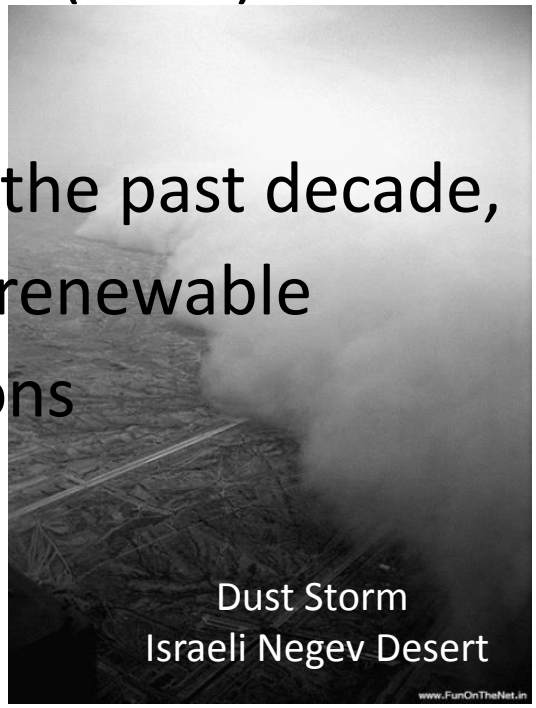
Monitoring and Modelling Air Pollution and its Health Effects: Situation in Israel

Dr. Jonathan Dubnov,
Dr. Izabella Karakis, Dr. Tamar Berman,
Prof. Itamar Grotto, Prof. Shmuel Rishpon
Public Health Services, Ministry of Health, Israel

WHO Task Force on Health Effects of Long-range Transboundary Air Pollution meeting
WHO Regional Office for Europe, European Centre for Environment and Health, Bonn, Germany
14-15 May 2014

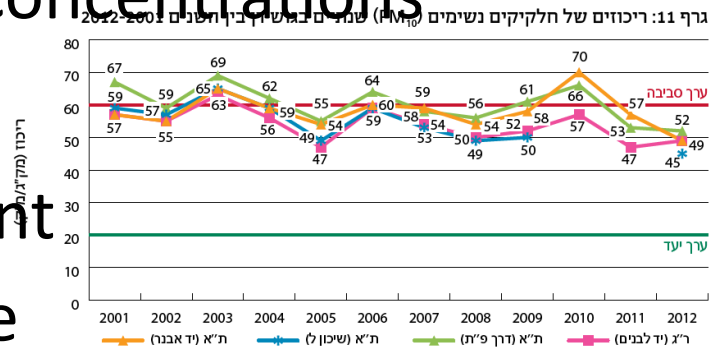
Ambient Air Pollution in Israel (1)

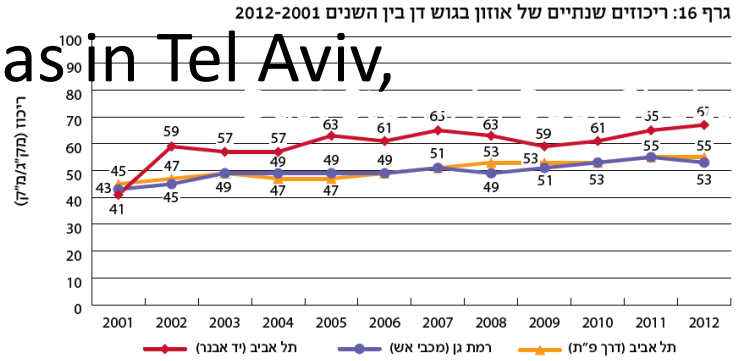
- The main anthropogenic sources of air pollution in Israel are power plants, industry and urban traffic, while dust storms originating in the Sahara and Arabian deserts are main natural source of particulate matter (PM_{10}) air pollution
- SO_2 and NO_X have decreased steadily in the past decade, due to transition to the natural gas and renewable energy sources, the annual concentrations of PM_{10} have remained relatively stable



Ambient Air Pollution in Israel (2)

- The concentration of PM_{10} in Israel is high, to a large degree, from high background concentrations resulting from dust storms
- In the last ten years no significant change in level of PM and ozone
- The 8 hour mean concentrations of ozone exceed WHO 2005 updated Guidelines in many areas in Israel, including large urban areas in Tel Aviv, Jerusalem, and Beer Sheba





Air polluted regions in Israel

- The regions with elevated levels of air pollution in Israel are:
  - Tel Aviv (Gush Dan) and Jerusalem metropolitan area are characterised by high air pollution attributed to traffic;
  - Ashkelon, Ashdod (Southern Israel), and Haifa (Northern Israel) are regions with both traffic and industrial air pollution

Current Legislation

- Environmental air quality is currently regulated by the Clean Air Law adopted in 2008
- Prior to the Law, ambient air quality in Israel was regulated by more than 10 different acts and standards, including the Standard on Prevention of Environmental Damage, adopted to regulate the maximum ambient air pollutant levels, generally less strict than those recommended by the WHO or adopted by the EU

Current Legislation (2)

- Today the Clean Air Law is a main legislative framework for air pollution monitoring with interim regulations establishing air quality values and updated regulations will enter into force in January 2015
- The regulations include environmental values for 27 chemicals, including gases (criteria pollutants), volatile organic compounds, and heavy metals

Air quality standards

- According to the current air quality legislation, the Ministry of the Environmental Protection updates regularly the following set of criteria:
- **Target values** - values based on health risk data;
- **Environmental values** - values based on health risk data but taking into account the technical, scientific and economic feasibility criteria;
- **Alarm values** are extreme departures from the accepted standards, after reaching which, population is alerted.

Air quality standards in Israel

(in units of $\mu g/m^3$)

	2011 interim guidelines	2015 updated guidelines	WHO 2005 updated guidelines
PM10	150 (24 hour mean) 60 (annual mean)	130 (24 hour mean) – with up to 18 annual deviations 50 (annual mean)	50 (24 hour mean) 20 (annual mean)
PM2.5	-	37.5 (24 hour mean) – with up to 18 annual deviations 25 (annual mean)	25 (24 hour mean) 10 (annual mean)
Ozone	230 (half hour) 160 (8 hour)	140 (8 hour mean) – with up to 10 annual deviations	100 (8 hour mean)
Nitrogen Dioxide	200 (1 hour mean)	200 (24 hour mean) – with up to 8 annual deviations 40 (annual mean)	200 (24 hour mean) 40 (annual mean)
Sulfur Dioxide	350 (1 hour mean) 125 (24 hour mean) 60 (annual mean)	350 (1 hour mean) – with up to 8 annual deviations 50 (24 hour mean) – with up to 4 annual deviations 20 (annual mean)	20 (24 hour mean)

The National Program on Reducing Air Pollution in Israel

- As part of implementation of the Clean Air Law, the multi – annual (2012- 2020) “National Program to Reduce Air Pollution” was approved in August 2013, after prolonged negotiations regarding the program budget
- Air pollution reduction activities required by the program include measures on energy production, industry, transportation and household energy consumption

Data on Health Effects / Risk Assessment associated with air pollution

- Nation-wide data are available in the Israel Ministry of Health for several health outcomes associated with air pollution - asthma, cardiovascular diseases, stroke and cancer
- In the frame of the National Program, the burden of diseases associated with exceeding the target values for particulate matter and ozone was estimated to reach 22 billion NIS in 2015 and 24 billion NIS in 2020

Studies on Health Effects of air pollution

- In 2010 - 2014 different Israeli research groups published more than 25 articles on air pollution and health outcomes, incl. studies on childhood asthma, risk of ischemic stroke, post-myocardial infarction mortality, respiratory morbidity, congenital heart defects, and cancer incidence
- Many studies have focused on residents of Northern Israel (the Haifa District) with important contributions in developing new methods for the evaluation of individual exposures

Examples of Researches on Health Effects of air pollution

Environmental Research 124 (2013) 28–34

Contents lists available at SciVerse ScienceDirect

Environmental Research

journal homepage: www.elsevier.com/locate/envres

Air pollution and congenital heart defects

Keren Agay-Shay [a,*,1], Michael Friger [b], Shai Linn [a,c], Ammatzia Peled [d], Yona Amitai [e], Chava Peretz [f]

[a] University of Haifa, School of Public Health, Faculty of Social Welfare and Health sciences, Mount Carmel, Haifa 31905, Israel
[b] Ben-Gurion University of the Negev, Department of Epidemiology and Health Services Evaluation, Faculty of Health Sciences, P.O.B 653 Beersheba 84105, Israel
[c] Unit of Clinical Epidemiology, Rambam Medical Center, P.O.B 9602, Haifa 31096, Israel
[d] University of Haifa, Department of Geography and Environmental Studies, Faculty of Social Sciences, Haifa 31905, Israel
[e] Bar Ilan University, Department of Management, Ramat Gan 52900, Israel
[f] Tel Aviv University, Department of Epidemiology, Faculty of Medicine, P.O.B. 39040, Ramat Aviv 69978, Israel

ARTICLE INFO ABSTRACT

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Spatial analysis of air pollution and cancer incidence rates in Haifa Bay, Israel

Ori Eitan [a], Yuval [a], Micha Barchana [b,d], Jonathan Dubnov [c,d], Shai Linn [d,e], Yohay Carmel [a], David M. Broday [a,*]

[a] Faculty of Civil and Environmental Engineering, Technion, Israel Institute of Technology, Haifa 32000, Israel
[b] Israel National Cancer Registry, Ministry of Health, Israel
[c] Haifa District Health Office, Ministry of Health, Israel
[d] School of Public Health, University of Haifa, Israel

Science of the Total Environment 441 (2012) 265–276

Contents lists available at SciVerse ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Residential proximity to petroleum storage tanks and associated cancer risks: Double Kernel Density approach vs. zonal estimates

Marina Zusman [a,*], Jonathan Dubnov [b,c], Micha Barchana [b], Boris A. Portnov [a]

[a] Department of Natural Resources & Environmental Management, Graduate School of Management, University of Haifa, Mount Carmel, Haifa 31905, Israel
[b] School of Public Health, Faculty of Social Welfare & Health Sciences, University of Haifa, Mount Carmel, Haifa 31905, Israel
[c] Haifa District Health Office, Ministry of Health, Palyam Ave. 15, Haifa 31999, Israel

HIGHLIGHTS

- Lung and NHL cancer risks near a petroleum storage site have been assessed.
- NHL and lung cancer ASRs for small census areas near the site have been estimated and compared.
- Double kernel density (DKD) analysis have been used as an alternative tool for risk assessment.
- ASRs detected no association between site proximity and cancers while DKD analysis detected such an association.
- As we conclude, DKD analysis is a more sensitive method for risk assessment when the number of census areas is small.

Atmospheric Environment 81 (2013) 633–641

Contents lists available at ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

Estimating multi-annual $PM_{2.5}$ air pollution levels using sVOC soil tests: Ashkelon South, Israel as a case study

Marina Zusman [a,*], Josefa Ben Asher [b], Itai Kloog [c], Boris A. Portnov [a]

[a] Department of Natural Resources & Environmental Management, Faculty of Management, University of Haifa, 199 Aba-Hushi Avenue, Mount Carmel, Haifa 3498838, Israel
[b] Israeli Institute of Energy & Environment, Haim Levanon str. 26, P.O. Box 17081, Tel Aviv, Israel
[c] Department of Geography and Environmental Development, Ben-Gurion University of the Negev, P.O. Box 653, Beer-Sheva 84105, Israel

Health & Place 15 (2009) 636–641

Contents lists available at ScienceDirect

Health & Place

journal homepage: www.elsevier.com/locate/healthplace

Short Report

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

Shlomit Paz [a,*], Shai Linn [b,c], Boris A. Portnov [d], Amir Lazimi [a], Boris Futerman [b,c], Micha Barchana [b,e]

[a] Department of Geography and Environmental Studies, University of Haifa, Haifa, Israel
[b] School of Public Health, Faculty of Social Welfare & Health Sciences, University of Haifa, Haifa, Israel
[c] Unit of Clinical Epidemiology, Rambam Medical Center, Haifa, Israel
[d] Department of Natural Resources and Environmental Management, Graduate School of Management, University of Haifa, Haifa, Israel
[e] Israel National Cancer Registry, MOH, Jerusalem, Israel

ARTICLE INFO

Article History:
Received 24 June 2008
Received in revised form
7 October 2008
Accepted 9 October 2008

Keywords:
Non-Hodgkin Lymphoma (NHL)
Road proximity
Traffic pollution

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.

Contents lists available at ScienceDirect

Health & Place

journal homepage: www.elsevier.com/locate/healthplace

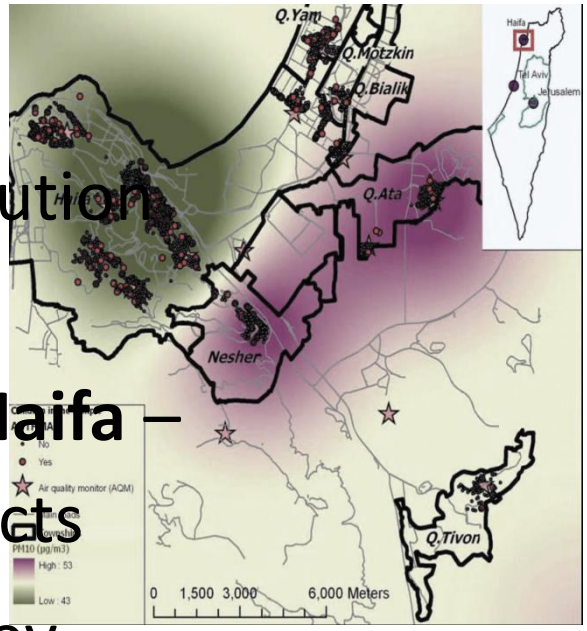
Who is affected more by air pollution—Sick or healthy? Some evidence from a health survey of schoolchildren living in the vicinity of a coal-fired power plant in Northern Israel

Tamar Yogev-Baggio [a], Haim Bibi [b], Jonathan Dubnov [c,d], Keren Or-Hen [e], Rafael Carel [d], Boris A. Portnov [a,*]

[a] Department of Natural Resources & Environmental Management, University of Haifa, Israel
[b] Carmel Medical Center, Haifa, Israel
[c] Haifa District Health Office, Ministry of Health, Israel
[d] School of Public Health, University of Haifa, Israel
[e] Graduate School of Education, University of Haifa, Israel

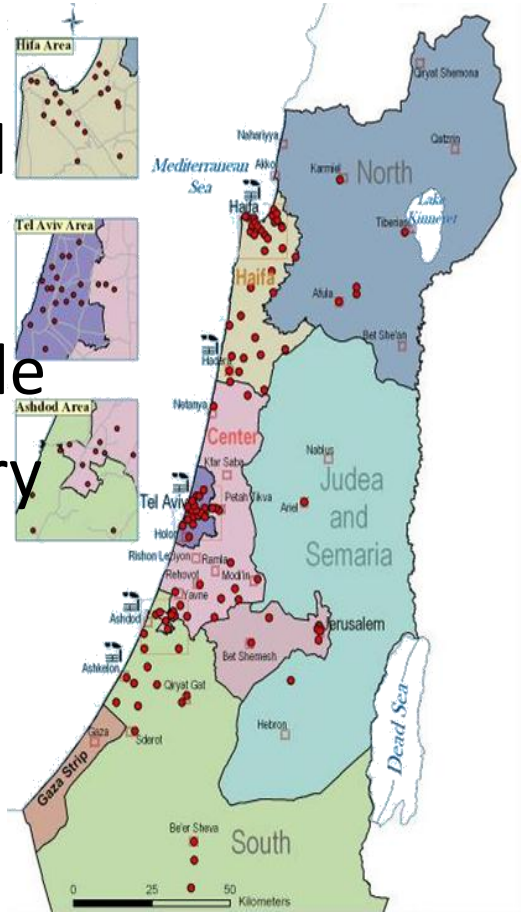
Study Groups

- The **Technion** (TCEEH) – development of exposure assessment tools
- **University of Haifa** – impact of air pollution on children respiratory health
- **Tel Aviv University** and **University of Haifa** – air pollution and congenital heart defects
- The **Ben-Gurion University** of the Negev – effect of air pollution on childhood development



Air Quality Monitoring Network

- The National Air Monitoring System in Israel includes over 130 monitoring stations, managed by governmental and industrial entities
- The data are routinely collected and made available on the website of Israeli Ministry of Environmental Protection - National Monitoring Centre



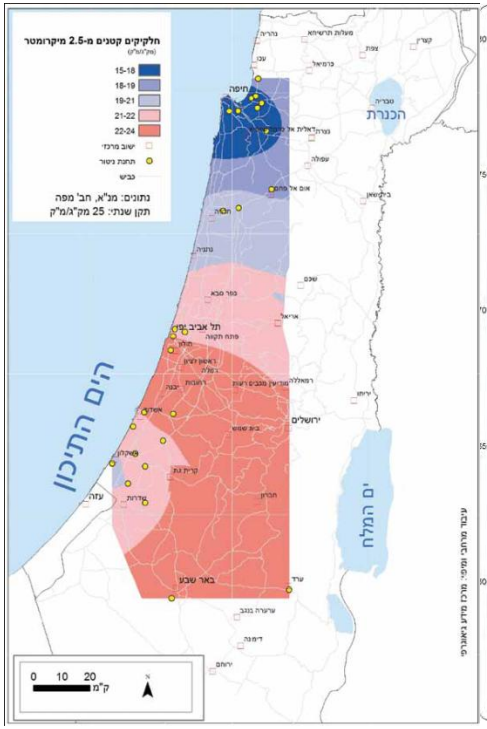
Air Quality Monitoring Network (2)

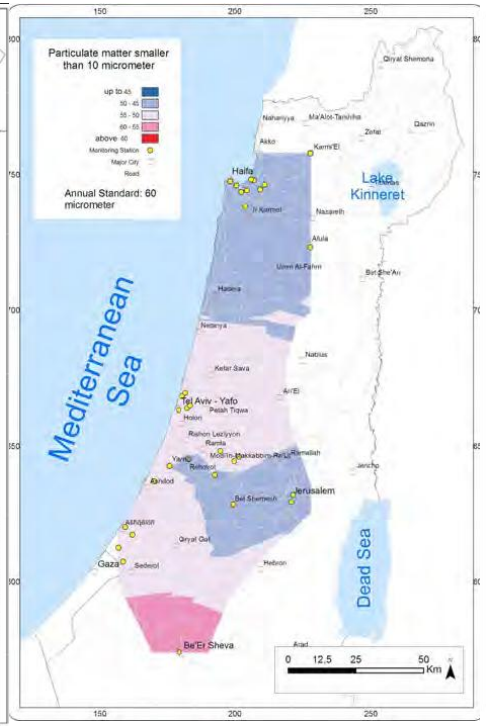
- The Ministry of Environmental Protection maintains two types of monitoring stations: traffic monitoring stations and general monitoring stations
- General monitoring stations measure airborne criteria pollutants: SO_2, NOx, O_3, CO and $PM_{2.5}$ - PM_{10}
- Traffic stations measure primary pollutants emitted from vehicles: NOx, CO, $PM_{2.5}$, and VOCs (benzene, toluene, xylene, ethyl benzene and 1, 3- Butadiene (BTX + VOC))

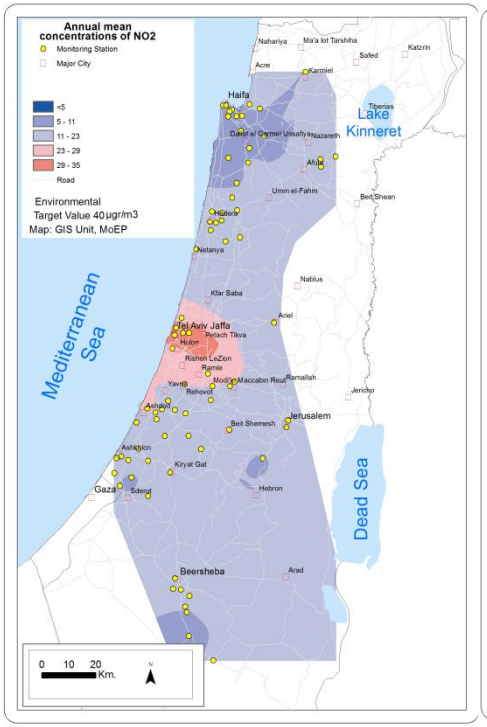
Examples of Air Quality Monitoring Data

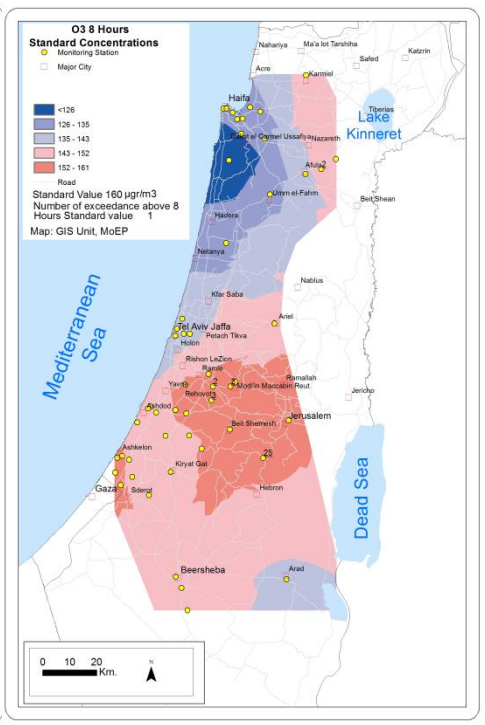
(Spatial variations of major air pollutants in 2012)

$PM_{2.5}$ PM_{10} NO_2 Ozone (O_3)









Progress and Challenges (1)

- Adoption of the 2008 Clean Air Law marks a major progress in establishing a comprehensive regulatory framework for improving ambient air quality in Israel
- As part of this process interim Clean Air Regulations were approved in 2011; updated version of the Regulations were approved in 2013 and will be implemented in 2015
- New standards are expected to result in reduced morbidity and mortality attributable to air pollution

Progress and Challenges (2)

- However, for many ambient air pollutants with major public health effects, observed values are currently higher than the target values
- Both target values and environmental values need to be re-evaluated periodically (e.g., each 5 years) to ensure that Clean Air Regulations are effective

Progress and Challenges (3)

- Adoption of the National Program is expected to lead to major reductions in the ambient air pollution levels by 2020: VOC (30% reduction), SO_2 (68% reduction), NOx (60% reduction), and benzene (85% reduction)
- While emissions of SOx and NOx have decreased in Israel since 2000, ambient air concentrations of PM_{10} and ozone remained stable, especially in metropolitan areas
- PM levels are not expected to change significantly as a result of the National Program

Air Monitoring Network Tasks

- The national air monitoring network in Israel is one of the densest in the world; data are comparable with different systems and widely available to the general public and to researchers
- However, spatial distribution of monitoring stations is uneven and data are still lacking for several geographical areas, especially in the South
- To date, there is no national strategy for monitoring air pollutants that are not monitored continuously, including PM-bound metals, POPs, PAHs, EDCs, and PBDEs

Research Strategies and Health Impact Assessment

- Whereas environmental risk assessment is regulated legally in Israel, health impact assessment (e.g. quarry, mining, oil refining, etc.) depends on voluntary requirements from different governmental entities
- The establishment of comprehensive and lawful process of health impact/risk assessment is necessary for Israeli public health

Research Strategies for Health Impact Assessment (2)

- An important task is to establish a long term epidemiological monitoring framework for observing changes in morbidity and mortality in air polluted areas
- Future research strategies should be focused on studies of causality effect of air pollutants on different health outcomes and on the evaluation of individual exposures

Thank you for your attention!