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Short Report

Non-Hodgkin Lymphoma (NHL) linkage with residence near heavy roads—A case study from Haifa Bay, Israel

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ABSTRACT

The linkage between NHL morbidity and residence near heavy roads is analyzed among the Jewish population of the Haifa Metropolis, Israel. The addresses of 1436 patients (94.5% of all cases, 1995–2004) were geocoded. The geographic distribution of NHL patients was adjusted by the overall density of population in the study area. The analysis indicates steady decline in the "density adjusted" numbers of patients as a function of increasing road distances ($P<0.01$). Differences between genders/age groups were not found. The much higher occurrence of NHL in areas near main roads may be indicative of disease risks.

1. Introduction

Non-Hodgkin Lymphoma (NHL) is a large, heterogeneous group of cancers of the immune system. These can occur at any age, although most people with the disease are over 60. NHL is often marked by enlarged lymph nodes, fever and weight loss. There are many different types of the disease, which can be divided into B- and T-cell neoplasm, based on the histological characteristics. They are also separated into aggressive (fast-growing) and indolent (slow-growing) types (Muller et al., 2005; NCI, 2008a). The distribution of NHL types varies globally (Anderson et al., 1998).

Several reports comparing internationally available data showed that NHL rates in the US are among the highest in the world (Parkin et al., 2003). A comparative incidence analysis performed in recent years showed the rate among Israeli Jews to be even higher-15.2/100,000, versus 12.9/100,000 in the US for the period 1996–2001 (Freedman et al., 2006). Recent data show that the differences in the incidence rates are kept, if white US males and females are taken into account (16.1/100,000 and 11.3/100,000, respectively; SEER CanQuest, 2000–2005),while Israeli Jews incidence reached 18/100,000 in males and 14.2/100,000 in females. (All rates are standardized to the World Standard Population (SEER Cancer Query Systems, 2008; Israel National Cancer Registry, 2008.)

During the last 50 years, a striking increase in NHL rates has been detected in all world registries. Significant increase has been shown in the US, in the EU, in Japan (Levi et al., 2002), and in Israel, where male NHL rates increased from 8.82/100,000 in 1980 to 17.83/100,000 in 2005, and female rates increased by the same magnitude, from 8 cases per 100,000 to 14.29 (Israel National Cancer Registry, 2006).

The frequent risk factors for NHL include weakened immune system, certain infections such as AIDS, Epstein–Barr virus (EBV) or Hepatitis C virus (NCI, 2008b). However, there are many other influencing factors related to NHL, such as family or personal history, environmental exposure (e.g. to pesticides, solvents) and occupations (e.g. farmers, meat handlers) (e.g. Hartge and Devesa, 1992). These and other factors are mentioned in the detailed review on the epidemiologic literature concerning NHL, recently published by Alexander et al. (2007).

1.1. Cancer and exposure to traffic air pollution

Many studies dealt with risk of cancer types (mainly lung) and occupational exposure to air that is polluted especially by gasoline vapors or diesel engine emissions (e.g. Lynge et al., 1997; Hansen et al., 1998; Bruske-Hohlfeld et al., 1999; Boffetta et al., 2001). Other studies focused on cancer and exposure to air pollution as a result of *residence* in metropolitan areas (Pope et al., 2002; Nafstad

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et al., 2004; Palli et al. 2004; Cohen et al., 2005; Castano-Vinyals et al., 2007; Hwang et al., 2007; Kabir et al., 2007).

Indeed, the major source of ambient air pollution in urban areas is road traffic that emits a complex mixture of many chemicals (Health Effect Institute, Cambridge, 1995; Lynge et al., 1997; Fillinger et al., 1999; Kunzli et al., 2000) of which several are known or suspected carcinogens. This was revealed by Dreyer et al. (1997), who indicated that air pollutants caused by traffic clustering include a number of chemical compounds that, at high doses, are carcinogenic in animal models and in some instances, also in humans.

Various studies have dealt with the impact of traffic pollution on public health (Nielsen et al., 1996; Palli et al., 2001; Filleul et al., 2005; Finkelstein et al., 2004; Jerrett et al., 2005; Norman et al., 2007). Some focused on the linkage between lung cancer and exposure to traffic pollution as a result of *residence* near major

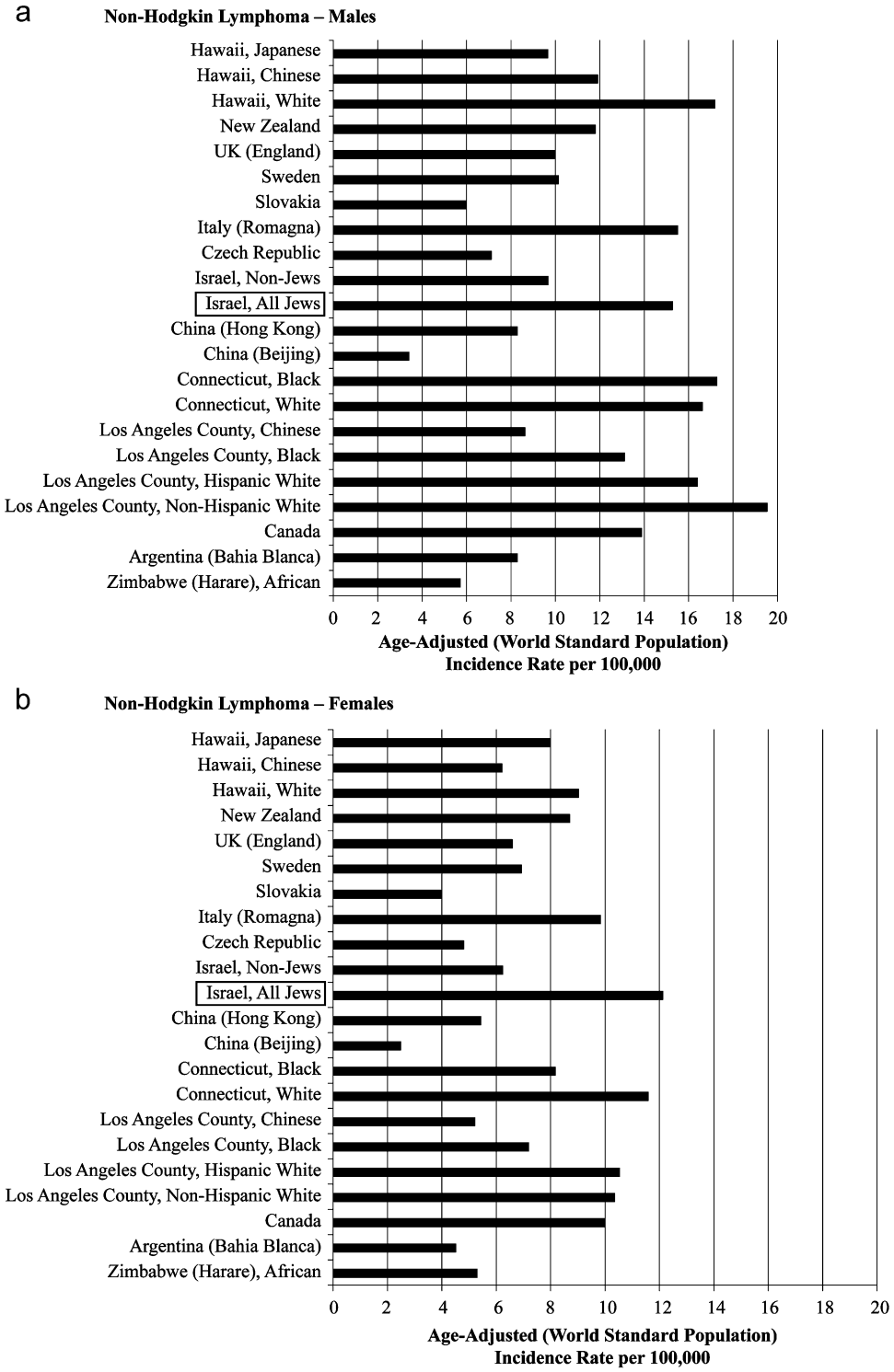

Fig. 1. International and ethnic variability of reported NHL incidence [males (a) and females (b)] from 1993 to 1997. "Israel, all Jews" is highlighted (adapted from Alexander et al., 2007).