

Spatial distribution of road traffic crash fatalities in Karachi: Perspective from 2008-2012

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Abstract

Road Traffic Crash (RTC) mortality and morbidity is one of the major public health problems in Karachi. In this study we used geographic information systems (GIS) to visualize and quantify the spatial distribution of RTC mortality and yearly trend from 2008 to 2012, for all 24 administrative subdivisions of Karachi, using Road Traffic Injury Research and Prevention Center's (RTIRPC) data. Cumulatively, 6040 deaths were recorded by RTIRPC, out of which we were able to map 4657 (77.1%) deaths based on location information available in the database.

During the 5-year period, highest number of cumulative RTC fatalities were recorded for Kemari, Bin Qasim, and Gushan-e-Iqbal; while lowest were recorded in Malir, Orangi, Korangi Cantonment, and Karachi Cantonment. Use of GIS for studying spatial distribution of RTC would help craft better response to RTC in the city and design public policy.

Keywords: GIS, Mortality, Pakistan.

Introduction

Road Traffic Crash (RTC) mortality and morbidity is one of the major public health problem in Karachi. Several studies have reported on RTC burden in Karachi, including time series analysis, based on Karachi's 'Road Traffic Injury Research and Prevention Center' (RTIRPC) data.¹⁻⁵

These studies have used descriptive and analytical approaches to studying RTC victims, both injured and dead. However, only one study has used the geographic information systems (GIS) approach to studying RTC's health burden using RTIRPC's 2008 data.⁶ While another study using 2004 medico-legal

office records of road traffic injury cases from three major hospitals in Karachi used GIS to map RTC injuries.⁷ These two studies mapped point data, were limited to one year data, and did not present burden of RTC victims by administrative subdivisions of Karachi.

Karachi is the only megacity of Pakistan, with an estimated population of 17.121 million in 2016, with projected increase to 24 838 by the year 2030, based on United Nations estimates.⁸ The city represents nine percent of the country's total population and 22.8% of its urban population.⁸ For effectively addressing RTC mortality burden in the city, it is important to identify its spatial distribution by administrative subdivisions of Karachi.

In this study we used GIS to visualize and quantify the spatial distribution of RTIRPC's RTC mortality and yearly trend from 2008 to 2012, for all 24 administrative subdivisions of Karachi.

Methods and Results

From September 2006 to December 2016, the Karachi Road Traffic Injury Research and Prevention Center (RTIRPC) collected RTCs data from the emergency departments of five major public and private hospitals in the city: Jinnah Postgraduate Medical Center, Civil Hospital Karachi, Liaquat National Hospital, Abbasi Shaheed Hospital and the Aga Khan University Hospital. In 2015, data collection was limited to three public sector hospitals only i.e. Jinnah Postgraduate Medical Center, Civil Hospital Karachi, and Abbasi Shaheed Hospital. Data for all injured or deceased victims of RTCs brought/admitted to these hospitals were recorded on 24-hour and seven-days a week basis; either directly from the victims and/or accompanying persons, in addition to ambulance drivers, police and eye-witnesses. Subsequently, these records were entered in an Excel based database.

The geographic coordinates of the RTCs for each fatal victim in the database were either geocoded or manually assigned as points, using the RTC location information

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from the records. We analyzed data in terms of cumulative frequencies and number of fatalities per year from 2008 to 2012, for all 24 administrative subdivisions

of Karachi, using ArcMap 10.

For the five-year period i.e. from the year 2008 to 2012, cumulatively 6040 deaths were recorded by RTIRPC, out

of which we were able to assign points on the map (X and Y coordinates) for 4657 (77.1%) deaths based on location information available in the database. Figure 1 shows all 24 administrative subdivisions of Karachi, and the number of fatal victims of RTCs in each. During the 5-year period, highest number of cumulative RTC fatalities were recorded for Kemari, Bin Qasim, and Gushan-e-Iqbal; while lowest were recorded in Malir, Orangi, Korangi Cantonment, and Karachi Cantonment. Spatial distribution of RTC fatalities for each administrative subdivision by each year i.e. from 2008 to 2012 are shown in figures 2 and 3. Figure-2 shows how all 24 administrative subdivisions divided and grouped in three maps. While figure 3 shows the number of road traffic crash fatalities by each administrative subdivision and each year from 2008 to 2012. The three maps in figure 3 how the trend of RTC fatalities over the course of five years in each administrative subdivision. Again Kemari and Bin Qasim areas show the highest number of RTC fatalities, albeit with some fluctuation over the study period. While Malir, Orangi, Karachi Cantonment, and Korangi cantonment persistently

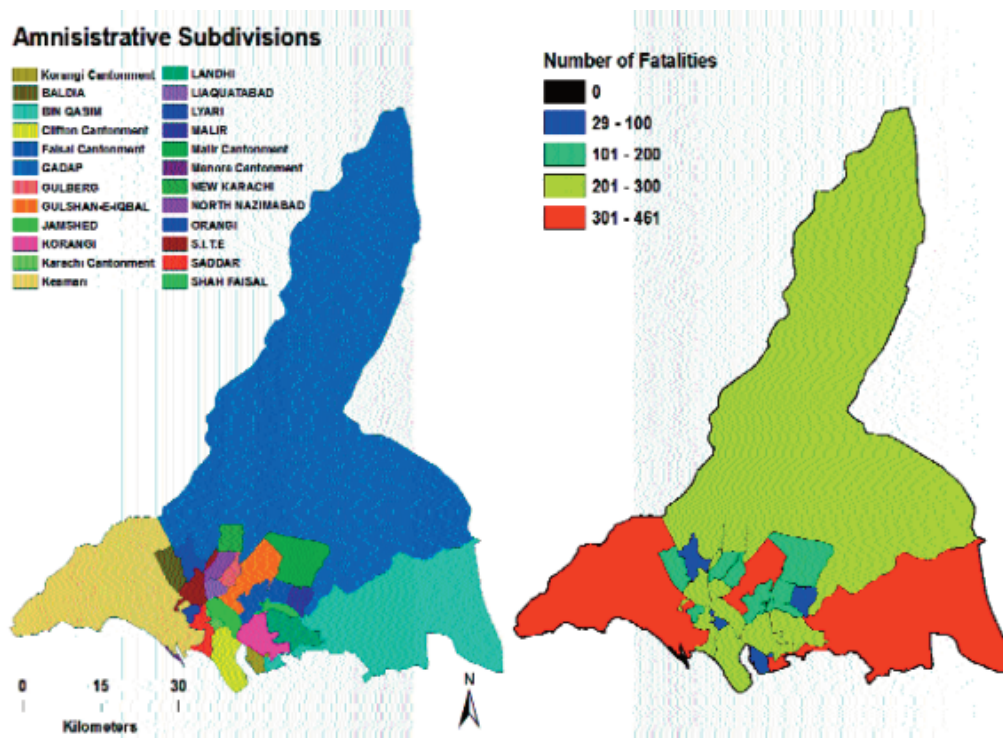
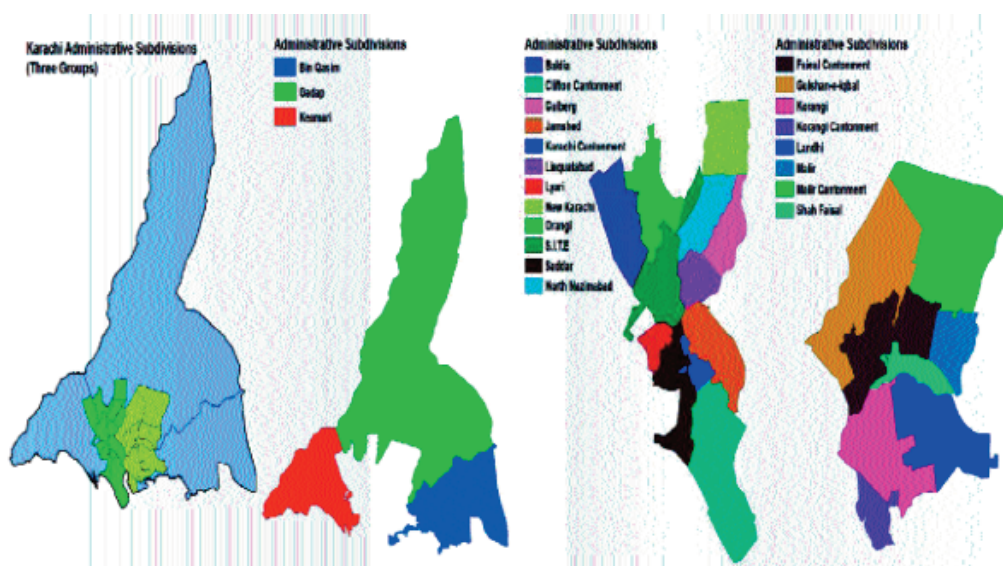


Figure-1: Administrative subdivisions of Karachi (left), and number of road traffic crash fatalities by administrative subdivisions (right).



Starting from left to right; the first map shows all 24 administrative subdivisions grouped in three, next three maps show the names and areas of administrative subdivisions in each group

Figure-2: Grouping of Karachi administrative subdivisions.

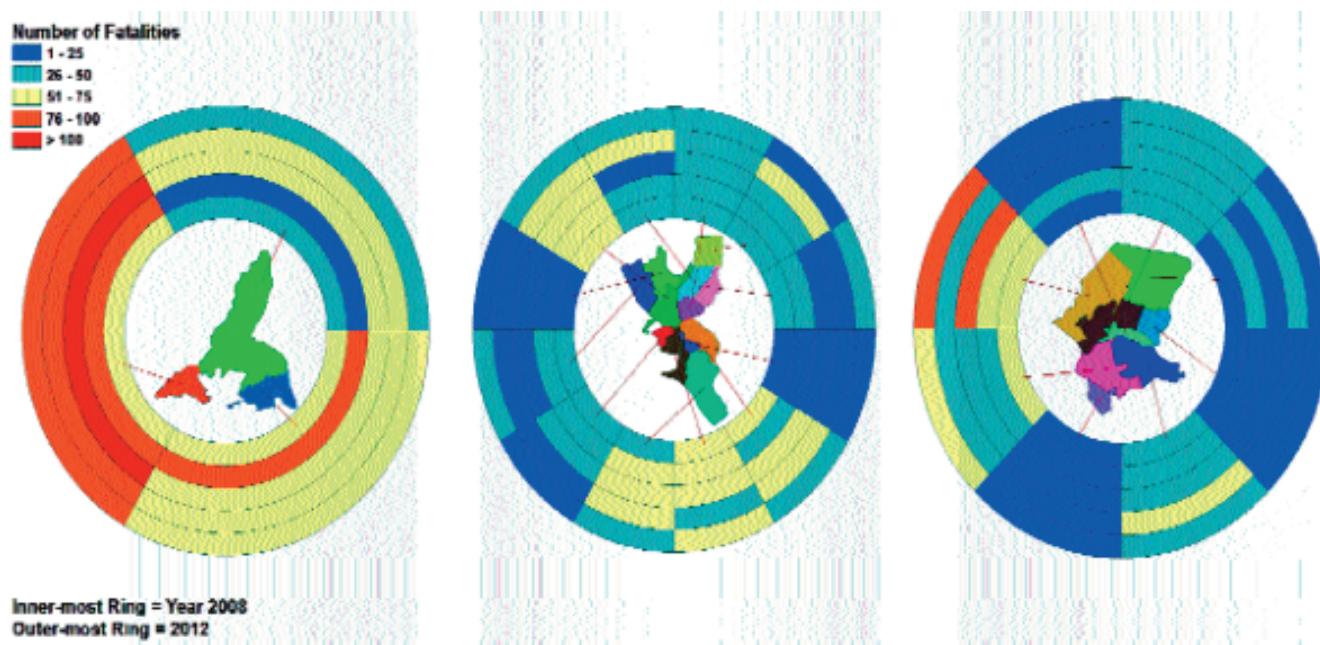


Figure-3: Number of road traffic crash fatalities by administrative subdivisions and year from 2008 to 2012.

show the lowest number of such fatalities for each year, during the 5-year period. All other administrative subdivisions show varying levels of RTC fatality trends by year.

Discussion

In this study GIS was used to quantify and visualize the spatial distribution of RTC mortality and yearly trend from 2008 to 2012, for all 24 administrative subdivisions of Karachi. We identified the administrative subdivisions with the cumulative highest, and lowest RTC fatality burden, as well as year-to-year trends in each. Cumulative RTC fatality burden by administrative subdivision, during the 5-year study period, was echoed in the 5-year, year-to-year trend.

However, there were differences in the number of fatalities each year, during the study period, in administrative subdivisions of Karachi.

This is the first study of its kind in Pakistan to visualize the 5-year spatial trend of RTC mortality in Karachi by administrative subdivisions. However, availability of location data was the limitation of our study, as we were able to spatially aggregate fatalities data for 77.1% of the fatalities recorded during the study period. Secondly, our data were limited to five major hospitals of Karachi. Hence, results need to be interpreted with these caveats. Nonetheless, we provide a perspective on spatial distribution of RTC

fatality in Karachi that underscores the need for better collection of RTC location information in future studies from all hospitals. Use of cell phones is becoming ubiquitous, and GPS-enabled 'smart' phones is on the rise in Karachi, as in other parts of the country. Thus providing a unique opportunity to collect and report location

information for RTCs and other public health events data using crowd sourcing applications.^{9,10}

When this data collection and reporting is coordinated efficiently, it could reap rich benefits — at low cost — for better understanding of spatial distribution, and response to RTC and other public health events in the city and the country by helping choreograph public policy.

Disclaimer: None.

Conflict of Interest: This first author being in charge of the Karachi's road traffic injury research and prevention Center (RTIRPC) has signed the IRB statement declaring that ethical approval has been granted for conduct of spatial analysis of RTIRPC's data.

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