Geomedical intelligence a new horizon for health care

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Abstract
There is a strong link between health and geography. Disease distribution and health outcomes are very much affected by the places where people live. World Health Organization (WHO) estimates that about a quarter of the diseases which mankind is facing today occur due to prolonged exposure to environmental pollution. Unfortunately, today's medical record is a vast collection of clinical facts and observations but remains silent about the accumulation of environmental health impacts and risks of the patient. A new application is needed for environmental monitoring which can collect data on environmental exposures. Such application can relate one's personal health status to the specific geographical risk factors by just entering the address of the patient, which will provide a powerful set of information that medical professionals can use for better diagnosis

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1. Introduction

Over the last few decades, there is tremendous global concern over the public health impacts towards environmental pollution and it's attributed burden of disease. The World Health Organization (WHO) has predicted that maximum diseases of mankind are due to prolonged exposure to the environmental pollution. Most of such diseases that are acquired during childhood and manifest at adulthood are generally environment related.

Health is on a continuum-one cannot reach at good health by mistake. Personal health starts before birth and continues throughout a person's life.

There is a strong link between health and geography [1]. For a better understanding of the oral health/disease process, it becomes interesting to explore the relationships between surroundings and community health. Disease distribution and health outcomes are very much affected by the places where people live. The environmental risk factors like pollution, influence disease patterns, life expectancy, mortality, morbidity. In short, "places form people as much as places are formed from people [1].

In 2012, an estimated 12.6 million deaths globally were attributable to the environment. The air we breathe, the food and water we consume, and the ecosystems which sustain us are estimated to be responsible for 23 per cent of all deaths worldwide.

Any shift away in a society from infectious, parasitic and nutritional diseases, reflect a higher share of people having access to safe water and sanitation. The excessive prevalence of non-communicable diseases is definitely has a link with poor air quality, chemical exposures and unhealthy lifestyles. While the environmental effects on health represent 23 per cent of deaths globally, the figure increases to 26 per cent for children under 5 years and 25 per cent for adults between the ages of 50 and 75 years in the duration of ten years from 2002 to 2012 globally [2].

Unfortunately, today's medical records concentrate on vast clinical facts recording, observations, test results, and diagnostic conclusions but nothing about the accumulation of environmental health impacts and risks of the patient. Linking one's personal health status with specific geographic factors provide vital information which medical professionals must use to improve the quality of the care they deliver [3].

Hence this review is being designed to emphasize the importance of environmental factors towards the health of the population, making this information available to each and every individual.

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2. Need of an application

In this modern era, where Internet Of Things are growing by leaps and bounds like various smartphone health applications that let you know about the calories you burn, resting heart rate and various fitness tracking applications, similar to them, a new application is needed for environmental monitoring which can collect data on air pollution, noise levels and various other environmental exposures, as we are still lacking behind in the innovative utilization of the address or geographical history of the patient. Such application can relate one's personal health status to the specific geographical risk factors by just entering the address of the patient, which will provide a powerful set of information which medical professionals can use for better diagnosis. This new approach is called as "geomedicine".

Geomedicine uses the technology of geographic information systems to add value to information for public health planning and decision making towards the impact of surroundings on human health.

3. GIS (Geographic Information System)

GIS is "computerized system which relates and displays data collected from a geographic entity in the form of a map [4]. GIS has always played a vital role in protecting communities from risks and toxic exposures which are otherwise overlooked.

Using GIS in delivering geomedical intelligence for health care practitioners could profoundly alter the level of care [3].

It is estimated that nearly 80% of the information needs of local health system decision and policy makers involve geographical positioning, which means using maps in one way or the other [5]. The health mapping, as an e-health application will be of great benefit if it supports health systems development. WHO has been using mapping techniques coupled with surveillance to monitor the global health situation and present it through user-friendly systems. It improves the ability of decision makers, planners, academicians, researchers and health care professionals to organize and link thematic and spatial datasets. It provides the ability to generate relations between datasets that may seem unrelated without using the geographical dimension.

GIS is widely used around the world as one of the most important technologies to help nations addressing their most serious health goals including impact of surroundings on health of individuals and reducing disparity in available medical services.

4. Areas of public health mapping

A useful disease surveillance system depends on appropriate distribution of surveillance data to health officials and the public. Temporal and spatial trends in disease outbreaks can be envisioned through maps showing for each location, the time of climax of disease incidence, i.e. the week or month when the largest number of cases occurred. An integrated approach and enabling technology for disease surveillance can be supported by an effective public health mapping programme [6]. It works as a unifying factor for various disease surveillance activities, because location is the common factor among them. Examples of the diseases which can be surveillanced in India using GIS are tropical diseases, parasites, rabies epidemic, malaria, cholera, sleeping sickness and HIV/AIDS.

4.1. Epidemiology

The spread of a disease is proficiently traced by epidemiologists as they study outbreaks of the disease through time, place and population. Disease source and its spreads can be possibly identified by mapping the location of a population or subgroup and looking at the presence of ill health among the population over time. So, by identifying these elements, national authorities can easily build a plan to combat the spread of the disease.

4.2. Water supply and delivery

Health of people is greatly affected by the quantity and quality of water intake. The first known use of health mapping was related to water sources, when John Snow mapped cholera cases at the time of an outbreak in London during 1852 and allied it to a specific water source.

Mapping the sites of water sources and the flood seasons connected to these locations facilitates control and prevention of water-borne disease such as malaria, cholera etc. Maps can also be generated to make out the correlation between sources of water supply and areas of high dental caries prevalence [7].

5. Assessing air quality and other exposures

Air quality is important to our health and environment, but sources of contamination are often difficult to monitor. GIS technology manages statistical and spatial record that shows the correlation between poor air quality and environmental health. Thus, GIS aids in monitoring pollutant emissions and permit us to find out the source of pollutants and to keep an eye on those areas to preserve the quality of air. Inorganic forms of particulate matter can be minerals, such as asbestos or silica, or a suite of minerals (quartz etc.) that can be seen in various geological deposits like volcanic ash or sedimentary rock [8].

Asbestos, which is made up of group of heat and corrosion resistant minerals, has been widely used as insulating, building materials and in friction products (like brakes) and its exposure is well known to cause mesothelioma [9].

Arsenic (As), a metalloid and well known carcinogen [10] is present everywhere in the environment and can originate from both natural and anthropogenic sources. The intake of increased Arsenic levels through drinking water and diet (mainly through seafood) [11] is well documented issue, that can cause skin and bladder cancer, and other non-carcinogenic effects such as skin lesions, neurological and hepatic effects [12].

Many leading public health organizations have authorized the use of GIS in public health practice and research. CDC (Centers for Disease Control and Prevention) says, "GIS plays an important part in health promotion and protection WHO has recommended GIS and have made following recommendations-

- Is "appropriate for analyzing epidemiological data, revealing trends and interrelationships that would be more difficult to find out in tabular format"
- "Allows policy makers to visualize existing health problems, social services and natural environment along with target resources."
- Is a "podium for the convergence of disease-specific information and analyzing it for population settlements and surrounding social and health services"

5. Conclusion

GIS technology's ability to share critical information about the spatial dynamics of disease makes it, the technology of choice for improving the detection and credentials of disease clusters. Health of this planet is being monitored from years ago with the help of GIS and now being used to monitor the health of individuals. It is based on the fact that the health of people depends on the heath of the planet and this evolves a new branch of medicine called as Geomedicine. Geomedicine has the potential to alter the physician's way of observing their patients and to endow with a more holistic view of the many unseen facts that often defeat achieving successful long-term health outcomes. The Government of Indian Ministry of Environment, Forest and Climate change, must adopt the GIS system in order to make the new generation disease free. The level of pollution has reached alarming levels in heavily populated cities of India. Hence such system implemented will allow the people to make correct choice in order to settle at places with less polluted surroundings.

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