A Community Health Support System for the Planning of Healthy Cities

Ori Gudes[1], Tan Yigitcanlar[2], Virendra Pathak[3]

Abstract

Communities are at the centre of concern for sustainable development, and they are entitled to a healthy and productive life, in harmony with the natural environment. Therefore, assuring equitable and effective health services through community and environmental health planning is an important factor for promoting sustainable development and constructing harmonious societies. Environmental and community health is crucial for the development of sustainable and healthy cities. One of the important pre-requisites of developing a sustainable and healthy city is a sound planning and development mechanism. This paper aims to investigate the challenges and opportunities of planning for healthy cities, and examine the effectiveness of participatory decision making systems in the development of healthy communities. It also introduces a recently developed methodology based on a web-based decision support system. This system contributes to solving environmental and community health problems, supports planning of healthy cities, and provides a powerful and effective platform for stakeholders and interested members of the community to confer with technicians, experts and decision makers. The primary focus is on the prospects and constraints of such a decision support system in improving community health behaviours, health planning, surveillance in urban communities, and environmental planning. The effectiveness of the web-based decision support system is measured by using the following yardsticks: increasing cooperation between stakeholders and the general public; improving the accuracy and quality of the decision-making process; and enhancing healthcare services of the locality. The paper tables the preliminary findings of the initial implementation of the decision support system in a pilot case study of the city of Logan, Australia, and concludes with future research directions.

Keywords: Healthy Cities, Decision Support Systems, Community Health, Public Health

Introduction

Environmental and community health gains significantly from a healthy urban environment. The growing challenges of public health have encouraged a rapid expansion of research, especially in the field of urban planning. The growing impact and costs of health issues for the community forsake the traditional methods taken by previous studies. This paper introduces a recently developed framework, which is based on a Decision Support System (DSS). The new framework contributes in solving environmental and community health problems and in planning healthy cities, as well as provides a powerful and effective platform for stakeholders and interested members of the community.

This new framework is defined as a Community Health Support System (CHSS). The main question of this research was to examine the effectiveness of developing an innovative conceptual framework based on a Web-based Community Health Support System (WCHSS) to improve the management, surveillance and planning of community health. This basic question led us to examine the quantitative effectiveness and the contextual contributions of WCHSS in an actual health planning process of a city. The real-world case study of Logan, Australia was used to

---

[1] PhD Student, School of Urban Development, Queensland University of Technology.
[2] Senior Lecturer, School of Urban Development, Queensland University of Technology.
[3] Lecturer, School of Urban Development, Queensland University of Technology.

examine these questions. The paper provides an overview of recent literature on healthy cities and communities, decision support systems, public participation, and includes preliminary conclusions on the potential use of these technologies.

'Healthy Cities' Movement: Challenges and Opportunities

The 'Healthy Cities' initiative was officially introduced in 1986 by Ilona Kickbusch at a conference of the World Health Organization (WHO) in Copenhagen, Denmark. In 1987, the Healthy Cities project included 24 cities from around the world. Seven key steps were defined in the establishment of healthy cities; establishment of an intersectoral group, work of technical group, links with educational and research institutes, health impact analysis, health advocacy, models of good practice and sharing knowledge.

Literature argues that towns, cities and communities committed to promoting health and sustainability face two key challenges: how to move from the margins to the mainstream; and how to integrate the frameworks (Dooris, 1999). The literature indicates that although 20 years have passed since the initiation of the Healthy Cities movement, it did not achieve its full potential (Ashton, 2009). However, recently the founder of Healthy Cities (i.e. Kickbusch) called for a renewal of the commitment. The urban agenda has become more relevant, as trends of rapid urbanisation, overdevelopment, and global warming emerge.

A healthy city is a city that constantly changes and improves these physical and social environments and expands community resources (Hancock and Duhl, 1988). The WHO (2008) defined three core themes for healthy cities: healthy ageing, healthy urban planning, and health impact assessment. Whereas, Duhl and Sanchez (1999) defined a list of fundamental characteristics for healthy cities: commitment to health, political decision-making, inter-sectoral action, community or public participation, innovation and modernisation and healthy public policy. Adopting key components such as social model health and health-promoting systems, public participation and strategic local area planning contribute to the establishment of healthy cities.

In order to plan effectively for healthy cities, we need to revive the historic collaborative link between urban planning and public health professionals, and together conduct informed science (Northridge et al, 2003). In other words, environmental health promotion efforts must include the creation of structures and processes that actively work to dismantle existing inequalities and to create economic, political, and social equality (Schultz and Northridge, 2004). This process should contain a structured DSS model (Scoth and Parmanto, 2006). Incorporation of DSS within a case-study of a health planning initiative seems to be a major challenge.

Decision Support Systems

Public health surveillance is the systematic and ongoing collection, analysis and dissemination of outcome-oriented health data, whose findings are linked to actions in the decision-making process (Fonseca and Malheiros, 2005). Analysing and mapping public health-based data is becoming increasingly important in the attempt to improve the performance of major public health actions and to promote community health (Cromley and Mclafferty, 2003). Maps might help stakeholders better understand how to improve decision-making by visualising and simulating spatial phenomena (Conway et al., 2008).

GIS is defined as a DSS tool. GIS is one of the new core technologies in public health, providing the universal link that allows integration of data needed for effective public health decisions (Rushton, 2000). Literature indicates that GIS has the potential to be used in a range of healthcare decision-making tasks. The use of analysis and visualisation capacities within a GIS program provides an opportunity to use this tool as a decision-making system. Through GIS, users can visualise the effects of healthcare delivery strategies (Higgs and Gould, 2001). Moreover, for applications to be truly integrated into the strategic decision-making process, an 'intelligent GIS' framework must be created in order to understand the impact of complex changes in demand-supply relationships (Birkin et al., 1996). Therefore, access to GIS is a vital component of any decision-making system (Yigitcanlar, 2008).

Previous studies suggest that use of GIS technology in local governments has significantly increased in the past decade (Stern, 2002). However, the public healthcare field has been slow to adapt (Philips et al., 2000). Nowadays there is an increasing demand for the use of GIS in many public health programmes (Cromley and Mclafferty, 2003). Additionally, the role of GIS in public health management and practice continues to evolve. For example, some of the spatial analysis can be outlined from GIS as mapping layers of socio-economics, demographics, and projected regional growth forecasts. Another example is creating a priority mapping by the stakeholders and the people who are exposed and involved in this project. In addition to targeted prevention efforts, this tool has potential for predicting changes in decease distribution (Rich et al., 2005). The use of GIS increases efficiency by providing timely and rapid assessment of epidemiological patterns relevant to decision-making (Fonseca and Malheiros, 2005). Application of this technology is an important step towards a better understanding of public health issues and their inherent complexities (Waring et al., 2005). GIS is an important tool for gaining insight into the spatial distribution of disease determinants and health outcomes (Higgs and Gould, 2001). However, it is essential to expand the use of this tool. One of the ways to do so is by using web-based GIS platforms.

Web-based GIS technologies are being widely used by various organisations as more homes connect to the internet. Enabling the service on the internet allows access to a broad audience. The number of web-based interactive map sites is increasing rapidly around the world as more industries realise the potential of these sites (Theseira, 2002). The growing interest in web-based applications encourages a rapid expansion of research, especially in online decision-making and planning systems. Web-based Decision Support Systems (WDSS) need to be interactive and to promote knowledge sharing and exchange (Yigitcanlar, 2008). Implementation of

such applications in public health planning provides new insights and increases public involvement, community empowerment, healthcare improvements and health service delivery. Health applications of web-based GIS technology or WDSS are adopted by several countries such as the US and the UK. WDSS create the potential for an enhanced decision support environment (Scoth and Parmanto, 2006). WDSS should be based on three main components; usability, accurate data, and interactivity. Theseira (2002) notes that the flexibility and the ease of the use of the interface are critical for the successful implementation of these systems. It is essential that the data included must be clear to both professional and non-professional users. Users need to be able to query the data and to print various outputs for their own usage.

Concerning interactivity, the technological platforms enable a base for people to socialise, interact and build knowledge. The enabled interactivity of the community technological platform can have important implications on the knowledge-building process and is a way to facilitate citizen involvement (Refaeli et al., 2008). For example, web-based questionnaires are an essential tool for a formalised interactivity with the citizen (Theseira, 2002). Refaeli et. al. (2008) also found that increased interactivity leads to increased citizen participation in the process. A successful WDSS empowers users. Empowerment is feasible in cases of integrating participatory procedures in a case study.

Public Participation for Healthy Communities
Public participation is an important factor in the planning process because it provides a sense of real involvement in the decisions-making process. This involvement has a direct influence on the public's future. This process was exhibited in the past in traditional meetings where all participants had the opportunity to express their opinions and preferences. Adopting the DSS model in a public participation process (i.e., GIS) might lead to significant improvements for the public, such as empowerment and increased involvement. Using GIS, public participation takes DSS to the next phase by sharing GIS as a decision-making tool within the wider public.

Using Public Participation Geographical Information Systems (PPGIS) in the process of public participation has several advantages for the planning process, such as improvement of the decision-making process; increased confidence of the public in the given information; increased influence of general public opinion; increased number of active participants in the process; and increased involvement and expression of opinions of the general public in the process (Stern et al., 2009). The literature suggests that the contribution of both technical experts and interested members of the community improves the decision-making process (i.e. Yigitcanlar, 2008). Therefore, it is also important to establish technical collaboration between stakeholders and members of the community. There is great potential for health-related geographical information to increase our understanding of the health environment. Yet, it is vital to expand the use of PPGIS. One of the ways to do so is to use web-based public participation GIS platforms.

The growing interest in Web-based Public Participation (WPP) has encouraged a rapid expansion of research, especially in countries practicing public participation in decision-making and planning (Carver, 2001). Studies have investigated the potential advantages of WPP (Kingston et al., 2001; Schroeder et al., 2001), as well as their

relevance to various types of planning and management systems (Peng, 2001). The recent developments of the internet, media, communication media, and advanced geographic knowledge systems, have caused the emergence of a new area, which is defined today as Web-Based Public Participation Geographic Information Systems (WPPGIS). The growing interest in web-based techniques forsakes the traditional techniques of public participation (TPP), which are mainly based on various types of face-to-face interaction. WPPGIS enables the public to participate in the process, at any time or place. WPPGIS also provides higher accessibility to a wider public, along with updated and visual information (Kingston et al., 2001), allowing free individual expression, without public exposure or social pressure (Carver, 2001). In addition, it is possible to share and interact based on the access of spatial and interactive maps. There is evidence that these qualities increase the number of participants and public involvement (consequently contributing to community empowerment), as well as instituting trust in both the planning process and the local authorities (Sarjakoski, 1998; Trevor, 1998; Stern et al., 2009). Therefore, implementation of WPPGIS within a real case-study of a health planning initiative is a significant opportunity for the community.

A Community Health Support System
The cost of disease to society remains significant and current management methods in Australia do not appear to have sufficient impact. To examine the impact of a new method on health planning and its outcomes for the community, the city of Logan has been selected as the case study for this study. The Logan case study is a unique opportunity to examine a new method in improving health capacity in the region. This new method used is defined as Community Health Support System (CHSS). The main question was to examine the effectiveness of developing an innovative conceptual framework based on Web-based Community Health Support System (WCHSS).

Web-based technologies have the potential to extend participation and to contribute to the planning of healthy communities by serving as the technological backbones of health decision making. The literature argues that web-based participation increases involvement and outcomes for the planning of healthy cities. It has been recognised that the importance of the environmental community, the necessity of adopting new methods such as WCHSS and the awareness among policy makers and key stakeholders, are essentials for planning healthy communities.

Thus far, no previous health planning research has utilised a web-based decision support system in Australia. Different approaches have been applied in assessing the potential of spatial accessibilities. Hancock (1993) presented a conceptual framework for planning healthy cities. The framework is based on three main themes; community, environment, and economy. Figure 1 illustrates this framework.
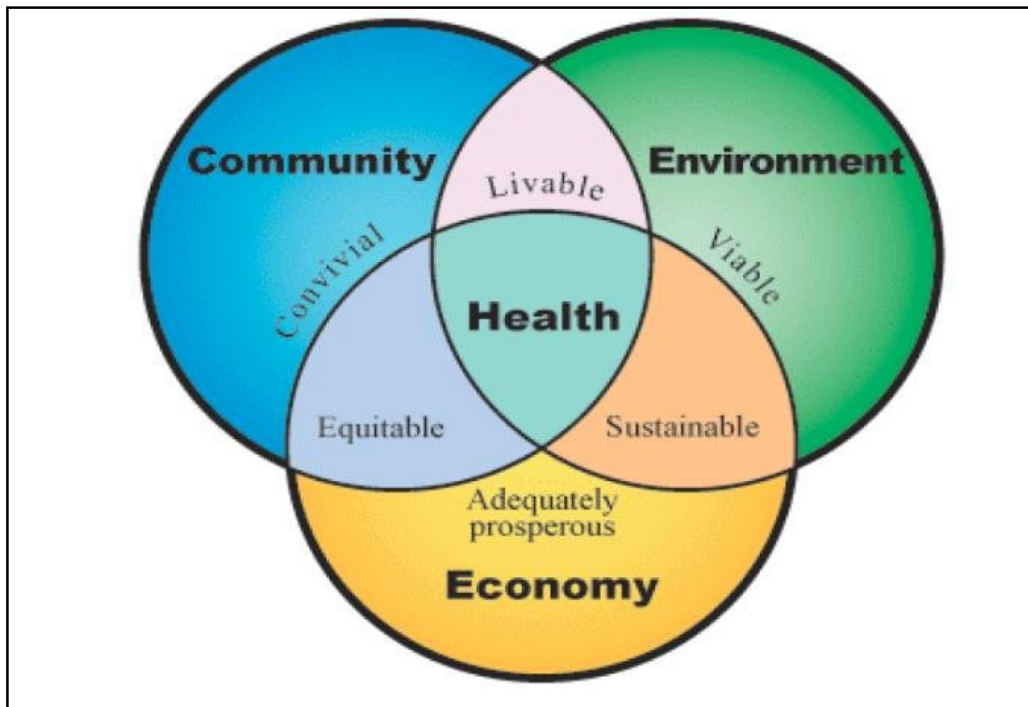
Figure 1: Healthy cities framework (Hancock, 1993).

This study proposes to extend and reconceptualise this framework. The new proposed framework offers relevant polices and proposes new dimensions. Figure 2 illustrates this new conceptual framework. The new framework addresses three main themes which are similar to Hancock (1993). However, six new elements are proposed to be added. Amongst these elements are innovative economy, quality of services, quality of place, quality of life, community empowerment, and quality of policy. These elements are located according to their logical correspondence with the internal circles (e.g. framework themes). Based on these elements, it is possible to observe in the circle of external arrows linkages among the six proposed relevant polices. The study proposes that effective governance focusing on developing healthy cities is likely to improve access to services. Better accessibility improves interactivity and decision-making within stakeholders and the community in the planning process. This in turn empowers community and improves the level of participation. Consequently, this leads to higher level of 'commitment to health' by stakeholders and the local community. Subsequently, this is a convenient environment to develop public health policies. Furthermore, the study proposes that polices shown in this framework would be implemented based on a web-based interface. It is possible to enhance interactivity, decision making and the level of public participation by offering it as a service in a web-based platform dimension.
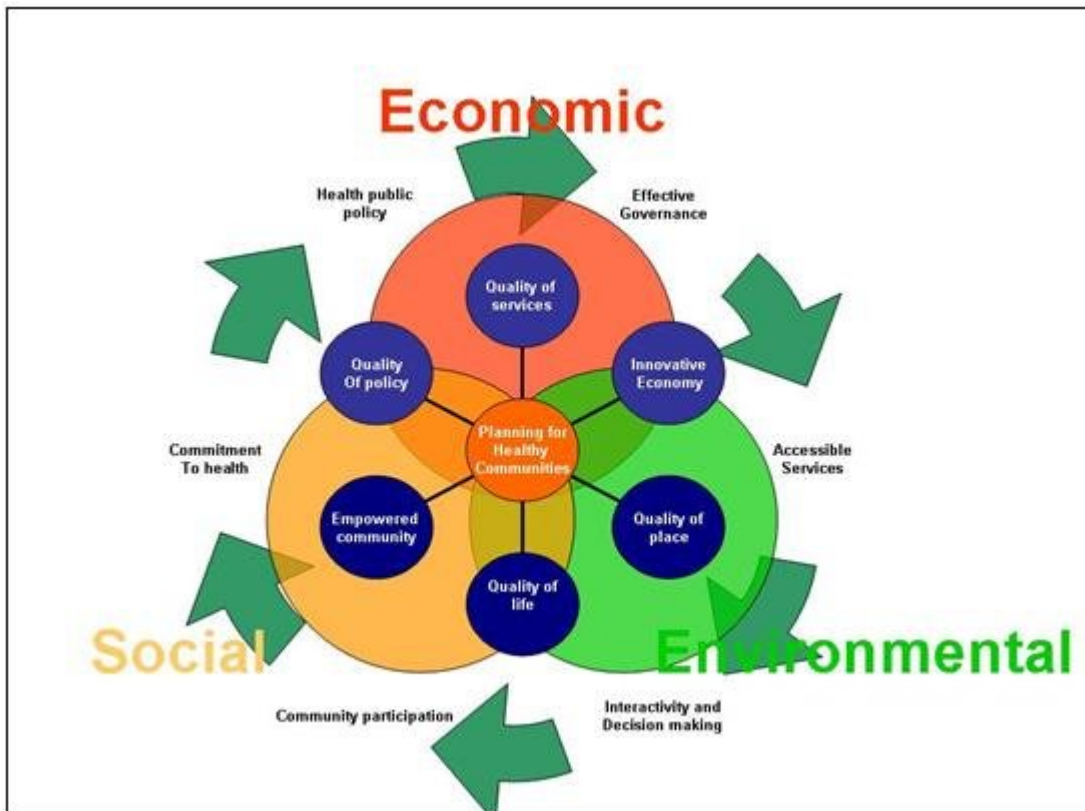
Figure 2: Proposed framework for healthy Communities.

A new analytic framework (i.e. WCHSS) based on WDSS technology was developed. The WCHSS is an innovative and user-friendly web-based platform for analysing data that is applicable to the process of local health planning. It includes an easy interface, accurate and updated data, and encourages interactivity. It enables the integration of spatial data, together with analytical and visualisation methods. The WCHSS encourages public access and input into health related decision-making and provides real-time information for professionals and stakeholders. The framework also provides information and participation availability to the general public in the decision process. The WCHSS offers different tools of interactivity such as; forums, forms, and questionnaires. This empowers users and enables access to feedback and input from the community and stakeholders from Logan.

Conclusions and Future Research

This study investigates the challenges and opportunities of planning healthy communities and examines the effectiveness of participatory WCHSS. WCHSS is a community-based environmental framework that uses DSS as its integrating platform. The WCHSS used in this study is at the forefront of technological advancement. With the advancement of internet technology and the continual increase of public use of the web, a growing amount of users will be able to learn about and become involved in their local community health issues. The vision of this fragment is to enable the public easy access to this channel, using the Internet to receive and spread public health information, utilising the high accessibility of an interactive platform.

WCHSS applications are innovative tools to address health issues. The literature indicates that cooperation between stakeholders and technicians supported by the

7

government are a convenient setting for enhancing access and interactivity with the local public. Therefore, another target is to improve this participatory mechanism within the local community.

There are few important issues that are likely to be considered in the future work of this project, such as: the structure of partnerships and coalitions between the university, stakeholders and participants; the tension between community participation and health data confidentiality; and the role of WCHSS and the potential output in terms of addressing health issues. In sum, this collaborative project is a first step in Australia toward the integration of WCHSS and public participation in planning healthy communities. Combining enterprise resource planning systems with WCHSS seems to be a positive, long-term opportunity as it introduces a common and useful tool for the improvement of health society.

References

ABS. (2004). National Health Survey Results. Accessed on 8 September 2008 from: www.abs.gov.au.

Birkin, M., Clarke, G. P., Clarke, M., and Wilson, A. (1996). *Intelligent GIS: Location Decisions and Strategic Planning*. Cambridge.

Carver, S. (2001). Public Participation Using Web-based GIS. *Environment and Planning B: Planning and Design 28*(6), 803-804.

Central Northern Adelaide Health Service. (2008). Social Health Atlas. Accessed on 24 November 2008 from: http://www.publichealth.gov.au/interactive_mapping/sa_sha_cnahs_2005/atlas.html.

Conway, M.D., Rizzuto, C.D., and Weiss, L.M. (2008). Mapping the Way Decision Makers Interact Could Hasten The Introduction of Vaccines. The McKinsey Quarterly. Accessed on 20 August 2008 from: http://www.mckinseyquarterly.com/A_better_way_to_speed_the_adoption_of_vaccines_2173

Cromley, E.K., and Mclafferty, S.L. (2003). GIS and Public Health. *Health and Place, 9*, 279.

Dooris, M. (1999). Healthy Cities and Local Agenda 21: the UK experience-challenges for the new millennium. *Health Promotion International 14*(4), 365-375.

Duhl, L., and Sanchez, A. (1999). *Healthy Cities and the City Planning Process - A Background Document On Links Between Health And Urban Planning*. Copenhagen: WHO Regional Office for Europe.

Fonseca, L., and Malheiros, J. (2005). *Social Integration and Mobility: Education, Housing and Health*. Lisbon: Centro de Estudos Geográficoso.

Hancock, T., and Duhl, L. (1988). *Promoting Health in the Urban Context*. Copenhagen: WHO Regional Office for Europe.

Hancock, T. (1993). Health, Human Development and the Community Ecosystem: Three Ecological Models. *Health Promotion International 8*(1), 41-47.

Higgs, G., and Gould, M. (2001). Is There a Role GIS in the 'New NHS'? *Health and Place, 7*, 247-259.

Kingston, R., Carver, S., Evans, A., and Turton, I. (2001). Public Participation, GIS and Cyber Democracy: Evaluating On-line Spatial Decision Support Systems. *Environment and Planning B: Planning and Design, 28*(6), 907-921.

Kushner, J. A. (2007). *Healthy Cities: The Intersection of Urban Planning, Law and Health*. Durham: Carolina Academic Press.

Lane, B. M. (2005). Public Participation in Planning: An Intellectual History. *Australian Geographer, 36*(3), 283-299.

Melbourne. (2008). Melbourne 2030 Planning for Sustainable Growth. Accessed on 15 September 2008 from www.melbourne2030.vic.gov.au.

Northridge, M.E., Sclar, E.D., and Biswas, P. (2003). Sorting Out the Connections Between the Built Environment and Health: A Conceptual Framework For Navigating Pathways and Planning Healthy Cities. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 80,* 556-568.

Peng, Z.R. (2001). Internet GIS for Public Participation. *Environment and Planning B: Planning and Design, 28*(6), 889-905.

Philips, R.L., Kinman, E.L., Schnitzer, P.G., Lindbloom, E.J., and Ewigman, B. (2000). Using Geographic Information Systems to Understand Health Care Access. *Arch FAM Med, 9*, 971-978.

Rafaeli, S., Hayat, T., and Ariel, Y. (2008). Virtual Knowledge-Building Communities, in Putnik G.D. and Cunha, M.M. *Encyclopaedia of Networked and Virtual Organizations, 3*, 1792-1796.

Rich, B., Savage, B., Adkins, B., and Caldeweyher, D. (2005). *GIS as a Tool For Decision Making and Evaluation.* Paper presented at the Social Change in the 21st Century Conference.

Rushton, G. (2000). GIS to Improve Public Health. *Transactions, 4(1),* 1-4.

Sarjakoski, T. (1998). Networked GIS for Public Participation and GIS on Utilizing Image Data. *Computer Environment and Urban Systems, 22*, 381-392.

Schroeder, C.P., Boudreau, P.R., Boyce, M.A., Brehme, C.E.W., Evans, A.J., and A.R. (2001). The Gulf of Main Environmental Information Exchange: Participation, Observation, Conservation. *Environment and Planning B: Planning and Design, 28*(6), 865-887.

Schulz, A., and Northridge, M.E. (2004). Social Determinants of Health: Implications for Environmental Health Promotion. *Health Education and Behaviour, 31*(4), 455-471.

Scotch, M., and Parmanto, B. (2006). Development of SOVAT: A Numerical-Spatial Decision Support Systems for Community Health Assessment Research. *Medical Informatics, 175*, 771-784.

Stern, E. (2002). Planning Hierarchy and Public Participation in Israel. *Perspective (in Hebrew), 14*, 38-42.

Stern, E., and Amir, I. (2006). *Benefits of Public Participation as Evaluated by the Participating Citizens,* Paper presented at the Annual Conference of Israel Planning Association Hertzelia (in Hebrew).

Stern, E., Gudes, O., and Svoray, T. (2009). Web-Based Traditional Public Participation Comprehensive Planning: A Comparative Study (accepted on September 2008). *Environment and Planning B,* 113-134.

Theseira, M. (2002). Using Internet GIS Technology for Sharing Health and Health Related Data for the West Midlands Region. *Health and Place, 8*, 37-46.

Trevor, H. (1998). Empowerment Marginalization and Community-Integrated GIS. *Cartography and Geographic Information Systems, 25*(2), 67-76.

Waring, S., Zakos-Feliberti, A., Wood, R., Stone, M., Padgett, P., and Arafat, R. (2005). The Utility of Geographic Information Systems (GIS) in Rapid Epidemiological Assessments Following Weather-Related Disasters: Methodological Issues Based on the Tropical Storm Allison Experience. *International Journal of Hygiene and Environmental Health, 208*, 109-116.

World Health Organization. (2008). Welcome to WHO's public health mapping and GIS programme. Accessed on 10 September 2008 from: http://www.who.int/health_mapping/en/.

Yigitcanlar, T., (2008), 'A Public Oriented Interactive Environmental Decision Support System', In GIS and Evidence-Based Policy Making, edited by S. Wise and M. Craglia. London: Taylor and Francis, 347-366.