NEHAP Project CES-2006 – "Cities and Pollution"

Health Impact Assessment of Outdoor Air Pollution

Final report

Suzanne Remy, Institut Scientifique de Service Public
Tim Nawrot, KULeuven

Rapport ISSeP N°08-02418
October 2008

Appendix:

Final report Phase 1
Local city report Brussels
Local city report Antwerp
Local city report Liège
Final report Phase 2
FAQ
Power-point presentation + text
Presentation for citizen (A4 poster)

Letters, questionnaire, PV of steering committee, program and power point presentations of information session,

Introduction

The calculation of air pollution impact on health outcomes such as the number of deaths or number of hospital admissions for specific causes enables to assess both the impact of current pollution and the expected benefits of different policy scenarios for reducing air pollution. The findings issued of the health impact assessment (HIA) are providing appreciable tools useful as well at local and regional levels to support cities and regions policy makers, as at European authorities level by giving a global AP overview to define air quality limit values.

To measure the health impact of air pollution, the European Union has been financing since 1999 APHEIS (Air Pollution and Health: An European Information System) a program for modelling and predicting sanitary impacts related to air quality (APHEIS, 2004). In 2005, the APHEIS program was used to assess the sanitary impact of atmospheric pollution in about 30 urban centres, including accounting more than 46.000.000 inhabitants (ENHIS, 2005).

At the Belgian NEHAP level, the first phase of the project « Cities and pollution » related to this study has for purpose to test and validate the APHEIS methodology at the level of three Belgian cities (Brussels, Liège and Antwerp). Afterwards, these cities could become candidates to integrate the international network of cities and then, take part to the next steps of the APHEIS project.

The second phase of the project « Cities and pollution » aimed to communicate the results to the urban decision makers and to help them to communicate the results to their citizen.

The second phase also includes an evaluation of the project.

1 Test and validation of the APHEIS methodology at the level of three Belgian cities : Brussels, Liège and Antwerpen

In this first section we studied the feasibility and we validate the APHEIS methodology to assess the impact of air pollution in Belgian urban areas.

1.1 Feasibility study

The health surveillance system proposed by APHEIS implies the integration of health and air pollution data on a local urban scale.

The study areas for the three selected cities have been defined according to the “air quality zones” already defined by the European directive and in the regional regulations as areas and agglomerations for air quality assessment and management. Study area of Brussels includes the 19 municipalities [1] of the Region of Brussels Capital, Study area of liege includes 10 municipalities[2] and the study area of Antwerpen includes 7 municipalities[3]. The numbers of inhabitants are respectively 999.899, 428.234 and 567 728 for the areas of Brussels, Liège and Antwerpen. The age distribution of the three cities included in the impact assessment did not differ significantly. The population covered in this health impact assessment includes nearly 2 million inhabitants.

[1] Bruxelles ville, Schaerbeek, Etterbeek, Ixelles, Saint-Gilles, Anderlecht, Molenbeek-Saint-Jean, Koekelberg, Berchem-Sainte-Agathe, Ganshoren, Jette, Evere, Woluwe-Saint-Pierre, Auderghem, Watermael-Boitsfort, Uccle, Forest, Woluwe-Saint-Lambert, Saint-Josse-ten-Noode

[2] Liège, Ans, Herstal, Saint-Nicolas, Seraing, Chaudfontaine, Beyne-Heusay, Fléron, Grâce-Hollogne, Flémalle

[3] Antwerpen, Edegem, Mortsel, Borsbeek, Wommelgem, Wijnegem, Schoten

Common last year available was 2006 for exposure data and 2004 for outcomes data. Consequently the common study period for HIA was chosen as 2004.

At APHEIS levels, air pollution indicators were selected on the basis of the epidemiological studies that provided the exposure-response functions.

Air pollution (AP) indicators : Only urban or suburban background stations should be selected. PM10 and ozone data are available in the three areas. However the number of the monitoring stations per km^2 differs between the study areas. The number and the localisation of the monitoring station may influence the representativeness of the measures for exposition assessment. Air pollution (AP) data are public data. They are easy to obtain in the three areas. The Belgian Interregional Environment Agency (CELINE / IRCEL) has been very efficient.

HIA has been achieved using two types of air pollution indicators for exposition assessment:

- (1)"Measured" air pollution indicators (average concentrations calculated directly from validated measurement values);
- (2) population weighted interpolated AP indicators calculated by IRCELINE.

Mortality data are obtained from death certificates. Mortality data holders are located at regional level.

Hospital admissions data were extracted from the information systems health programs (Résumé clinique minimum, RCM) by the Federal Ministry of Public Health. They are total hospital admissions data including both emergency and scheduled hospital admissions and concerns public and private hospitals.

Both mortality and morbidity were obtained by written request. To get mortality for Antwerp a registration had to be made for the privacy commission

1.2 Health impact assessment of air pollution in Brussels, Antwerp and Liège

Method

HIA has been carried out using the APHEIS methodology[4]. APHEIS developed guidelines for gathering and analyzing data on air pollution and the impact on public health. APHEIS has analyzed the acute and chronic effects of fine particles on premature mortality using the estimates developed by Aphea2 study and two American cohort studies. This health impact assessment was performed for different scenarios on the health benefits of reducing levels of particles less than 10 µm in size (PM_{10}) and ozone.

Calculations were made using the Excel spreadsheet developed for ENHIS-1 project (ENHIS-1, 2005) and APHEIS-3 project (APHEIS, 2004). HIA carried on ENHIS-1 focused on children health impacts and ozone, APHEIS-3 focused more on PM and general population impacts.

Results

Complete results for the three urban zones figure in the “Local city reports”. We present here a summary of the HIA made with interpolated population weighted air data

Concerning the impact of exposure to PM10 in the very short term (48h), short (40days) and long term, in the three areas totalling 2 millions inhabitants, if the outdoor concentration of

[4] http://www.apheis.net/

PM10 is reduced to 20µg/m³, 163 premature deaths including 83 cardiovascular and 43 respiratory death, could be prevented annually if the impact is only estimated over a very short term. The short term impact cumulated over 40 days, would be more than twice as great, totalling 331 premature deaths prevented annually, including 194 cardiovascular and 140 respiratory deaths. And the long term impact would be even higher, totalling 1079 premature deaths prevented annually. This figure accounts for 5.4% of the total mortality.

The impact was the highest in Liège although not significantly different from Brussels or Antwerp. Standardised per 100 000 inhabitants the acute impact ranges from 7 in Brussels to 11 in Liège and the chronic impact ranges from 40 in Brussels to 79 in Liège (figure 1)

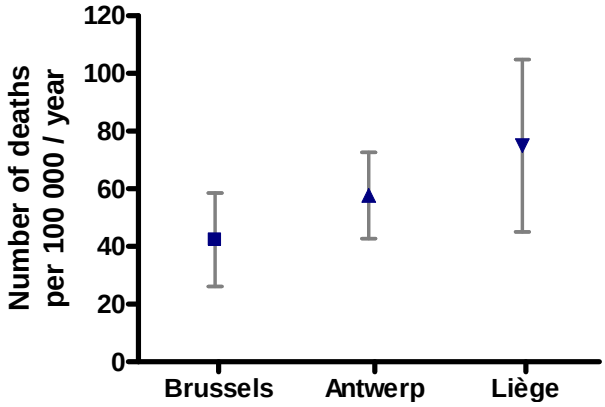

Figure 1: Reduction of annual mean of PM10 to a level of 20 µg/m³ and impact total mortality (chronic exposure).

Infant mortality in Europe is quite low and consequently, the expected attributable number of deaths related to air pollution is also very low. All other things being equal, the reduction of the annual average levels of PM10 to 20 µg/m³ would prevent, for the three areas 2,47 post neonatal deaths (about 10 postneonatal deaths per 100 000 neonates).

Regarding hospital admissions, reducing PM10 daily mean values to 20 µg/ m³ would prevent 561 respiratory and 257 cardiac diseases.

As far as short-term effects of O3 in summer are concerned, all other things being equal, each reduction by 10 µg/m³ of the daily maximum 8-hour moving average concentrations would delay 29,5 deaths per year in the general population for the three study areas, 15.8 from cardiovascular diseases, and 12.6 from respiratory causes.

The above results have to be interpreted keeping in mind the hypothesis, limits and uncertainties underlying the different steps of HIA (see the "Local city reports")

2 Communication of the results to the decision makers and evaluation of the project

Once the local HIA reports were approved by the pilot committee, we started the second phase of the project: the communication of the result to the decision makers of the urban area and the evaluation of the project.

2.1 Communication of the results

The results were presented during an information session holed on January 22nd 2008 and the interest of such information, as a support for the decision making, was highlighted.

After this information session, we prepared 2 communication tools: a first version of FAQ and the written commentaries of the power point presentation. The 4 HIA reports (3 local and 1 Belgian) were sent with the FAQ and the power-point presentation + commentaries to the 37 burgomasters and to the participants at the information session. A letter explained that we were waiting for their opinion about the documents, their needs of additional information's, their suggestions and we proposed them to collaborate to the elaboration of the document dedicated to the citizen. A small questionnaire encouraged the authorities to respond in an easy short and easy way. The sending of the post occurred the 15 of July.

13 municipalities were present and about 20 representatives of the administrations and ministries at the information session. 13 municipalities answered to our mailing.

Several municipalities proposed to include other questions / issues[5]. Three municipalities were willing to collaborate to the elaboration of the document for the citizen. This latter document appeared to be important for the municipalities. Taking into account some advices, we elaborate an "A4 poster" to inform the citizen about the project.

3 Evaluation of the project "Cities and pollutions"

The 2 phases of the project cities and pollution have been evaluated for some aspects.

Concerning the achievement of the HIA in three urban area using APHEIS methodology, HIA could be performed in each of the three areas and for all the selected ERfs. But the results are depending of the air pollution and health indicator. The representativeness of the morbidity, mortality and air pollution indicators are to be improved, this latter especially for the Liège area.

The communication of the results to the decision makers was not very effective. It is difficult to know if this disinterest of the burgomasters is linked to our communication strategy. Many external reasons can explain the low participation of the municipalities. A personalized presentation of the project to representatives in each municipality would probably improve the interest for our results. However, according the 10 questionnaires we get back completed, it seems that the FAQ, the power point presentation + commentaries and the presentation of the project to the citizen will be more useful for the municipalities than the 4 HIA reports.

The project "cities and pollution" has been achieved in a harmonized, scientific and efficient approach. The skills of the partners (ISSeP/ KUL) were complementary and the communication good.

4 Conclusion

Health impact assessment of urban air pollution has been achieved using APHEIS methodology for 3 Belgian urban zones including 20% of the Belgian population.

Health and air pollution data for the year 2004 were available with a reasonable delay for the three areas. APHEIS methodology appears to be an efficient tool to calculate the health impact of air pollution. Nevertheless, results have to be considered like order of magnitude of health impact due to air pollution, based on actual scientific knowledge and local available data.

The two main conclusions for the three areas are:

[5] However those questions were out of the scope of this project.

- Air pollution constitutes a threat for public health. Reduction of annual PM10 levels (as an indicator of AP) would lead to substantial health benefit. 5% of the total mortality is linked with a reduction of PM10 annual mean to 20 µg/m³ proposed limit value for 2010 in 1999/30/EC directive. A more voluntarist reduction of PM10 below 20µg/m³ would even lead to a higher health benefit.
- Chronic impact due to background levels of PM10 is much higher than acute impacts due to peaks. That means that decisions makers have to focus more on a lowering of background level than on daily levels.

The APHEIS methodology provides an important approach in public health to evaluate policies and to determine their actual and potential impacts on public health.

An information session was organized and communication tools were elaborated to improve the communication of the results to the decision makers. This communication focused on the highlighting of such results & methodology as a support to the decision. The responds we got about the communication documents was not a big success but the three communication tools elaborated might be used later by the municipalities when health impact of air pollution will become again the first subject in the newspapers.

The skills of the consortium KUL/ISSeP were complementary, the coordination of the steering committee was strong and the APHEIS methodology was feasible. These synergetic factors lead to a HIA of AP estimated in a harmonized, scientific and efficient way.

5 Recommendations for next steps

The APHEIS risk estimates provide an important approach in public health to evaluate policies and to determine their potential and actual impacts on public health. **The current assessment should be repeated during the next decades on a yearly basis and for all the big cities of Belgium** to evaluate the impact of air pollution on public health in one of the most polluted areas in terms of particulate air pollution of Europe. **An impact assessment of the previous years** will allow a better estimation of the impact of future reductions and would make a comparison with other European cities of which estimates have been reported since 1999.

The cost benefit of a continuous evaluation will be low. With minimal costs data on mortality, morbidity and air pollution can now be used in a highly efficient way to monitor the health impact of changes in air pollution. Using only air pollution levels would not predict the impact on mortality accurately because the effects also depend on characteristics of the population on which the risk function is applied. The ageing of the population might indeed change the health impact at a more fundamental level than changes in the level of air pollution, because the pool of susceptible subjects and therewith the mortality rates are likely to increase. In other words, the health gain of air pollution reductions might even be higher in the future.

Risk functions on the risk of dying of lung cancer are becoming available from large cohort studies in the US. These are based on exposure to $PM_{2.5}$**. In future health impact assessments these estimates could also be used in our population as more monitoring stations on $PM_{2.5}$ become available**. An alternative would be that in future health impact

assessments $PM_{2.5}$ will be converted from PM_{10}. Before, applying this, the conversion factor which is valid for the Belgian situation should be determined.

From 2008 more monitoring stations in the Walloon Region of Belgium will become available so that the interpolation to a population averaged exposure value or the measured exposure value can be predicted at the urban or the regional level with more accuracy. This will allow us to assess the impact not only at the level of the city but also at the regional level.

Finally, removal or decrease of the exposure will reduce permanently the annual number of deaths by the number attributed to the factor. In reality, deaths are merely postponed; estimating **the effect of exposure on life expectancy or reduction is both more straightforward and of greater public health interest**. This has been done for a few APHEIS centers.