively engaged in a wide area of industrial software and engineering projects at senior levels.

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Dr. Castillo-Salgado has served in several technical positions at the Pan American Health Organization/World Health Organization. He has been the Area Manager for the Health Analysis and Information Systems Area, Chief of the Special Program for Health Analysis and Information Systems, Program Coordinator for the Health Situation Analysis Program, and Regional Advisor in Epidemiology for the Communicable Diseases Program; he has been consultant for many inter-governmental organizations in the area of health information systems, measuring health inequalities, geographic information systems, epidemiological risk assessment and health impact assessment.

Currently he is an Adjunct Associate Professor of the Department of Epidemiology of the Bloomberg School of Public Health, Johns Hopkins University and Courtesy Professor of the Colleague of Public Health, University of South Florida. He served as Professor and Research Coordinator in Primary Health and Community Medicine at the National University of Mexico and Visiting Associate Professor in most of the schools of public health in Latin America and Spain.

Dr. Castillo-Salgado is author of several scientific publications and articles of epidemiology and public health. In 2008, he developed the Health and Education section of the National Geographic Family Reference Atlas, Third Edition, 2008. He also produced the first and second editions of this World Atlas. He has been the scientific editor and coordinator of the Pan American Health Organization 2 flagship's publication: "Health in the Americas" during the cycles of 1998, and 2002. He is the main author of "Geographic Information Systems in Epidemiology", 2001 (with English, Spanish and Portuguese editions), "Measuring Inequalities in Brazil", 2002, and "Mortality Profiles of the Sister Communities on the United States-Mexico Border", (1992–1994 and 2000 Editions). Also, he was the Editor and author of the Special Issue on Measuring

Health Inequalities of the Pan American Journal of Public Health, 2003, and of the Scientific Publication "Health Services in the Americas: Historical Trends of Basic Indicators 1954–1984", which provided relevant analyses of the first 30 years of health information in the health reports of PAHO. From 1999 to 2006, he has served as the Editor in Chief of the *PAHO/WHO Epidemiological Bulletin*.

He is the author of scientific articles and publications on applied epidemiology and health metrics. He developed and/or coordinated several important graduate

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Since 2002 is member of the Publication Board of the American Public Health Association (APHA). In 2007 was elected as Member of the APHA's Governing Council, representing the International Health Section. He is member of multiple professional associations in epidemiology and public health.

Among Dr. Castillo-Salgado's many honors and awards are the PAHO Special Award 2002 Best/Outstanding Unit/Team Award, in recognition of the leadership in the use of innovative and creative approaches in the field of public health analysis; 2002 Border Health Hero- from the US-Mexco Border; OTHLI Award Medal from the Government of Mexico and the Program for the Mexican Communities Abroad, 1999. The President of Mexico gives this award to distinguished Mexican Nationals living abroad for their exceptional contribution to the development of the Mexican Community; PAHO/WHO Director's Award for Outstanding Performance, 1996, PAHO/WHO's highest professional staff award offered in recognition of outstanding contribution and services to the organization. PAHO/WHO Special Recognition of Technical Programs, 1993.

Communicable Diseases Program, HPT, in recognition of the excellence of the professional work of its staff in 1992. Washington, D.C.; National Dissertation Grant Award in Health Services Research, 1986. National Center for Health Services Research and Health Care Technology Assessment. Department of Health and Human Services. Rockville, Maryland; J.D. with Honorable Mention. Universidad A. De Guadalajara, Guadalajara, Jal, México, 1972.

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**Professor Ian Marshall** is Pro-Vice Chancellor (Research) at Coventry University. Initially employed as the Dean of Mathematical and Information Sciences, in August 2005 he merged this School with the School of Engineering and the Built Environment Subject Group to form the new Faculty of Engineering and Computing. Previously he was Head of School of Computing & Advanced Technologies at the University of Abertay Dundee between 1997 and 2004. In 1997 he started the world's first Masters degree in Computer Games Technology and followed this up in 1998 with the first full undergraduate degree in Computer Games Technology. In 1999 he established the International Centre for Computer Games Technology (IC-CAVE) at the University of Abertay Dundee. He is currently responsible for the Serious Games Institute (SGI) at Coventry University. In total he has obtained over £7 million to support research in the last 15 years. Prof Marshall's applied research interests are focussed around the use of games in education and training and in development effort estimation for multimedia and other interactive courseware.

**Professor Raouf Naguib**, BSc, MSc, DIC, PhD, CEng, CSci, MIET, MIPEM, SMIEEE is Professor of Biomedical Computing and Head of the Biomedical Computing and Engineering Technologies Applied Research Group (BIOCORE) at Coventry University, UK. Prior to this appointment he was a Lecturer at Newcastle University, UK. He has published over 280 journal and conference papers and reports in many aspects of biomedical and digital signal processing, biomedical image processing, the applications of artificial intelligence and evolutionary computation in cancer research, healthcare informatics and environmental health. He has also published a book on digital filtering, and co-edited a second book on the applications of artificial neural networks in cancer diagnosis, prognosis and patient management, which is his main area of research interest. He was awarded the Fulbright Cancer Fellowship in 1995–1996 when he carried out research in the USA, at the University of Hawaii in Mãnoa, on the applications of artificial neural networks in breast cancer diagnosis and prognosis.

He is actively taking part in a number of collaborative research projects with various partners and consortia in the UK (breast, colon, ovarian and urological cancers, and Hodgkin's disease), the EU (prostate and colorectal cancers), the USA (breast cancer and cancers of the oesophago-gastric junction), Canada (hereditary non-polyposis colon cancer and perinatal difficulties), Vietnam (health informatics and environmental health), the Philippines (colon cancer and environmental health) and Egypt (bladder cancer).

In 2003, Prof Naguib was appointed as Adjunct Research Professor at the University of Carleton, Ottawa, Canada, and in 2005 he was appointed as Honorary Professor at De La Salle University, Manila, Philippines.

**Michael L. Popovich**, CEO, President, Scientific Technologies Corporation has over 36 years of applied engineering and information technology consulting in support health, environmental, transportation, and defense planning projects. He is the founder and CEO of Scientific Technologies Corporation (STC), established in 1988 providing health information technology strategic planning, solutions, and services to local, state, federal and international governments. Mr. Popovich was instrumental in developing standards and HIT solutions for population based immunization registries, working closely with the U.S. CDC, private foundations, and state governments. As CEO he provides the vision for the next generation of STC technology products to support disease surveillance, outbreaks, and population based registries in support of communicable and chronic disease.

Mr. Popovich is a nationally and internationally invited speaker. He addresses health information technology best practices with a focus on results. He has provided expertise and consulting to organizations, including the WHO, EU CDC, Ministries of Health, and U.S. and international health organizations. An author of over 150 articles, white papers and presentations, his focus is on utilizing technology and the data collected to increase knowledge for health decision support.

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