



Spatio-temporal patterns of road traffic noise pollution in Karachi, Pakistan

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ABSTRACT

We studied the spatial and temporal patterns of noise exposure due to road traffic in Karachi City, Pakistan, and found that levels of noise were generally higher during mornings and evenings because of the commuting pattern of Karachi residents. This study found the average value of noise levels to be over 66 dB, which could cause serious annoyance according to the World Health Organization (WHO) outdoor noise guidelines. Maximum peak noise was over 101 dB, which is close to 110 dB, the level that can cause possible hearing impairment according to the WHO guidelines. We found that noise pollution is not an environmental problem reserved for developed countries, but occurs in developing countries as well. For this reason, steps might be required to reduce noise levels caused by road traffic.

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1. Introduction

Dense transportation systems, including roads, railways, and air traffic, characterize the modern urban environment. These systems have caused environmental noise (also known as *community noise*) pollution (McMichael, 2000; Wee, 2007; Moudon, 2009). In recent years, road traffic has played a dominant role in causing environmental noise, which can have ill effects on communities (Chepesiuk, 2005; Bluhm et al., 2007).

Traffic noise is known to have both psychosocial and physiological effects on exposed people. The most negative psychosocial effects of traffic noise are annoyance and sleep disturbance (Stansfeld et al., 2000; de Kluizenaar et al., 2007; Murphy et al., 2009). Annoyance is a psychological response to noise, and it can result in adverse emotions including anger, disappointment, anxiety, and depression (Lipscomb and Roettger, 1976; Fields, 1998; King and Davis, 2003; Moudon, 2009). Noise-induced annoyance is not limited to developed countries. Instead, it also happens in the cities of developing nations (Al-Harthy and Tamura, 1999). Traffic noise at night can adversely affect sleep patterns, causing fatigue, decreased task performance, injuries, and accidents (Carter, 1996; King and Davis, 2003; Jakovljević et al. 2006; Moudon, 2009).

Recent noise studies indicated that traffic noise, as an environmental stressor, increased the activation of the sympathetic nervous and endocrine systems, elevated physiological risk factors such as hypertension and myocardial infarction, and caused serious health

problems such as cardiovascular disease (van Kempen et al., 2002; Babisch, 2003; Griefahn and Spreng, 2004; Ising and Kruppa, 2004; Babisch et al., 2005; Bluhm et al., 2007; Fyhri and Klæboe, 2009). It is known that 70% of the world's urban population lives in developing countries (Cohen, 2006). Much of these urban populations are vulnerable to the ill health effects of traffic noise.

Taking into account the adverse effects of noise, the European Union (EU) has initiated two phases of strategic noise mapping for communities with more than 250,000 and 10,000 inhabitants (EC, 2002). The EU initiative of noise mapping aims at reducing the number of exposed population to noise and achieving a better quality of life only in its member communities.

Road traffic noise has been reported to be high enough in industrialized nations with well-developed transportation. However, there have been few studies to report how severe traffic noise is in developing countries although high levels of noise would be observed in the nations. Nevertheless, a few studies have indicated that developing countries also experience noise pollution due to the rapid increase of urban traffic in recent years (Onuu, 2000; Jamrah et al., 2006; Banerjee et al., 2008; Doygun and Gurun, 2008). Therefore, we provide an overview of how severe road traffic noise pollution in Karachi City, a densely-populated urban area, in Pakistan.

2. Material and methods

2.1. Study area

Karachi is the largest city of Pakistan, and it is experiencing continued rapid growth. The industrialization of Karachi has played an important role in attracting many rural people who are looking for

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KARACHI METROPOLIS Study Area

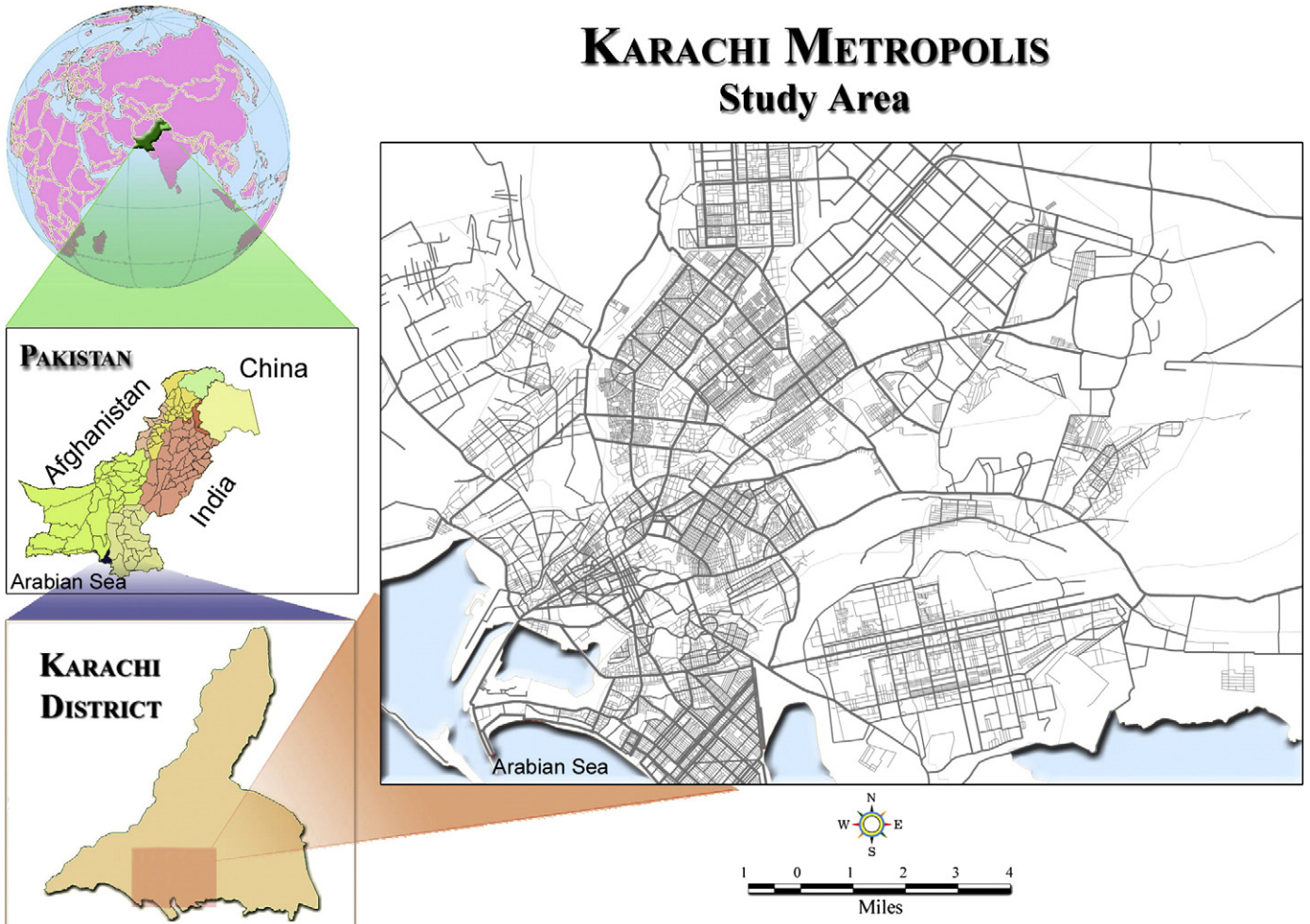


Fig. 1. Location of Karachi, Pakistan, and its road network.

jobs, which has led to rapid growth in recent years. Many manufacturing industries such as steel, textile, chemical, cement, refined petroleum, and processed food are located in Karachi, and it also serves as a national banking and stock exchange hub in Pakistan.

According to the City District Government Karachi (CDGK), approximately 16 million people live in Karachi, and 95% of the population resides in the urbanized areas of the city (Arsalan and Mehdi, 2005).

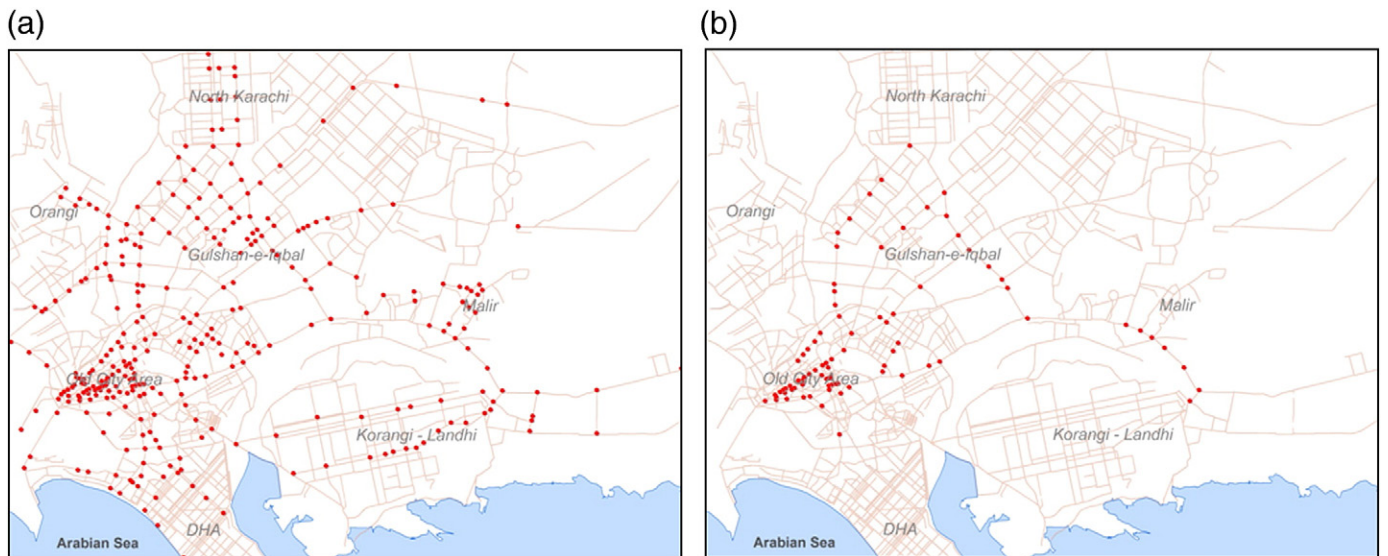


Fig. 2. Field measurement sites (a) and traffic jam locations in study area (b), represented in red dots, on Karachi road network.

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