Training and specialisation for health care professionals in environmental and health medicine

(call for offer – ref. n° DVZ/cel L&G/YN/2011-001)

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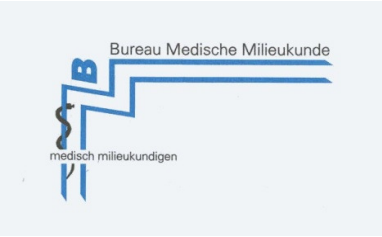

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List of abbreviations

BA	Bachelier/Bachelor
CIMES	Conférence Interministérielle Environnement-Santé (equivalent to GICLG)
CIUF	Conseil interuniversitaire de la Communauté française
CLPS	Centre Local de Promotion de la Santé
CRef	Conseil des Recteurs des universités francophones de Belgique
CPD	Continuous Professional Development
CPSI	Training centre for the nurses and health sectors
DEA	Diplôme d'études approfondies
DESS	Diplôme d'études supérieures spécialisées
ECTS	European Credits Transfer System
ECU	Enseignement Continu Universitaire
EDC	Endocrine Disrupting Chemicals
ETP	Equivalent temps plein (equivalent to FTE)
FTE	Full time equivalent (equivalent to ETP)
FUNDP	Facultés universitaires Notre-Dame de la Paix de Namur
GICLG	Gemengde Interministeriële Conferentie Leefmilieu – Gezondheid (equivalent to CIMES)
GLEM	Groupe local d'évaluation médicale (equivalent to LOK)
INAMI	Institut National d4assurance Maladie Invalidité (equivalent to RIZIV)
LOK	Lokale kwaliteitsgroepen (equivalent to GLEM)
K&G	Kind en Gezin (equivalent to ONE)
K.U.Leuven	Katholieke Universiteit Leuven
NVAO	Nederlands-Vlaams Accreditatie Orgaan
LOGO's	Lokaal (of loco-regionaal) GezondheidsOverleg
MA	Master
ManaMa	Master na (after) master
MMK	Medisch Milieukundige(n)
NEHAP	National Environmental and Health Action Plan
NGO	Niet-gouvernementele Organisatie (equivalent to ONG)
ONE	Office de la Naissance et l'Enfance (equivalent to K&G)
ONG	Organisation non-gouvernementale (equivalent to NGO)
PARES	Plan d'Action Régional Environnement-Santé
PhD	Grade académique de docteur
PPTOX	Persistent Pollutants Toxicity
RIZIV	Rijksinstituut voor ziekte-en invaliditeitsverzekering (equivalent to INAMI)
SCALE	Science, Children, Awareness, Legislation and Evaluation
SSMG	Société Scientifique de Médecine Générale
UA	Universiteit Antwerpen
UCL	Université Catholique de Louvain
UGent	Universiteit Gent
UHasselt	Universiteit Hasselt
ULB	Université Libre de Bruxelles
ULg	Université de Liège
UMons	Université de Mons
VAO	Voortgezette Academische Opleiding
VLIR	Vlaamse Interuniversitaire Raad
VLUHR	Vlaamse Universiteiten en Hogescholen Raad
VUB	Vrije Universiteit Brussel
WHO	World Health Organization

Introduction and context of the project

Environment is an important health determinant.

A clean environment is essential for human health and well-being. The interactions between the environment and human health are highly complex. The main causes of premature death and disability are increasingly resulting from chronic diseases. These disease related to, 'lifestyle'-related conditions, such as obesity, cardiovascular diseases, diabetes, allergies, neurological disorders and cancer appear earlier in life. It has been estimated that 25% of the disease burden can be prevented by environmental improvements, resulting globally in about 13 million deaths per year[1]. Especially foetus, developing children, chronically diseased people and the elderly are vulnerable. Large proportions of deaths and disability in European children are thought to be attributable to outdoor and indoor air pollution, inadequate water and sanitation, lead exposure, and injuries[2]. Moreover there is a large inequity among the population, also in Europe, regarding life style, environmental exposures and health[3].

The uncertainties for attributing environmental factors to diseases are still large. Training and creating alertness of health professionals are essential for adequate monitoring, treatment and knowledge improvement.

Environmental factors are a broad term that covers life style factors, environmental and living conditions as well as chemical exposures. Some of the environmental chemicals have short-term effects on human health. Others, including some heavy metals and persistent organic pollutants, accumulate in the environment. This allows them to get into our food chain. Successful environmental policies have reduced the exposure to harmful environmental contaminants in air, water and food. However, these contaminants are still a problem, and several new health risks are emerging, for example, from new chemicals, new products and changing lifestyle patterns. Global sales of products from the chemicals sector doubled between 2000 and 2009, and there is an increasing range of chemicals on the market, including substances affecting human health. The classical protocols of toxicological assessment are not able to estimate the level of health risk related to low dose, mixture, and early (foetus) exposure to chemicals.

A recent report[4] on Environment and Health published on 30 May 2013 by the European Environmental Agency and the JRC (EEA Report No 5/20130) came to the following conclusions that highlight the importance of the environment for health.

- Poor air quality can have serious impacts on our health and the environment. There is evidence showing the contribution of **air pollution** to cancer, heart disease, bronchitis and asthma and it is estimated that air pollution reduces each EU citizen's life expectancy by an average of 8.5 months. Recent studies of air pollution suggest that exposure in early life can significantly affect adult health, and the effect of air pollution on pregnancy may be comparable to that of passive smoking. Up to 95% of city dwellers are still exposed to levels of fine particulate matter (PM) above World Health Organisation guidelines.
- Exposure to ground-level ozone concentrations above critical **health** levels is associated with more than 20 000 premature deaths in the EU-25 annually.

[1]Prüss-Ustün A, Bonjour S, Corvalán C. The impact of the environment on health by country: a meta-synthesis. Environ Health. 2008 Feb 25;7:7

[2]Valent F, Little D, Bertollini R, Nemer LE, Barbone F, Tamburlini G. Burden of disease attributable to selected environmental factors and injury among children and adolescents in Europe. Lancet. 2004 Jun 19;363(9426):2032-

[3]Braubach M, Fairburn J. Social inequities in environmental risks associated with housing and residential location--a review of evidence. Eur J Public Health.2010 Feb;20(1):36-42.

[4]http://www.eea.europa.eu/publications/environment-and-human-health

- There is growing concern about **'endocrine disrupting chemicals',** which affect the hormone system, found in a wide range of common products including pharmaceuticals, pesticides and cosmetics. Effects are not yet fully understood, but the chemicals may contribute to declining sperm count, genital malformation, impaired neural development, obesity and cancer.
- In Europe, an increasing health concern in relation to **water quality** is pharmaceutical residues and endocrine-disrupting substances, which are not always fully removed by water treatment. Water shortages and water quality issues may be further exacerbated by **climate change**.
- **Noise** can seriously harm health, affecting cognitive development, cardiovascular disease and sleep. Noisy areas are often those with high levels of air pollution, and each factor seems to augment the effect of the other. Noise may affect the health of up to40 % of people living in the largest cities in the EU.
- **Nanotechnology** applications might be an emerging risk, as little is known about the effects of nanomaterials in the human body. This will require an adequate assessment of potential risks, to guarantee the safe production of nanomaterials and their safe use in consumer products.
- **Green spaces** seem to have multiple physical and mental health benefits. There are significant differences in access to these areas across Europe.

Furthermore, there is growing concern about the impact of health care sector itself on environment and health. The equipment, the medical consumables and the medication produce environmental hazards and waste. Also, some behaviours (cleaning products) and medication processes (plastic bags or tubes) can have a health impact on the patients, especially on the youngest ones (babies)[5].

Until now only a few health care professionals (doctors, nurses, midwives …) are aware and/or have been trained specifically to environmental impacts on health both at the individual level and in the more general level of public health. The consideration of the environmental determinant would improve prevention and ensure a more adapted treatment to chronic or acute pathologies.

The general strategic objective of this project[6] is better information and a more complete training of healthcare professionals regarding the environmental health and environmental medicine. This implies the presentation of a multidisciplinary argumentation validated by the public authorities, actors from the civil society and the scientific community to integrate the consideration of the environment as a health determinant into the basic and continuous trainings of health care professionals.

For clarification: the term "**environmental medicine"** relates to the task of diagnosis and individual treatment of patients. This domain is more specifically directed at doctors, while the term "**environmental health"** is also open for other professions and more directed towards 'Public Health'.

Also, environmental health and medicine are usually less interested by acute exposure to specific environmental factors as occupational medicine does and where the link between exposure and health effects is often clear but to chronic exposure to low level of pollution during the whole lifespan, including during pregnancy (cf. Characteristics of environmental medicine in the annex report).

[5] Health Care Without Harm website: www.noharm.org; International Society of Doctors for the Environment website: www.isde.org

[6] Call for offer ref. n° DVZ/cel L&G/YN/2011-001

The operational objectives of this project are:

(1) Define the contents of information concerning the environmental health and environmental medicine to be included into the basic and continuous trainings of healthcare professionals;
(2) Propose a protocol to set up a specialization in environmental medicine in Belgium;
(3) And define, list, develop the most adequate tools intended to be proposed to the healthcare professionals.

This project is implemented in the general framework of the thematic recommendations of the National Environment and Health Action Plan (NEHAP) set up under the aegis of the World Health Organization (WHO) Europe and of the EU Strategy Environment and Health[7].

Such as defined in the specific context of the NEHAP, the environment includes air, soils, water, the flora, the fauna, other than human organisms, the ecosystems, the landscapes and the climate. Within the framework of the NEHAP are also taken into account the indoor and outdoor air as well as the psychosocial or combined effects linked to environmental damages (such as hindrance and smell). On the other hand, the health determinants linked to life habits (such as alcohol, tobacco, food habits) are not concerned since they rather depend on the social sphere. Regarding the protection of the population against the ionising radiations, including radioactive waste, the federal authorities remain the only ones to be competent in Belgium. It is however necessary to remind that these determinants not taken into account by the NEHAP remain important.

In 2003, the first NEHAP (phase 2004-2007) included 7 recommendations establishing the framework to develop projects on environment and health at all levels. Among these recommendations, the sixth stated the necessity "to support the development of courses and specific trainings on the relations between environment and health". These works led to the development of specific plans in Belgium. The Walloon Government adopted on December 12th 2008 a plan of regional actions on environment and health (PARES) where one of the 7 axes aimed to develop specific trainings in environmental health (Axe VI). This axis includes the development of modules for the continuous training (Action 17) and the specific training of healthcare professionals in the areas with sites with high level of risk (Action 18). In the Region of Brussels-capital several trainings addressing healthcare professionals were organized (www.bruxellesenvironnement.be) as well as health and environment forums (February 2000, November 2008) and thematic conferences (for example on indoor air quality and the specific tools developed to address health care professionals and social workers).

February 12th 2007, the Interministerial Conference on Environment and Health (Conférence Interministérielle Environnement-Santé (CIMES)/Gemengde Interministeriële Conferentie Leefmilieu - Gezondheid (GICLG) asked the national Cell for Environment and Health to develop objectives and actions regarding environment and health within the framework of the second NEHAP (phase 2009-2013). The project "Health care professionals and environment" was then defined according to the action 10 of the EU Action plan on Environment and Health (2004-2010) and the Budapest declaration (Paragraph 18) as stated at the WHO conference in 2004[7].

The outline of the project as approved by the CIMES/ GICLG, the project "Health care professionals and environment" includes four objectives:

1. Include a training “environmental health and environmental medicine” in the basic training of the practitioners;

[7] EU. Communication of 9 June 2004 from the Commission: "The European Environment & Health Action Plan 2004-2010" COM(2004) 416 - Official Journal C 49, 28.02.2006.

2. Include a training “environmental health and environmental medicine” in the continuous training of the practitioners;
3. Set up a specialization in environmental medicine (recognized by the SPF-SPSCAE and if necessary by INAMI/RIZIV);
4. Develop specific tools for the environmental medicine: implementation of what already exists or what is under development.

The first two objectives being interconnected, it was suggested to group these four objectives into 3 parts of the project:

1) Define and develop an operational protocol of implementation of the contents in environmental health and in environmental medicine to be integrated into the basic and continuous training of health care professionals;
2) set up a specialization in environmental medicine;
3) Develop the specific tools of the environmental medicine.

These 3 above-mentioned objectives represent the scope of the present project.

Part 1. Proposal of a content for a curriculum in environmental health and medicine

1 Existing trainings in environmental health and medicine and proposal

This section provides an overview of existing trainings in Belgium, Europe and some countries outside Europe. A collection of trainings (including Masters), courses or Continuous Professional Development trainings in public health/environmental health for physicians, nurses and other health care professionals is given.

Methods. Results of European projects PHEEDUNET, 'Training of Professionals (TOP project) and other public sources of training institutes have been used. The websites of all Belgian universities and Superior schools were searched and the content of the training was reviewed for each training year for training or courses related to health and environment. Topics such as environmental health, environmental science, toxicology, occupational medicine, epidemiology, risk communication, risk assessment, etc. were considered as well as courses that could include an environmental health chapter such as courses related to the aetiology of the pathologies.

Results. Universities and Superior schools are the main producers of educational programmes in Belgium related to environmental health. No trainings on environmental medicine have been identified at Belgium universities or Superior schools. Professional associations are the main providers of continuous training. Detailed results for each country are presented in the annexes. Relevant extensive courses with environmental health content for multidisciplinary medical professionals have been identified in Belgium, France, Germany, Greece, Netherlands, United Kingdom. In other countries courses within broader Master Programmes have been identified. Academic and other institutions delivering programmes were identified. It has been assumed that the core public health skills are present in designated public health programmes. Therefore basic public health research skills (epidemiology, statistics, qualitative research, professional skills related to critical analysis and research presentation) as well as general public health skills such as health promotion are assumed to be present in the programmes. For the purpose of this inventory the emphasis was on identifying specific discipline teaching, including Environmental Science, Environmental Epidemiology, Environmental Public Health/Environmental Health, Toxicology, Risk Assessment, Risk Communication,Project Management / Research Management Skills and Crisis Management.

1.1 Introduction

There are several initiatives for training by different partners in the fields of environmental health and environmental medicine.

This section provides an overview of existing trainings in Belgium. The initiatives are limited to those from the last ten years. The domain on environmental health/environmental medicine has developed itself content-wise and looking back further is not really useful since we are still in a learning by doing process (cf. "*We are learning by doing tools*", SCALE Process)(EU, 2004). The inventory of initiatives in Belgium has been as complete as possible. However, the educational field shows continuous changes. First, an overview is given of the universities and Superior schools in Belgium.

There are also some initiatives for trainings in environmental health/medicine known in several other countries. Every initiative is judged on its relevance and feasibility for use at a Belgium level.

The results of a European project PHEEDUNET and other public sources of educational institutes have been used to produce this inventory (PHEEDUNET, 2010). We have looked both at initiatives within Europe and outside Europe, using the internet as source.

1.2 Methodology

1.2.1 Objectives of data collection

The purpose is to describe in details the process of data collection for a collection of trainings (including Masters), courses or Continuous Professional Development trainings in public health/environmental health for physicians, nurses and other health care professionals. The relevant objectives for the data-collection are:

1. Identify training and Continuous Professional Development (CPD) training in the field of public and/or environmental health in the European Union (EU) and other countries addressing medical practitioners (generalists and specialists);
2. Identify training and Continuous Professional Development (CPD) training in the field of public and/or environmental health in the European Union (EU) and other countries for other medical professions.
3. Identify relevant courses within the different schools of medicine, public health and other health care professionals concerning environment and health and environmental health,
4. Develop an overview of programs of training and CPD courses across EU countries that would be exemplary for the Belgian situation.
5. Collect and translate existing registered curricula for the initial training of physicians and for each professional body (for part 1 of the project, chapter 2 on the content of curriculum of trainings).

This inventory was updated until January 2013. A few trainings that were considered the most relevant ones were updated until the end of 2013.

1.2.2 European projects

Information for this report was used from the results of European projects PHEEDUNET (PHEEDUNET, 2010), 'Training of Professionals (TOP project) (TOP, 2011) and other public sources of training institutes. This information relates both to initiatives inside and outside Europe and focuses also to the existing training offer in Belgium. These data were collected three years ago. Some countries have been updated because there was knowledge about a change in the programme or that the training has been successful. Again, no trainings have been identified which had the sole purpose to train medical doctors, except for Germany were a course exists on Environmental Medicine for medical doctors.

The PHEEDUNET project provided a lot of basic information. Therefore the methodology of that project is briefly described here.

The PHEEDUNET project collected part of the information through snowballing methods. Snowballing is a process where information is allowed to grow and be generated from previous or other information. Thus, a primary source (either a person, a web-site or a document) is used. From the primary source, other sources (people, organisations, documents) are identified and from each of these possibly other until either repetitiveness is achieved (all sources keep referring to already identified sources) or the full expectation (all expected sources) has been achieved. The safest end point is repetitiveness as only then is one sure of completeness and is not just self-fulfilment.

According to the objectives, three groups of professionals were identified to collect the information needed. These three groups were:

1. Those in charge of the physician's specialty registration for public health medicine.
2. Institutions (academic or outside) and the main professionals teaching in public health or related discipline areas in environmental health, environmental science, toxicology, occupational medicine, risk communication, risk assessment. This included professional and other organisations such as Schools of Public Health (often outside academic institutions), national and international professional organisations such as International Society of Doctors for the Environment, International Epidemiology Association, International Society for Environmental Epidemiology, EU, WHO etc.
3. Those located in the governmental institutions who are (likely to be) in charge of or creating policy relevant to the practice of public health (environment). These persons were located in Department of Health, Department for the Environment or several other governmental departments depending on the organisation of the country.

So, the PHEEDUNET protocol was to identify for each country one (or several independent) primary source (people, documents, institutes, web-sites) and from these through asking or searching, as many as possible people from the two groups mentioned above.

Once the crucial persons from group 1 (registration people) have been identified, the documentation of any relevant public health specialisations and continuous professional development program was asked for. If this was available in English this would be preferred, otherwise, the original language has been translated if feasible.
Process of data collection in PHEEDUNET was conducted in several phases. First, the protocol for data collection was developed and agreed by the partners. An agreed version was used for the main data collection. Second, each partner in PHEEDUNET conducted the data collection. Third, all partners met to review the progress.
Overviews were produced which could be found on the internet, in scientific literature and reports by organisations dealing with training.
Besides the information from the three groups of professionals the PHEEDUNET project used an extensive search:

1) Search by keywords on the internet;
2) Search by keywords on websites of universities of all EU-countries;
3) Inventory of trainings at producers (organisations) of existing trainings in Public Health.

In addition of the PHEEDUNET data, an extra internet search has been conducted, to see if there were any recent additions to the available information, with the following keywords: training, environment(al) health, public health and environment, environmental medicine and training, curriculum environment(al) and health.

The TOP project interviewed a total of 23 stakeholders from 15 different countries. The goal was to interview these stakeholders on the current situation of training in their country and their views on environment and health training in Europe. Stakeholders were interviewed by means of a structured interview containing the following topics:

- Training in environment and health;
- Job opportunities for professionals;
- Implementation of Training of Professionals (TOP);
- Potential role of the EU in Training of Professionals (TOP).

1.2.3 Belgian inventory

To make the inventory of Belgian trainings within universities and Superior schools we looked at master trainings addressing medical and other health care professionals and masters trainings (for bio-engineers) which are including or could include several topics relevant for trainings in environmental health and environmental medicine. The websites of all Belgian universities and superior schools were searched and the content of the training was reviewed for each training year for training or courses related to health and environment. Topics such as environmental health, environmental science, toxicology, occupational medicine, epidemiology, risk communication, risk assessment, etc. were considered as well as courses that could include an environmental health chapter such as courses related to the aetiology of the pathologies.

The Flemish partner collected information on existing trainings and medical experts through a screening of 4 information sources (as a first group). Potential overlap between these sources is not an issue, on the contrary: it helped as a control mechanism (repetitiveness).

1. The inventory of trainings or related trainings in public health, environmental sciences, environmental specialities, occupational medicine, available at the Vlaamse Hogeronderwijsregister.be, the official data web source for professional and academic bachelors and masters was the primary source. The links to the specific trainings were further used to identify the involved courses on environmental medicine and environmental health and their lecturers. 23 programs and trainings, 55 courses at 5 universities and 2 high schools with environment & health primers have been identified.
2. Flemish partners in environmental sciences trainings that participated in a Dutch-Flemish collaboration on a benchmark for Environmental Sciences.
3. Flemish experts in environmental health within the Flemish Steunpunt Milieu en Gezondheid plus other Belgian experts that have been consulted during 2000-2012 for specific contributions on exposure, health effects, risk assessment, health and mortality registers.
4. The Flemish network of environmental health professionals, the 'Medisch Milieukundigen bij de LOGO's (MMK)', an active network at the regional and local level, was consulted by mail for experience with specific environmental expertise at high schools and professional trainings. No additional sources were identified. Academic contacts referred to dietists.
5. In addition, 7 interviews with representatives of educational programmes at Superior schools (nurses, midwifes, social care) enabled us to check for environment & health aspects in existing trainings at Superior schools.

Experts out of this first group but also the equivalent experts from the other regions and communities that are in charge of teaching roles in environmental medicine and in environmental health could be labeled as 'forerunners' and were invited to the 1st workshop organized in the framework of the project in January 2013 (cf. Part 2 of the present report). Extension to academic experts in the fields of risk assessment, toxicology, nutrition, food safety etcetera would have led to a very large and heterogeneous group (see Flemish inventory). In order to prepare the 1st workshop, a meeting has been organized with Catherine Bouland in January 2013, member of the steering committee and coordinator of the Master in public health with a finality in environmental health at the School of Public Health of the Université Libre de Bruxelles (ULB). The elements of the discussion have been included in the report of the workshop. The forerunners are supposed to have experience with organization aspects of trainings, their content, prospective students and alumni. To complete the list, the snowball method was used. A written invitation by mail was directed to the first group in order to collect additional references through their contact network. A reminder was sent by post a few days later. We received among the Flemish experts feedback of 12 out of 21 initial contacts. All Flemish universities (except for VUB) had at least one positive responder. Face-to-face interviews and information exchange by e-mail with academics after the workshop (5 persons in total) completed

the opinions. For the Flemish Superior schools and in particular the nurses, 7 in depth interviews have been conducted.

In addition, the respondents were also invited to screen the completed list of existing Flemish trainings and related courses.

For the Federation Wallonie-Bruxelles, besides the participation of the 'forerunners' at the workshop in January 2013 (as mentioned above), the consultation of the teachers concerned by the environment and/or health has been also organized through face to face meetings within the different universities and Superior schools: 7 of the 9 Superior schools responded promptly to our invitation and deans from the 3 universities have been consulted. In order to better understand the needs in this field, meetings with the targeted professional associations have also been organized: 7 interviews have been conducted and the reports of the discussions are placed in report with annexes (see annex 8 in the annex report).

1.2.4 International inventory

For trainings in the USA we referred to the National Environmental Health Science & Protection Accreditation Council (EHAC) (EHAC, 2012) which develops and applies accreditation guidelines for institutions of higher education that wish to ensure premium quality education and training of environmental health science and protection practitioners. This organisation provides a list of educational organisations where graduate training can be obtained. Through this list we searched for additional information on trainings.

For the United Kingdom all Master Programme related to environmental health can be found at the website:http://www.postgraduatesearch.com/masters/environmental-health-and-safety/uk/study/postgraduate-browse.htm.

Worldwide Master programmes can be found at the website http://www.university-directory.eu/degrees-programs-courses/Masters-degrees-in-Environmental-Health.html#.UO7emW_wx8E from the University Directory worldwide. Currently there are 80 degrees found in environmental health, 371 in Public Health and 1590 in environmental sciences. It is not feasible for this project to check all these Master programmes for their differences. This list is the most updated list available online related to Master programmes. The list of Masters in Europe that is presented in the report with annexes gives more details but is less updated. Another list is provided by www.mastersportal.eu/countries (search for environmental health). This website gives another overview of most available masters with detailed description, duration and tuition fees.

1.2.5 Inventory curricula

In order to better highlight the gaps in the existing training offered in Belgium regarding environment and health and respond to the requirements of the call for offer, a proposal of content of training addressing different health care professionals (medical doctors (basic training (bachelor and master) and specialisations), nurses and public health professionals[8]) has been developed. The content under the different topics proposed has been further elaborated according to the priorities highlighted in the framework of the EU strategy on environment and health known as SCALE (for Science, Children, Awareness, Legislation and Evaluation)(EU, 2004) which considered some priority diseases (cancer, neurodevelopment diseases, respiratory diseases and air pollution related

[8] Public Health professionals consist of professionals from many fields who analyse the effect on health of genetics, personal choice and the environment in order to develop programmes that protect the health of the family and community (definition American Public Health Association).

diseases), priority pollutants (heavy metals, EDC's,…) and tools (biomonitoring, environmental and health indicators). The results of some main conferences in the field (PPTOX (PPTOX, 2013), Paris Appeal (Paris Appeal, 2013), International Society of Environmental Epidemiology (ISEE, 2013), etc.) have also been reviewed.

For the proposal of the specialisation, a draft curriculum has been built based on the curriculum of the Master Training for Physicians in Environmental Health in the Netherlands, which has been formed based on 25 years of experience and evaluations. The time schedule of this programme has been used as a starting point for deliberations with Belgian experts at the training institutes.

For the training of doctors, nurses and midwives, a draft curriculum has been proposed by adapting the draft curriculum of the Master Training for Physicians in Environmental Health in the Netherlands to the needs of these practitioners (NSPOH, 2012, 2013). A similar curriculum has been proposed in the UK by the Health Protection Agency (PHEEDUNET, 2010). However, a structural training and registration has not been established for physicians. Also, in other countries not specific curriculum for medical students or physicians has been identified.

The content of the training offer has then been compared to the proposed curriculum addressing the same professionals. A table of comparisons has been set up and allowed highlighting the gaps and the existing competencies. The training offer of the schools of public health has been completed by the offer of training for bioengineers and environmental sciences.

1.3 Results

Inventory Belgium

Universities and Superior schools are the main producers of educational programmes in Belgium. However, professional associations are the main providers of continuous professional training for their related group of health professionals and a few small scale initiatives in the field of environment and health have been proposed. We have looked for educational programmes both for environmental health as for environmental medicine.

1.3.1 Environmental health

The universities

The list below gives an overview of the universities in Belgium. Annex 1.2 (Flanders) and 1.3 (Federation Wallonie-Bruxelles) provide an overview of existing trainings, which are related to environment and health. All these trainings can be considered to be trainings for environmental health. A training for Environmental medicine is not found in Belgium. Only a few specific modules and courses, embedded in other academic bachelor or master (and advanced master) trainings, such as medicine, occupational medicine, public health, epidemiology, biomedical sciences do exist.

The following universities exist in Belgium:
HUB-KU Brussel
Vrije Universiteit Brussel
Universiteit Antwerpen
Katholieke Universiteit Leuven
Universiteit Hasselt
Transnationale Universiteit Limburg
Katholieke Universiteit Leuven in Kortrijk

Universiteit Gent
Université Libre de Bruxelles – Free University of Brussels (ULB)
Université de Liège - University of Liège (ULg)
Université Catholique de Louvain (UCL)
Université de Mons
Université Notre Dame de la Paix Namur
Université Saint-Louis Bruxelles

The following university has no medical training: Université Saint-Louis Bruxelles.

Four belgian universities have been identified that provide a master in health and environment:

1. **the University of Antwerp**: "Master in de biomedische wetenschappen: milieu en gezondheidswetenschappen" (120 ECTS);
2. **the University of Hasselt**: "Master in de biomedische wetenschappen: Milieu en gezondheid" (120 ECTS);
3. **the Université Libre de Bruxelles**: « Master en santé publique à finalité Santé Environnement » (120 ECTS) (since 2007) and
4. **the Univeristy of Liège** : « Master en sciences de la santé publique - option Promotion de la santé et environnement » (120 ETCS) (since 2003).

The aim of the Master in Public Health with a "finalité" in environmental health (at ULB) or with the option of promotion of health and environment (ULg) is to train students with different backgrounds, including health care professionals, to public health with a multi-faceted skills profile. The graduates will be able to draw up, implement and assess health effects related to environmental determinants and develop qualitative and/or quantitative research projects. They will also be able to manage and analyse databases and use health information when taking decisions, and will have the required knowledge of epidemiology and method (in terms of statistics and information technology) to implement them. They will also be able to provide training in the health care management and environmental health.
The Master in Antwerp (120 ECTS) is not focused on acquiring clinical skills either, as this is addressed in medicine and pharmacy, but prepares so much for technological or scientific research in a clinical context. The students acquire knowledge and insight in toxicology, epidemiology and risk assessment. The biomedical sciences field of study is a multidisciplinary training with teachers from the faculties of Pharmaceutical, Biomedical and Veterinary Sciences, Medicine and Sciences. At the end of the 1990's this master was established; in the same period a module 'man & environment' of 4 ECTS was made compulsary in the bachelor of Medicine (till 2012).
The Master in de 'Biomedische wetenschappen: milieu en gezondheid' in Hasselt offers a course which deals with biomedical, biological, toxicological and chemical aspects. In addition, the focus is on the social dimension of environmental issues. This master is in existence since 2003.

Superior school professional education in nursing and for midwives

The identified Superior schools of the total of 43 Superior schools in Belgium conducting trainings for nurses and midwives are listed in the annex report 'Overview of existing trainings' as annex 3 as well as their training offer regarding environment and health.

In Belgium, for nurses, 3 levels of diplomas exist:

- Trainings organised at the Superior Schools leading to a Bachelor diploma (A1 level of training);
- Trainings organised at the High School level (high school professional training) leading to a brevet in nursing (A2 level of training);
- Training at the Superior Schools leading to a master diploma.

In Belgium, for midwives, 2 levels of diplomas exist:

- Trainings organised at the Superior Schools leading to a Bachelor diploma (A1 level of training (in Flanders) or a 4 years master (in the Federation Wallonie-Bruxelles);
- Training at the University leading to a specific master diploma (e.g. master in 'de verpleeg- en vroedkunde').

Other organisations
There are a few other organisations that provide trainings for the health care sector. But no training in this field with a structural continuous format has been identified (one shot trainings).

1.3.2 Environmental medicine

Universities
No trainings on environmental medicine have been identified at Belgium universities.

Superior schools
No trainings on environmental medicine have been identified at Belgian Superior schools.

Other organisations
No trainings have been found that have a continuous character.

1.4 Initiatives on environmental health training in Europe

An inventory is made of the different trainings in Europe. Information that has been used has been collected from the European project PHEEDUNET (European Commission Directorate General for Health and Consumers (2011) and the report 'Training of professionals in environment and health'. (Public Health Services Gelderland-Midden/DG SANCO (2011)[9]). Furthermore information has been collected from contacts of course providers in the Netherlands and the United Kingdom.

The detailed results for each country with all the data are presented in tables in the annex report. If available the detailed programme was studied to identify the relevant modules. If they seemed to be present, and details on the content were available, these are presented also. At this time the countries are listed alphabetically as per their English name.

Austria
The detailed results for Austria are presented in annex report 'Overview of existing trainings' annex 1- Table 1). For Austria the search for Master degrees in Public Health is reasonably comprehensive. However, the listing of non-public health degrees may be less so. Austria, like Germany also has a formal education for Environmental Medicine (Environmental medicine) which was also added as it does contain some overlap with the area of Public Health (Environment). The Environmental Medicine courses are listed as one short course. In total nine public health degrees were identified

[9] http://ec.europa.eu/health/healthy_environments/docs/env_training.pdf (2011)

but only one mentions environmental health, none of the other identified disciplines were mentioned. In the four non-public health Masters that were identified, none of the disciplines that were looked for were identified. It should be noted that some of the public health degrees are jointly set-up with other universities including two that are cross-border (one with Germany and one as part of a European Masters).

Cyprus

The detailed results for Cyprus are presented in annex report 'Overview of existing trainings' annex 1- Table 2. For Cyprus one public health degree was identified and this degree is a joint certification with Harvard University in the U.S.A. and requires travelling there. Scholarships are mentioned but this may well be prohibitive for those outside Cyprus.

Denmark

The detailed results for Denmark are listed in annex report 'Overview of existing trainings' annex 1- Table 3. The listing for Denmark may not be complete as it has been an opportunistic search based on some patchy information and some brochures collected at conferences. For Denmark one public health masters was identified which allows for environmental health as an elective but contains no mention of the other disciplines of interest. In total three other relevant degrees were identified which contain some mention of crisis management and risk assessment or sanitation (thus implicitly environmental health) or toxicology and risk assessment but none of the other disciplines that were looked for. For Denmark, several short courses were also identified which were somewhat related to environmental health and ecology.

Estonia

The detailed results for Estonia are presented in annex report 'Overview of existing trainings' annex 1- Table 4. It is unclear if the search for Estonia has been comprehensive and it also seems that some of the degrees and courses that would not be listed for other countries have made it unto the list here such as courses offered within the Medical or related degrees or courses at Bachelors level. However, due to language constraints, it was not possible to check the original websites so no further information could be collected. However, taking the information at face-value it seems that no dedicated public health degrees were identified and that four potentially related master's courses that cover some aspects of environmental health were identified.

Finland

The detailed results for Finland are presented in annex report 'Overview of existing trainings' annex 1- Table 5. For Finland the search showed one specific master programme: Master's Degree Programme in General Toxicology and Environmental Health Risk Assessment at the University of Eastern Finland. The international master's degree programme where students, after common basic studies in toxicology and environmental science can specialize either in general toxicology including toxicological risk assessment or environmental health risk assessment with special emphasis on exposure assessment. The duration of the programme is two academic years. See for programme the annex. The public health master identified does have an environmental health stream and does offer an environmental epidemiology module but none of the other disciplines that were looked for were identified in the public health degree. The non-public health degree does seem to offer toxicology, environmental health, environmental epidemiology and risk assessment but not risk communication or crisis management.

France

The detailed results for France are presented in annex report 'Overview of existing trainings' annex 1- Table 6. The Ecole des Hautes Etudes en Sante Publique (EHESP) does deliver (partly with many other institutions around Europe) a degree that contains a focus on environmental health and also

has options for environmental health including toxicology and risk assessment as well as some indication that crisis management is taught. However, no risk communication and seemingly no environmental epidemiology. This same institution offers many related degrees, none of which seem to mention the disciplines that were looked for even though some seem to concentrate on environmental health issues. However, too little detail was available. The Sorbonne Paris Cité - University Paris Descartes offers a Master in Toxicology, Environmental Health as a 2 year course. The same university also has a Master called: Public Health, Specialty: Public Health and Environmental Risks. This specialization explores the field of research on the relationship between the physical environment and health. The University of Marseille organises a Master in Public Health specialising in society, environment and health stakes (Société, Environnement, Enjeux Sanitaires (SENS)). Over 2 years, the cursus includes notions about the relation between environment and health, toxicology, statistics, sociology and global changes.

Germany

The detailed results for Germany are presented in annex report 'Overview of existing trainings' annex 1- Table 7. The search for relevant information for Germany has probably been quite comprehensive as it was conducted by a German speaker with access to a full list of potential Universities. Germany, like Austria also has a formal education for Environmental Medicine (Environmental medicine) which was also added as it does contain some overlap with the area of Public Health (Environment). The Environmental Medicine courses are listed as one short course. For Germany, nine public health degrees were identified, some of which are offered in collaboration with other institutions, some being located in other countries. Environmental health is identified for two of the degrees but none of the other disciplines looked for were identified. In total 17 potentially relevant master degrees were identified for Germany in this search. However, besides a dedicated epidemiology programme that does mention environmental epidemiology none of the disciplines looked for were identified. The European Academy for Environmental Medicine provides a short course for medical doctors to support them in diagnosis of environmental related diseases. This course is not acknowledged by the Medical Association.

Greece

The detailed results for Greece are presented in annex report 'Overview of existing trainings' annex 1- Table 8. National and Kapodistrian University of Athens (Medical School) provides a Master programme on Environmental Health which is meant for a multidisciplinary audience including physicians, nurses, public health professionals, policy makers ore ecologists. This course runs already for almost 10 years and is quite successful. In annex 18 of the annex report an overview is given of the content of the Master Course at the National and Kapodistrian University of Athens.

Hungary

The detailed results for Hungary are presented in annex report 'Overview of existing trainings' annex 1- Table 9. For Hungary, the information presented may be comprehensive as most major institutions seems to be represented. It identifies 14 programmes in public health at a master's level. Detailed programmes were not available but the general descriptions and lists of topics seem to indicate that environmental health is recognised as a focus. For Hungary two non-public health degrees at master level and two doctoral degrees were identified. All other Masters and at least one of the doctoral programs have an environmental health focus. Also, a specialist training program was identifed with substantial environmental health components. Many short courses were also identified with sometimes environmental content.

Ireland

The detailed results for Ireland are presented in annex report 'Overview of existing trainings' annex 1- Table 10. In Ireland the search has shown some new master trainings in environmental health and safety and one in Occupational health.

Italy
The detailed results for Italy are presented in annex report 'Overview of existing trainings' annex 1- Table 11. For Italy the search has been diificult due to language issues. Some information was identified through brochures collected at conferences or an informal network. For Italy two potentially relevant master-level degrees were identified but these contained no references to environmental health or any of the other disciplines that were looked for. Also, three short courses were identified but these were only methodological in nature.

Lithuania
The detailed results for Lithuania are presented in annex report 'Overview of existing trainings' annex 1- Table 12. However, due to language constraints, it was not possible to check the original websites so no further information could be collected. However, taking the information at face-value it seems that two public health degrees were identified one which does mention environmental health. Two potentially relevant non-public health masters were also identified with clear environmental labels, one even listed as 'environmental health'. However, the level of detail was insufficient to check for the presence of the disciplines that were looked for. In total 13 potentially relevant short courses were also identified with some mention of epidemiology, toxicology and risk assessment.

Malta
The detailed results for Malta are presented in annex report 'Overview of existing trainings' annex 1- Table 13. For Malta, two courses were identified, one a dedicated public health degree. This degree is closely associated with programmes in the UK and uses the UK-Faculty of Public Health Medicine exam format. The other degree identified is concerned with health care management and does not contain any mention of environment at all.

Netherlands
The detailed results for the Netherands are presented in annex report 'Overview of existing trainings' annex 1- Table 13a. In the Netherlands there exists a training on Environmental health for medical doctors since 1986. In 1989 the profession of environmental health for doctors has been recognised as speciality within social medicine. The speciality is considered a sub speciality of the main domain "Community Health". This training programme has a general part "Community Health" that takes two years and a part environmental health of two years. This latter part also includes practical field work.

For the Netherlands, three public health master degrees were identified with only one mentioning risk communication (as a 'one of' course module). For the Netherlands a total of 16 potentially relevant master level degrees were identified. Between these degrees, course modules on risk assessment, environmental epidemiology, toxicology and risk communication are available but no general environmental health or crisis management. Also, two short courses were identified but neither one mentions the relevant disciplines. These trainings are open to different disciplines within the biomedical sciences.

Norway
The detailed results for Norway are presented in annex report 'Overview of existing trainings' annex 1- Table 14. For Norway a complete list of Universities had been supplied and the websites of the universities were all available in English even for those courses presented in Norwegian only. The information of all non-arts universities was searched but the 'Høgskole' were not as it was assumed these were predominantly courses at bachelor's level. For Norway a total of seven public health masters were identified. Some environmental health (sometimes seemingly as a strong focus) was present but none of the other disciplines that were looked for. For Norway five potentially relevant

non-public health masters were identified and between them toxicology and environmental health (including perception) were present but none of the other disciplines that were looked for.

Poland

The detailed results for Poland are presented in annex report 'Overview of existing trainings' annex 1- Table 15. For Poland, one public health degree was identified which has environmental health but does not mention any of the other disciplines that were looked for. Another non-public health degree was identified but this does not mention health.

Portugal

The detailed results for Portugal are presented in annex report 'Overview of existing trainings' annex 1- Table 16. For Portugal, the search may well have been comprehensive. In total four public health master degrees were identified, three of which mention environmental health, one also environmental epidemiology but none of the disciplines that were looked for were identified. Also, two non-public health masters were identified and they included environmental health, environmental epidemiology and some toxicology and risk assessment but no risk communication or crisis management.

The Slovak Republic

The detailed results for the Slovak Republic are presented in annex report 'Overview of existing trainings' annex 1- Table 17. For the Slovak Republic the search may not have been comprehensive but one relevant not-primarily public health degree was identified. This degree does contain toxicology and risk communication but there is no mention of any of the other disciplines that were looked for.

Spain

The detailed results for Spain are presented in annex report 'Overview of existing trainings' annex 1- Table 18. For Spain very many potentially relevant degrees seem to have been identified but many were classified as 'signatures of degrees'. As limited information is available for most of these degrees, these are not further discussed. For Spain 10 public health master degrees were identified from three main institutions. Of these three mention environmental health and environmental epidemiology and are likely to contain toxicology and risk assessment but there is no mention of risk communication or crisis management. In total three non-public health master degrees were identified that seemed relevant and between them they have environmental health, toxicology, environmental epidemiology and risk assessment but again no mention of risk communication or crisis management. A total of five short courses were identified but limited detail is available.

Sweden

The detailed results for Sweden are presented in annex report 'Overview of existing trainings' annex 1- Table 19. For Sweden the search showed some elective courses within Master's of Public Health on Occupational and Environmental Health.

Switzerland

The detailed results for Switzerland are presented in annex report 'Overview of existing trainings' annex 1- Table 20. For Switzerland, the search for relevant information has probably been comprehensive for the German speaking part of Switzerland but likely to have been less so for the French, Italian and Raetoromanish speaking parts. For Switzerland, four public health master degrees were identified, one of those delivered through a collaboration of three universities. This particular collaboration delivers course content containing environmental health but the other disciplines are not mentioned even though it is known that it is present at the participating universities. None of the other disciplines are mentioned in the context of the other degrees. For Switzerland two non-public health degrees are identified but again the relevant disciplines are not mentioned.

United Kingdom

For the UK, the results are presented in annex report 'Overview of existing trainings' annex 1- Table 21. For the UK, the master level public health degrees were identified using Google. The search term used was Public Health and the hits that were academic units given the address or description were identified. In total 40 Google pages were scanned on 01/06/09. To those identified in this manner were added the names of institutions not found through this but known to colleagues or lists such as those provided to National Health Service employees (NHS Education South Central http://www.publichealthcoursesguide.nhs.uk) as being public health degree providers. Public health degrees were those labelled public or population or community health or those that had a component of that in the title of the degree.

The degrees were analysed using the information available on the web and summarised in Table UK-1. The main aim of the analysis was to identify the components that would be relevant for the Public Health (Environment) education as identified previously. In total, 63 public health master degrees plus some additional related degrees were identified for the UK. Of these, 13 degrees have some of the disciplines that were looked for and between those 13, environmental health, environmental epidemiology and crisis management would be available and probably toxicology and risk assessment. However, risk communication most probably not. However, not one degree has all of them.

For all institutions identified, the list of taught postgraduate courses were also scanned for health science, health research, environmental health, toxicology or related courses. These were also separately identified using address lists for mailing out books and searching through Google. However, the number of courses got so large that the evaluation has not at all been comprehensive. A minimum of 45 related degrees were identified after a severe cull of the many hundreds of Google hits. Some crisis management components were identified as well as risk management (and probably assessment) but even if an explicit environmental health degree, health was often not mentioned and mostly the other disciplines that were looked for were not present. Again not one degree had all we were looking for.

Besides the master level degrees, some professional doctoral degrees were identified. These are of interest as they tend to be of a more applied character for the research and often contain coursework components. Also the programme for specialisation and a substantial number of relevant short courses were identified. Most of the short courses are accessible for people from outside the UK but this is not entirely guaranteed since some of them are in-house courses for those employed within the wider health structure of the UK.

Other countries

The detailed results for other countries (Bulgaria, Croatia, Czech Republic, Iceland, Latvia, Lichtenstein, Luxemburg, Rumania, Slovenia, Turkey) were sought but not identified. This does not imply that these countries do not have any relevant courses, only that tduring this project we were not able to identify them.

For some of these countries such as Bulgaria, the project team was explicitly informed that no formal training for public health exists at the level we were expecting it.

1.5 International

One of the aims of EU project number **2006335** entitled 'A European network for the training and development of public health (environment) physicians (PHEEDUNET) was to identify training and

CPD programs for Public Health and Environment physicians in each country as well as those provided by the regional bodies like the EU and WHO (PHEEDUNET, 2010).

Teaching according to the context of PHEEDUNET is defined as formal coursework (teaching) as part of public health or other programmes such as Masters of Public Health as well as short courses. These are often delivered by academic institutions but also sometimes by professional organisations or others. This is distinct from training which is often contained in in-house programmes of supervised practice.

The information was mainly collated from web pages produced by the organisations themselves. To facilitate the process given all the languages encountered, the information was translated into English (if not readily available in English) by those reasonably familiar with the language. However, these translations were not given back to the institutions to check as the project did not allow enough time for this to happen.

As much as possible, all information for a country was collected, for some countries this meant that a Google search was conducted, for others a complete list of Universities was collated and relevant pages form their websites identified. For some countries, all that was available were incidental brochures collected at conferences or other sources of information. The method of searching is described per country to indicate the completeness of the information. The current project has made additions were available.

Academic and other institutions delivering public health and other (master) programmes were identified. It has been assumed that the core public health skills are present in designated public health programmes. Therefore basic public health research skills (epidemiology, statistics, qualitative research, professional skills related to critical analysis and research presentation) as well as general public health skills such as health promotion are assumed to be present in the programmes. For the purpose of this inventory the emphasis was on identifying the presence of specific discipline teaching. The disciplines that were identified as specifically relevant are:

- Environmental Science
- Environmental Epidemiology
- Environmental Public Health / Environmental Health
- Toxicology
- Risk Assessment
- Risk Communication
- Project Management / Research Management Skills
- Crisis Management

The components of the (masters) programme are referred to as courses in this document. These can be dedicated short courses or part of (master) programmes. Please note that in some of the descriptions copied into this document other terms may be used. As much as possible, the word module is used if the course delivery is in time-compressed or limited to a specific time frame, so weeks or weekend blocks.

The description of existing trainings in other countries than Belgium are given in annex 1.1. and for outside Europe in annex 1.6.

2 Choice of targeted health care professionals

A selection has been made of those professionals for whom a specific training in environmental health or environmental medicine would be beneficiary. There are two categories:
a. doctors
b. other medical professionals (nurses, nursing aids, physiotherapists, midwives, etc).

Methods. For each different health care professional the potential pathologies related to the environment they can encounter in their practice is identified according to the scientific literature. A focus group of general practitioners provided additional information on their needs. Additional information of Medical associations has been used to complement the described need for health professionals. Literature provides examples of medical associations that have conducted their own training programmes for their own speciality, e.g. the International Pediatric Association.

Results. In Belgium the medical occupations are described in the Royal Decree n° 78. For each medical speciality the proposed competence in the area of environmental health is described. For different medical professions the knowledge about certain living conditions is already integrated into the basic training. Knowledge in the field of environmental health means getting a clearer picture of the causal relations with external exposure factors. Also other medical professionals have benefits of being trained in environmental health to enable diagnosis and treatment.
There are different professional groups that are eligible for training in environmental health and/or environmental medicine. This applies to education about environment and health as an introduction in the general training or doctors, nurses, auxiliary nurses etc. and to training within the further specialization of health care professionals.

Several specialties are considered with the highest priority to be educated in environmental health during their training: General practitioner, Neurology, Internist, Pneumology, Gastro-Enterology, Cardiology, Paediatrics, Gynaecology Obstetrics, Dermatology, Medical Oncology, Occupational medicine, Social medicine, including school medical officers. Other medical professionals (nurses, nursing aids, physiotherapists, midwives) need similar basic training in environmental health during their basic training. Adequate training in basic curriculum of environmental medicine (focus on individual health care) is recommended for all doctors. This training deals essentially with knowledge about individual health care related to environmental related diseases or disorders.

However, for the purpose of this project, the steering committee, after deliberation at the January 2013 meeting, decided to focus the next steps of the project (course content, feasibility) to the following health care professionals: general practitioners, paediatricians, gynaecologists, pneumologists, allergologists and cardiologists for medical specialists; nurses in public health promotion, paediatrician nurses and potentially nurses in promotion of environmental health and midwives.

2.1 Introduction

For each health care professional group and specialist, we described the specific interest for environmental medicine and health in their own practice. For clarification: the term *environmental medicine* relates to the task of diagnosis and individual treatment of patients (Paris Appeal, 2012). This domain is more specifically directed at doctors, while the term *environmental health* is also open for other professions and more directed towards 'Public Health' (WHO, 2012).

In this section an inventory has been made of the different professionals in the health care sector. A selection has been made of those professionals for whom a specific training in environmental health or environmental medicine would be beneficiary. There are two categories:

a. doctors ;
b. other medical professionals (nurses, nursing aids, physiotherapists, midwives, etc.).

For the nursing profession the focus is on those who work in the fields of paediatrics, obstetrics and in the general practitioners domain (e.g.: public health, and in some cases home care).

The applied method has been gathering information from medical organisations and describes experiences from other countries. Furthermore, the collection and analysis of literature was done on the links between environmental factors, environment related diseases, target groups and medical specialties.

Finally, information has been gathered from a focus group and interviews including non-medical professionals, but who have worked in the environmental health field.

2.2 Methodology

In order to better understand the need for the different health care professionals to be trained in environment and health, we identified, according to the scientific literature, for each medical speciality and health care professional, the potential pathologies related to the environment they could encounter in their practice. We also identified how these professionals would be able to understand and/or interact with the environment of the patient and the role they are already playing or could play in this field.

A focus group with general practitioners has been organised within the SSMG in order to better understand their expectations. The debate has covered questions such as: has the environment a place in your practice? Do you think that you have a role to play? What are the priorities in terms of training organisation (basic training, specialisation and continuous training)? And in terms of content? What could facilitate or not facilitate your role? What tools would be useful to you and support you in your practice regarding environmental or potentially environmental related diseases? The report of the discussions is joined in annex 3 of the report of the project.

A focus group with non -healthcare professionals but actors in environment and health has also been organised in order to better understand how to fit the action of the health care professionals within the network of stakeholders active in environment and health and improve the use of already existing tools in the field of environmental health by health care professionals (cf. Reporting of the focus group in annex 3).

2.3 Results

2.3.1 Literature

There is a limited amount of literature on the introduction of knowledge in trainings in the field of environment and health for different medical professional groups. There is more literature available for other professionals groups.

Different organisations have been outspoken on the necessity of training medical professional groups in the field of environment and health. There are sometimes medical professional organisations or sometimes more publicly oriented organisations. Some examples follow of medical professional organisations that have called for more attention in training professionals on health issues in relation to the environment.

Internationally WONCA (global organisation for general practitioners) has stated that the environment is important for the health of people. WONCA has a working group that deals specifically with problems related to the environment. See box 1.

WONCA Special Interest Group on the Environment

The WONCA SIG Environment is a group of family doctors interested in the relationship between human health and the environment; some with just interest, some with more expertise. **Areas of potential interest include:**

- Climate change, Ozone depletion and health
- Air pollution: Indoor and outdoor
- Clean water and sanitation
- Chemical pollutants, including lead, mercury, pesticides etc
- Radiation, noise
- Children's environmental health
- Endocrine disruptors
- Cancer and the Environment
- the built environment and health

Box 1: WONCA (source WONCA 2012)

In Belgium, Domus Medica conducted for general practitioners and other interested professionals a day with presentations on the consequences of disturbances of the environment and its effects on public health (Domus Medica, 2010). Domus Medica states that general practitioners are confronted in their practice often with environmental problems. It can be a difficult task and search to find the right tools for diagnosis and treatment to reduce allergic reactions in young children or to reduce the uncomfortable effects of chronic airway disease.

The International Pediatric Association (IPA) made clear that paediatricians have to be trained in environmental related aspects (IPA, 2012). It is difficult to distinguish between such objectives between environmental health and environmental medicine. To get more clarity on this distinction, reference is made to the section on the inventory of the national and international initiatives in the field of the training environmental health and environmental medicine.

The American Academy of Pediatrics (AAP) has worked towards training of its members through different activities (AAP, 2013). This includes specific courses where paediatricians can obtain registration points (see example in box 2). Furthermore, the AAP produced policy recommendations on different topics that concern the health of children. So the AAP made policy recommendations in the field or air pollution and the indoor environment.

This PediaLink Essentials course, Asthma Case Studies: Environment and Comorbid Conditions, consists of a collection of case studies featuring patients of various ages and ethnicities and from various cultures who have or are being considered for a diagnosis of asthma. The cases in this series highlight helping patients identify and reduce exposure to relevant allergens and irritants and control factors that affect asthma, including: inhalant allergens, occupational exposures, irritants, and comorbid conditions.
According to the National Heart, Lung, and Blood Institute (NHLBI) guidelines, patients who have asthma and are exposed to irritants or inhalant allergens to which they are sensitive may experience increased asthma symptoms and asthma exacerbations (NHLBI, 2013). Patients and their families should be actively involved in finding out what makes their asthma worse and implementing appropriate control measures.
It is important to provide asthma education and to encourage self-monitoring and self-management at every opportunity. Patients require the skills and knowledge to recognize early signs and symptoms of worsening asthma and to adjust their medications accordingly.
Following are the cases included in this course:

- Refractory Asthma
- Sinusitis and Asthma
- Environment and Asthma
- EIB with Asthma and Allergic Rhinitis

Box 2: AAP course example (AAP, 2013)

Other specialties have less clearly spoken out for environmental education. A search on the internet yielded little information. However, some specialties deal at their congresses occasionally with topics about diseases that may have a relationship with environmental factors. Examples are pesticides and disorders of the nervous system (Neurology), asthma (Paediatrics), autoimmune diseases (internal medicine)(AAN, 2013)(AAP, 2013).

2.3.2 Analysis

Different occupational groups for which it is desirable that they have knowledge on environmental health or environmental medicine are described in this section. On the base of the information collected through literature, feedback through the audit groups, the EU Strategy on Environment and Health and evaluations on environmental health trainings in the Netherlands, the following analysis is made (GGD Kennisnet, 2013).
For different medical professions the knowledge about certain living conditions is integrated into the basic training. Knowledge in the field of environmental health means getting a clearer picture of the causal relations with external exposure factors.

The purpose of using this knowledge is to diagnose faster and more adequately the health effects related to environmental factors. There is less added value in more clinical health education for medical specialists. Health care professionals lack knowledge about the exposure factors and interaction with environmental stressors. In this area additional training is needed. Education of medical doctors, nurses and midwives contributes to a more adequate communication to patients (and their families) about risk factors in environmental health. This gives the patients the capacity to reduce their exposure to environmental stressors and to increase self-monitoring and self-management of their own disease (example: indoor exposure). The medical professionals play a part in addressing the concerns in the community. Doctors and other medical providers can help to reach out to other professionals for solving environment and health problems.

In Belgium the medical occupations are described in the Royal Decree n° 78 (Koninklijk Belsuit, 2012). The definitions that are specified in that decree serve as reference for the description of the different medical professions. The general legal basis for the approval of the medical profession doctors is set in the Royal Decree nr. 78 of 10 November 1967 with regard to the exercise of the medical professions and in the subsequent provisions and Royal Decrees. These regulate the permission for doctors who are authorised in Belgium to practice medicine and whose degree was endorsed by the

competent authorities. Among the doctors authorised to practice medicine are understood those to be the holders of a Belgian legal diploma of 'arts' (designation according to the most recent legislation on 31/12/2010) or "Docteur en médecine/dokter in de geneeskunde", or those from a country of the European Union where this degree has the equivalence with the Belgian title (in accordance with the Directive 74/60/EEC. 2005/36/CE or 9 September 2005). The doctor should also be registered at the Belgian Order of Physicians and receive a "numéro d'ordre".

The doctors are classified into the following main categories:

- certified general practitioners,
- general practitioners in training,
- approved medical specialists,
- specialists in training,
- doctors with special competence (in addition to their first speciality professional title),
- doctors with special competence in training,
- doctors without special recognised professional title.

General practitioners

General practitioners are basically generalists and see many patients with a variety of disorders. They are both curative as preventive active.

For environmental medicine tasks, it is important that they can diagnose and treat people in a timely and adequate manner. The problem is that many diseases cannot as such be related to environment factors, or are multi-causal. Many disorders are treated symptomatically. It is therefore possible that a causal exposure factor is not acknowledged, and therefore that a disease persists or recurs after initial treatment. It is desirable that a general practitioner has sufficient knowledge of such diseases (Stumpel, 1990). This knowledge concerns the recognition of environment related diseases and the treatment.

For environmental health it is important that the general practitioner has general knowledge of diseases that can occur in clusters at a common exposure. But it is also important to recognize disorders related to exposure in the individual or in the family setting. To this end, it is desirable that the general practitioner has sufficient knowledge of the living environment to be able to ask the right questions to the patient. Early diagnosis can be an important feature (Ontario College of Family Physicians, 2012) . Moreover, it is necessary to improve the knowledge of health practitioners to make them partners in the communication to the public. The training for the practitioners has to be created for general training on different medical domains.

Specialized doctors

The General legal basis for the recognition of doctors-specialists is contained in three decisions, namely:

• the Royal Decree nr. 78 (B.S. 1967) (Koninklijk Besluit, 2012).

• the Royal Decree of 21 April 1983 on the fixing of the detailed arrangements for recognition of doctors-specialists and general practitioners (Belgian Official Gazette of 27 April 1983)

• the ministerial order of 30 April 1999 laying down the general criteria for the approval of doctors-specialists, supervisors and 'stagediensten' (Belgian Official Gazette of 29 May 1999).

In addition to these three basic laws there are different ministerial decrees that contain the special criteria for the recognition or doctors-specialists, supervisors and 'stagediensten' for the different specialties.

The specialists recognised are:
Anaesthesia and resuscitation
Surgery
Neurosurgery

Plastic surgery
Orthopaedics
Urology
Neurology
Psychiatry
Neuropsychiatry,
Psychiatry, more determined for the Adult
Psychiatry, more determined for the child and adolescent
Internal medicine
Cardiology
Gastroenterology
Rheumatology
Pneumology
Urgency medicine
Intensive care
Paediatrics
Geriatrics
Gynaecology-Obstetrics
Oto-Rhino-Laryngology
Ophthalmology
Stomatology
Dermato-Venerheology
Physical medicine and Rehabilitation
Clinical biology
Radio diagnosis
Radiotherapy
Nuclear medicine
Anatomic Pathology
Medical Oncology
Occupational medicine
Management of Health data
Forensic medicine
Insurance medicine and Medical Expertise

In the ministerial decrees (from 1979 to and with 2007) are stipulated the special criteria that must be met by specialists (cf. listing of these decisions in annex). These special criteria deal with the description of the training and internship and describe the components of the theoretical and clinical study. This is a determination of the substantive disciplines and skills. There is no connection made with diseases. On the basis of this formal criteria no relationship can be made between the basic knowledge of specialists and the necessary knowledge in signalling and treatment of environment related diseases or disorders. The school health doctors are not in the list of specialties. However, they are described in the section below.

In the following sections the medical disciplines are described that treat diseases that have a possible relationship with the environment. This description is based on experience of doctors working in the field of environmental health/environmental medicine. The description is not an exhaustive list of possible case histories.

Paediatricians
Paediatricians are specialists who deal with a lot of different diseases, some of which are specifically for children. Children are more vulnerable in certain periods of their lives and also more sensitive to

exposure of factors in their environment. It is important that paediatricians have knowledge on those factors.

In the field of environmental medicine it is important that doctors know how to treat certain diseases that find their cause in the immediate vicinity of children. The treatment of asthma is a clear example. It is important that the paediatrician can recognize diseases that are related to an exposure in the environment. To this end, it is desirable that the paediatrician has sufficient knowledge of the living environment to be able to ask the right questions to the patient. A better knowledge of the direct living environment of the patient should enable the paediatrician to support or enable actions or to support campaigns in terms of environmental health (within the public health area).
The cooperation between the general practitioner, which has a better knowledge of the specific living conditions, environment and knowledge on his patients, and the paediatrician is paramount.

In the USA different hospitals are setting up centres specializing in the field of the environmental health and medicine. The Boston Children's hospital has for example developed a full service multi-disciplinary clinic specializing in paediatric environmental health issues (Pediatric Environmental Health Center at Boston Children's Hospital, 2012). More than 700 children and families are seen annually in the clinic. These types of clinic allow making the link between chronic diseases and environmental exposure and therefore propose remediation measures.

Pneumologist/Allergologists
Pneumologists are specialists who deal with a lot of different conditions on the respiratory tract. The airways are in particular under the influence of many different substances that are inhaled. It is important that the pneumologist knows how certain conditions are causal in the environment and how these must be diagnosed and treated. In the field of environmental health it is important that the pneumologist has knowledge on the exposure of his patients and how preventive measures can help in the prevention of complaints.

Internists
The internist is engaged in preventing, diagnosing and treating diseases of the internal organs. This includes kidney disease, allergic disorders, blood disorders, infectious diseases, gastroenterology and liver diseases, metabolic/endocrine disorders and cancer. Many internists have specialised in certain disorders and call themselves therefore also allergologist, pharmacologist, blood transfusion doctor, endocrinologist, haematologist, oncologist, nephrologist, immunologist, infectious diseases doctor, intensivist, elderly health care doctor or cardiovascular medical specialist. For most of these specialists it is of interest that the doctor knows what role the environment factors play as a cause or a condition.

Knowledge of environmental health can help the internist to recognize, such large-scale problems as clusters of certain disorders. In the table below more information is given about the cardiologist and the oncologist to specifically identify conditions they could face.

Dermatologist
Dermatologists deal with disorders of the skin. Some skin conditions have a relationship with factors of the outdoor environment where people can be exposed to. It is important that the skin doctor has knowledge of causal factors of skin conditions and the treatment thereof. For a number of disorders it is important that a causal factor can be taken away to realise recovery or healing of a condition.
Knowledge of environmental health may assist the dermatologist to recognize large-scale problems, like clusters of certain disorders. In addition, the skin doctor can better instruct the patients about the approach of their own living environment to prevent disorders.

Gynaecologists

The gynaecologist is dealing with organs and diseases that are specific for woman and possibly also with infertility problems within a couple. Furthermore, the gynaecologist is involved with pregnancy issues and obstetrics. Environmental medicine is limited to a number of disorders in which the environment plays a part.

Environmental health plays a great part in the preventive task to protect the unborn child. Knowledge of environmental health can help the gynaecologist to recognise problems such as clusters of certain congenital disorders. In addition, the gynaecologist can better instruct pregnant women about how to deal with their own living environment to prevent disorders in their children. Some aspects that are of interest: infertility, endometriosis, breastfeeding and early developmental disorders ("dohad" vision: Developmental Origins of Health and Disease. See box 3 below). Gynaecologists can also advise on questions about breastfeeding (trade-offs at signals about dioxins in breast milk).

From: *Eunice Kennedy Shriver* National Institute of Child Health and Human Development **Developmental Origins of Health and Disease**
Overview. Our nation faces a crisis of increasing chronic disease on an epidemic scale that will reduce the health and welfare of our citizens and will impose ever increasing financial burdens on society. The outcomes arising from chronic diseases have their roots in fetal and early childhood development. These include obesity, type II diabetes, insulin resistance, cardiovascular and atherosclerotic disease, dyslipidemia, and cognitive and behavioral disorders. Moreover, these diseases do not await adulthood to manifest, but rather appear now as chronic disorders in childhood and adolescents. Such disease burdens are predicted to affect the majority of young Americans in the coming few decades. The current focus of research infrastructure on what some view as reductionist science may limit our ability to conduct meaningful research that fully addresses the complexity of translating nearly three decades of understanding into public policy. We believe that we now have the scientific potential to significantly increase disease-free status of our society, but our ability to execute this change is hampered by lack of organizational structure and public support. In addition, mechanisms by which new scientific information can be translated and fully disseminated to the public are few.

Box 3: DOHAD (NICHD, 2012)

Neurologists
Neurology is the speciality that deals with the nervous system. For environmental medicine there are interfaces with the occupational medicine. There are disorders that affect the nervous system which are seen in certain professions. In a smaller part of the cases, such disorders also occur with exposure to substances in the environment. For environmental health the neurologist may have more knowledge on factors that can cause or worsen neurological disorders, for example heavy metals or solvents. Some disorders that are likely to be of interest are: Parkinson's disease or Alzheimer's disease, and behavioural disorders.

Emergency room doctors
Emergency room doctors have to deal with intoxications due to incidents or due to deliberate intoxications. Disorders are usually acute of nature and concern both local and systemic conditions. The care or Emergency room doctors falls more under the acute care services, which involves more medical disciplines. But it may make sense that SEH-doctors have more knowledge of chemical compounds and their properties. They play perhaps a role in discovering of clusters related to acute exposures.

Surgeons
In PubMed no environment related diseases were found in which surgeons are involved in the diagnosis and the follow-up of the patients. Surgeons themselves in their own operating room can cause environmental pollution. At 'electrocautery, laser tissue ablation, and ultrasonic scalpel' methods for tissue dissection occurs ' surgical smoke ' with ultra-fine (< 100 nanometre) and fine

particles (<1 micrometer). Electro-cauterization and argon plasma tissue coagulation methods produce a high concentration of (> 100000 cm^3) particles with a diameter of 10 nanometre to 1 micrometer. The peak concentration is of short duration for ultrafine particles and a few minutes for lower concentrations (Barrett, 2004).

Nose Throat Ear-doctors
NTE-doctors have to deal with conditions in the area of throat, nose and ear. Related to the environment are particularly noise related diseases of interest. These specialists can play a part in signalling new problems.

Psychiatrists/psychologists
Psychiatrists and psychologists have to deal with patients who have stress related diseases. Some environmental stressors can cause behavioural disorders. The psychiatrist should be aware of such influencing factors.

School medical officers
School medical officers are the doctors that see children outside their own living environment at school. The school medical officers form an important connection to other (medical) aid workers. School medical officers are important for screening of disorders on the area of environment and health. There is a training for youth health care (see list Flanders). School medical officers would eventually play a didactic part in the training of environmental health issues.
There are also training opportunities within ' l'Office de la Naissance et l'Enfance', an organization with a major focus on children below 3 years old and not at school yet (see list of the existing training courses in Wallonia and Brussels)(ONE, 2012). Its mission is to contribute actively to the well-being of young children and their families by rendering services on the policy fields preventive family support, child care and adoption. The Flemish counterpart is 'Kind en Gezin' (K&G)(Kind en Gezin, 2012).
All specialists described above should be able to include in their practice environmental medicine diagnosis.

<u>Other medical professionals (nurses, nursing aids, physiotherapists)</u>

Pharmacists
Pharmacists are concerned with providing medication. Medication can cause related problems of allergy and other conditions. Also pharmacists can have an alert function by signalling a spatial or temporal over-use of certain medications (possibly linked to an exposure to environment factors). They can report changes in the use or medication. A basic training in environmental health is therefore likely to be useful.

Nurses
Nurses are faced with patients who have diseases due to exposure to environmental factors.
Nurses act at various levels. They intervene as a prevention measure in the framework of the school medicine, the antenatal consultations and the early childhood (organized by the ONE and Kind and Gezin (K&G)) or in the follow-up of the elderly and persons with chronic diseases. They enter very often the living environment of the patient and can have quickly a holistic view of the person within his indoor and outdoor environment. A better understanding of the potential sources of exposure of the patient (indoor and in the local environment) constitutes an complementary asset essential to integrate into their basic training as well as in specialisation such as in paediatrics, community health, ONE, oncology and breast-feeding (Leyla, 2004; Rogers, 2004). Besides their role in prevention and detection of potential sources of exposure at the place of residence of the patient, they can also play a role in hospitals either next to the patient or in the environmental management of the hospital and

the sustainability of the organisation (for instance choice of materials and products used: plastic bags, cleaning products, syringes, etc.).

Nursing Aids
The activities of nursing aids consist in helping patients who are unable to take on their own elementary needs in their everyday life (wash themselves, get dressed, eat,…) but they also intervene into the framework of hospital hygiene. They work in close collaboration with the nurses. They thus enter, as the nurses, the place of residence of the patient and can, if they benefit from a knowledge regarding potential environmental sources of exposure, play an important role in prevention for example with regards to the choice and use of cleaning products safer for the respiratory health. Again, in hospitals they can play a role next to the patient or in the environmental management.

Physiotherapists
Physiotherapists can also intervene at the place of residence. Respiratory physiotherapists (early childhood) could act at the same time on the curative and preventive level. Other physiotherapists could play an indirect role in alerting the medical doctor or local nurses if they were identifying a potential risk with regard to environmental health either related to the patients dwelling or to the local environment. Some physiotherapists intervene also specifically all around the birth in the framework of antenatal and postnatal consultations, they can play in this case an important role in prevention while addressing exclusively pregnant women and young mothers.

Midwives
Midwives have to do with the care of the pregnant women and the unborn or newborn child. The midwife should be able to give advice for reducing risks due to exposure to environmental factors. Signal function, consulting and diagnostics are or interest.

The following table 1 shows the different medical professional groups with the existing training, the diseases found in which these disciplines may be involved and the possible services that they can provide. These aspects are all of interest for the adoption of the competency profile and the requirements of the desired training. This is not an exhaustive list.

Discipline	Existing trainings	Environmental diseases in practice	Services
General practitioners	In 1998 11-day course on indoor environment related diseases (Wallon)(not continued)	Broad spectrum of disorders	Prevention Signal function; Cluster detection; risk perception, First responders care; part of 'surveillance '; Community-Based Risk Assessment, Patient Assessment; Individual and collective risk communication
Pediatricians	Limited international	Lead poisoning, asthma, allergies, ADHD, early onset puberty, obesitas, metabolic disorders	Allergy/Immunology Diagnostics, lung function testing, risk assessment at population or individual level
Pneumologists / allergologists		Lung diseases; Asbestos-related	Diagnostics; 'early warning system' signalling
Dermatologists		Allergic skin diseases, melanomas	Diagnostics; Skin-testing
Internists		Organ related diseases	Diagnostics

Oncologists		Cancer	Diagnostics; (Genetic) counselling; signal function; registration cancers
Cardiologists		Heart- and vascular diseases	Diagnostics; signal function
Neurologists		Lead poisoning; mercury poisoning; diseases related to volatile compounds; pesticides; intoxication;	Diagnostics; Chelation therapy
Gynaecologists		Congenital disorders; hormone related effects at per- and trans generational levels; some hormone related diseases; breastfeeding; infertility; early puberty; epigenetics, DoHaD	Diagnostics; Prenatale screening; counseling; reporting congenital disorders; (EUROCAT?)
Psychiatrists	-	Autism? ADHD? depression	Differential diagnosis
Nurses	short courses related to intoxications; ad hoc	All diseases	Signal function; prevention; hygiene; sanitation of housing conditions (COPD)
Pharmacists	-		Advise function, signal function
Nursing Aids	-		Advise function, signal function

Table 1: Existing trainings (see annex)

Other professionals

It is important for this group of professionals to identify the starting point chosen for training. In other words what training is appropriate for initial training or continuing education. This can be independent (focused on specific target groups), thematic oriented (focused on specific disease patterns) or area oriented (focusing on the issues in a region). Based on experience from other countries it is of interest to train people based on academic or Superior school level. The field of environment and health has many technical components or leans on technical subjects for interpretation, for example the interpretation of measurements.

The focus group organised in collaboration with the Centre Local de Promotion de la Santé Brabant Wallon (CLPS) brought together different stakeholders and highlighted professionals that would be concerned by necessary training in environment and health (cf. annex 3 in the annex report)(CLPS, 2012).

2.4 Discussion and recommendations

There are different professional groups that are eligible for training in environmental health and/or environmental medicine. This applies to education about environment and health as an introduction in the general training of doctors, nurses, auxiliary nurses etc. and to training within their specialization or in the framework of continuous training. This kind of training will contain broad general and more specific topics. The training within the basic medicine course might probably lead to logistical problems (see Part 2 - Feasibility part of the report).

For training purposes, from a practical point of view, the courses to introduce the field of environmental health and environmental medicine could be merged. The level and the content of the training should refer to the identified training needs for different disciplines based on the specific

diseases that may have an environmental cause and that they may encounter in their practice. The proposed training contents are developed in the next chapter.

For a large group of specialists it is possible to name diseases or causes that have a relationship with exposure to environment factors.
Social medicine (Public Health), with amongst them school medical officers are not specifically mentioned in the list of the 36 medical specialities, but these specialities are also important in the domain of environmental medicine/environmental health.

The following specialties are the specialities that are considered with the highest priority for education in environmental health during their training. This list has been discussed within the focus groups, with the steering committee (at the January 2013 meeting) and with stakeholders interviewed in the course of the project.

- General practitioner
- Neurology
- Internist
- Pneumology
- Gastro-Enterology
- Cardiology
- Pediatrics
- Gynaecology Obstetrics
- Dermato-Venerheology
- Medical Oncology
- Occupational medicine
- Social medicine, including school medical officers

The steering committee, after deliberation at the January 2013 meeting, decided to focus the next steps of the project (course content, feasibility) to the following health care professionals:

- 5 medical doctors specialists:
  - General Practitioners
  - Paediatricians
  - Gynaecologists
  - Pneumologists, allergologists
  - Cardiologists
- 3 orientations for nurses:
  - General nurses
  - Paediatrician nurses
  - Nurses in promotion of environmental health : NEW – to be developed
- Midwives

Environmental medicine (focus on individual healthcare)

Adequate training in basic curriculum of environmental medicine (focus on individual health care) is recommended for all doctors. This training deals with knowledge about individual health care related to environmental related diseases or disorders. This knowledge focuses on diagnostic and treatment. So far, there is a limited amount of knowledge available in scientific literature that is specifically dealing with environmental medicine.

Specialists

An introduction to the field of environmental medicine is desirable during the training to specialist. Further training of specialists during and after their specialization is desirable for GP's, paediatricians,

neurologists, internists (e.g., cardiologists, endocrinologists, nephrologists, oncologists, allergists, immunologists, pneumologists), dermatologists, gynaecologists.

A limited introduction before and during the training as specialist is desirable as minimal knowledge about environmental medicine for all other specialists that are not mentioned above.

Particular case of General practitioners
– Introduction on environmental medicine during training and continuous training. For general practitioners it is desirable to have knowledge, on environment-related diseases that can occur in patients.

Environmental health (focus on public health care)
Sufficient training in basic curriculum for all doctors and/or other health care professional groups is required. To what extent and how to divide this education over the basic training or within advanced training needs to be studied.

Specialists
- Introduction during the training as specialist.
Option for further training for specialists after their specialization: paediatricians, neurologists, internists, dermatologists, gynaecologists, pneumologists, medical toxicologists, emergency doctors. They can be taught additional knowledge about environmental hazards that are linked to diseases they might encounter within their field of speciality.

Particular case of General practitioners
- Introduction during training. For general practitioners it is desirable to have knowledge on environment related diseases which can occur in clusters. In the training as general practitioners enough attention has to be given to this.
- Continuous training after registration as general practitioner. The general practitioner plays a role in risk-detection and individual and collective risk communication.

Other professionals
Nurses, midwives and paramedical professions.
Nurses and other healthcare professionals need to be trained in both environmental medicine as well as in environmental health. This depends on the position they have with their employer and whether they have to deal directly with patients or not. They will normally get an introduction during their basic training. Additional training can also be introduced.

Other professionals in the field of environmental health can also be trained. Professionals such as persons trained in biomedicine or otherwise skilled persons should be eligible. It then proceeds to a further training or extended to a master program. The possibilities for this have not been subject of this report.

In the table 2 a summary overview of different medical professions and the corresponding desired training is provided. This overview is formulated on the basis of the available knowledge on the area of case histories, literature and experience from the professional groups in environmental health. The input on case studies is based on literature, mainly environmental health handbooks, but also on practical experience by the project participants. Workshops in an international setting of professional organisations (e.g. Paediatric Association, General Practitioners' organisation) provided input on required and possible training needs for their constituents. Finally, evaluation feedback on training in environmental health in countries where trainings exist for health care professionals has been used (Netherlands, United Kingdom, Germany, Greece)(see annex for detailed information)(PHEEDUNET, 2010).

This information has been used, next ton the structure of the existing training of medical professionals to make a proposal for scheduling training on environmental health.

	Environmental medicine (individual care, diagnostics, treatment)	**Environmental health (population level, prevention, signalling, problem solving)**	**Continuous training**
Basic doctor	Yes, in the first three years	Yes, in the first three years, limited	Not applicable
General practitioner	Introduction during basic training	Only short introduction during training	Continuous training; Option as several short courses on different relevant topics
Specialist	Introduction during training as specialist	Option	Option for some specialities; continuous training in environmental medicine related to the speciality of the professional to be trained
Nurse	Yes, short courses in training	Option, depending of speciality	Option for some specialities; continuous training in environmental medicine related to the speciality of the professional to be trained, e.g. respiratory diseases
Health care professionals	Yes, short courses in training	Option, depending of speciality	Continuous training in environmental medicine and environmental health, based on preventive public health care issues
Non medical professionals	no	Yes, included in training	Continuous training in environmental health;Consider the development of a complementary Master

Table 2: summary overview of different medical professions and the corresponding desired training

3 Content of curriculum

The relevant content of a curriculum for medical and health care professionals should reflect the practice of disease patterns and health effects caused by environmental factors.

Method. Interviews and/or questionnaires were used to contact medical professionals and their teachers in particular to collect data about their current and desired skills and knowledge on environmental health/medicine in relation to their own speciality. The disciplines identified for an environmental curriculum would be:

- Environmental Science
- Environmental Epidemiology
- Environmental Public Health / Environmental Health
- Toxicology
- Risk Assessment and Communication
- Project Management / Research Skills
- Crisis Management

Developing a curriculum in environmental health/medicine also requires thoughtful specification—in concrete and, preferably, behavioural terms—of what graduating medical students should know, be able to do, and be sensitive to in the area of environmental health. These "competencies" should also reflect related societal and patient needs.

The expanded focus of environmental health provides the opportunity to involve more clinical specialties in the teaching of environmental health, such as paediatrics, obstetrics/gynaecology, and geriatrics. The competencies needed for clinical training in environmental health are provided. This leads to speciality modules, fundamental themes, environment components and specific environment and health themes as the proposed training modules.

Within the two kind of educational domains: environmental health and environmental medicine, there are different levels of training and professionalization available.. A proposal of content of training addressing different health care professionals: medical doctors (basic training (bachelor and master) and specialisations), nurses and public health professionals has been developed based on existing curricula in the Netherlands, Greece and the United Kingdom. Suggested topics are given in tables in the annexes. After speciality training for each medical specialist it is foreseen to have some continuous professional development (CPD).

3.1 Introduction

The relevant content of a curriculum for medical doctors and health care professionals such as nurses and midwives should reflect the practice of disease patterns and health effects caused by environmental factors.

In Europe these factors should be more or less the same. Differences might be expected due to some differences in climate zones, where people spend more or less time indoor. Individual differences in health effects are greater due to life style, work surroundings or behaviour.

The integral relationship between the environment and health implies the active participation of knowledgeable physicians in both clinical and community contexts. In 1988, the Institute of Medicine (IOM) in the USA examined the role of primary care physicians in occupational and environmental medicine and called for enhanced physician training and education in this area. Noting that primary care physicians are often the health professionals of first contact for patients with environmentally related illnesses, the IOM suggested that, "as a minimum, all primary care physicians should be able to identify possible occupationally or environmentally induced conditions and make the appropriate referrals for follow-up" (Institute of Medicine, 1988).

Today's challenge for medical students is to develop the knowledge and skills they will need to deal effectively with environmental health issues in clinical care and public health contexts. Doing this within the confines of an already stressed and overcrowded medical curriculum is not an easy task.

3.2 Methodology

Several methods were applied to collect information about a curriculum in environmental health for health professionals.

Interviews and/or questionnaires were used to contact medical professionals and their teachers in particular to collect data about their current and desired skills and knowledge on environmental health/medicine in relation to their own speciality. Additionally, information was collected from literature and other projects on training in environmental health/medicine.

*Information from other projects and/or EU-report*s

The PHEEDUNET project stated that the curriculum cannot be seen separate from the competencies that are needed for physicians in general and more specifically for those for public health doctors (specialist in social medicine) (PHEEDUNET, 2010). It was envisaged that by identifying such competencies, a country can identify what they themselves cannot offer due to country size or lack of current professional availability so potential trainees can take these courses elsewhere. Only the UK and Dutch programme are sufficiently detailed to allow for this insight. It should be noted that both are described in competencies in the PHEEDUNET report and in section 3.3 of this report; and that both require some skill and multi-discipline combination to actually achieve the competencies. However, when combining the two countries, the specifically identified disciplines are considered essential for an environmental curriculum would be:

- Environmental Science
- Environmental Epidemiology
- Environmental Public Health / Environmental Health
- Toxicology
- Risk Assessment and Communication
- Project Management / Research Skills
- Crisis Management

The final bullet point depends on the structure of the medical system and the foreseen role of physicians in crisis management. It is not specifically highlighted in the description for this project by the National Cell Environment and Health (FPS (FOD/SPF).

There has been no general curriculum at the medical faculties at universities identified in any European project on environmental health or environmental medicine.

Literature

A limited amount of studies have been conducted to look at the state of environmental health/medicine related trainings. We focus on trainings or courses of substantial duration and content. Short courses of 1 or two days are not considered here.

Medical schools have been slow in teaching students how to recognize and intervene in occupationally and environmentally related illnesses (Goldman, 1999). In this article, the efforts are described at one medical school, in which an occupational medicine physician teamed with medical school educators developed, implemented, and evaluated an environmental/occupational medicine (EOM) curriculum that was introduced in several locations, using a thematic approach. This effort resulted in new EOM content being added to eight core courses in a developmental sequence and the creation of several elective experiences. They described techniques and strategies that might be useful at other institutions in promoting the EOM theme and improving communication. Occupational/environmental physicians and educators can play leadership roles in raising interest in EOM within the medical school setting and in developing and implementing an EOM curriculum.

Shanahan (Shanahan, 2000) surveyed all the medical schools in Australia and New Zealand in order to determine the amount of teaching devoted to occupational and environmental medicine in the medical courses in 1998. A 100% response rate was achieved. The results showed that the number of hours devoted to these topics varied widely, but averaged 12.8 h and 10.5 topics. The most significant factor accounting for the variability was the presence on the universities' teaching staff of individuals trained in the practice of occupational medicine. While our findings show a greater time devoted to these topics than those of similar studies in the United States and Britain, the absolute time remains limited when compared with the prevalence of occupational medicine problems in the community. There is little congruence in terms of both content and assessment processes between schools.

Some other background information on related studies can be found in the text boxes below.

Abstract Frazier LM, 1999

To help primary care residency programs develop or improve residency curricula in occupational and environmental medicine, the National Institute for Occupational Safety and Health launched a train-the-trainer initiative. This project was called EPOCH-Envi (Educating Physicians in Occupational Health and the Environment). From 1990 to 1996, 46 2-day curriculum development workshops were held. These featured (1) guidelines on how to plan, implement, and evaluate a curriculum, (2) continuing education on occupational illnesses and injuries, (3) a worksite or environmental site visit, and (4) information resources. A total of 435 faculty from 305 residency programs participated, representing 42.5% of the family practice residencies and 24.9% of the internal medicine residencies in the United States. A survey conducted among attendees (60.4% response rate) 17 months after their workshop revealed that 65.6% of respondents had added lectures on occupational and environmental topics to the residency curriculum. Other curriculum improvements were also made. Primary care physicians manage most patients with occupational and environmental health problems or concerns. Providing technical assistance specifically designed to support occupational and environmental health education in primary care residencies can have a positive impact on curriculum content.

Abstract (Wiseman, 2009) Scientific evidence suggests that children may be especially vulnerable to environmental hazards. However, medical professionals are often unable to effectively diagnose and treat environment-related illness in patients. To rectify this, many have called for improved post-secondary education and training opportunities in this field in Canada. This study aims to assess the state of education and training for healthcare professionals in children's environment and health, identify related gaps and barriers, and develop recommendations for improvement. Survey participants indicated three primary barriers to the integration of children's health and environment topics in current curricula: a lack of available expertise in the discipline in Canada, a lack of perceived importance of the topic, and a lack of financial and institutional support. A concerted effort must be undertaken to overcome the identified barriers to produce a cadre of healthcare professionals skilled in children's health and environment.
Abstract (Eckstein, 2001) Well-rounded instruction in occupational medicine as part of family medicine residency training is feasible through a program that balances a longitudinal curriculum of monthly occupational and environmental medicine (OEM) lectures, community-based OEM patient care, and worksite assessment. Such training would help equip family medicine residents to integrate occupational medicine into their practices, which, in light of a shortage of board-certified practitioners in OEM, would help fill community needs. The Intern-Resident Training Committee of Carson City Hospital in rural Michigan established both learner and institutional goals and objectives for such a program of instruction. A learner-needs assessment found appreciable interest among the residents for occupational medicine training. In addition, results of a survey of the occupational health community suggested there is inadequate coverage of OEM in medical schools and residencies. Furthermore, a focus group of occupational health managers revealed that clarity of communication and standardization of reporting were paramount concerns. Instruments for standardized OEM history and for OEM case management were developed for use within the residency continuity clinic. The curriculum was implemented with a variety of teaching strategies, including worksite assessment. Practice-based, case-oriented instruction was subsequently phased into the program as residents assumed responsibility for managing cases under the supervision of family medicine preceptors knowledgeable in OEM. An occupational medicine rotation was developed that included focused clinical exposure to OEM patients and studies that would lead to eligibility for a certificate of additional qualification in occupational medicine. Learner evaluations included chart reviews and patient satisfaction surveys. Program evaluations included interviews with occupational health managers. The residents were judged by their preceptors to have performed well. The responses of the health managers and the patients were positive. This program in occupational medicine was found to be educationally sound with demonstrated community benefit and patient satisfaction. Further, it is cost-effective, requiring no external funding.

Box 4: Training examples

Interviews and audit groups

The feedback through the audit groups gave support for the choice of the disciplines to be covered in the curriculum at different stages of training for medical and health care professionals. The interviews with deans and staff both at universities and Superior schools confirmed the choice for the disciplines for the proposed trainings and curricula. Although the final version of any curriculum is in the hands of the educational institutes themselves.

3.3 Analysis

Defining the content of a curriculum in environmental health/medicine is far easier than ensuring its implementation and integration into existing medical education programs. The latter requires effective leadership, registration support and faculty resources, commitment, and skills in addition to an educational climate and format open to experimentation, adaptation, and change.

Developing a curriculum in environmental health/medicine also requires thoughtful specification—in concrete and, preferably, behavioural terms—of what graduating medical students should know, be able to do, and be sensitive to in the area of environmental health. These “competencies” should also reflect related societal and patient needs. In emphasizing competencies, specifying what should

be taught is not as useful as describing what students should know and be able to do at the completion of training.

The practical issues of establishing or implementing a new training, profession or curriculum are dealt with in the second part of this report.

Past recommendations for creating or enhancing a medical school curriculum in environmental health often focused on occupational health. Although many of the underlying principles and concepts of environmental and occupational health are the same, there are also significant differences, some of which may require additional or different learning objectives. Such differences include the absolute level of risk, the envisaged population (general population versus healthy workers), sources and routes of exposure, possibilities for intervention and environmental manipulation, and a number of administrative, legal, and political issues (Cullen, 1990). Another major difference between environmental and occupational health is the broader range of populations at risk in the former. The expanded focus of environmental health provides the opportunity to involve more clinical specialties in the teaching of environmental health, such as paediatrics, obstetrics/gynaecology, and geriatrics.

In its 1988 report, IOM suggested (Institute of Medicine, 1988: pp. 47–48) that didactic and clinical training in occupational and environmental health/medicine provide:

A solid grounding in epidemiology and toxicology;
B an understanding of the concept of risk and its application to groups and individuals;
C a method of obtaining an occupational and environmental health screening history;
D concepts of dose response and other factors that contribute to exposure and host response;
E knowledge and skill in finding and using information about environmental and occupational diseases; and
F sensitivity to special medical, ethical, legal, and economic factors in caring for patients with environmental and occupational diseases.

These items relate much more to competencies than the classical approach of naming content related topics. The competencies A thru F are shown again in the tables 2-4 below which give an overview of the preferred curricula for different medical professionals.
The content of a training needs to reflect the basic disciplines where the knowledge is collected and used in practice. The skills and competencies needed by professionals to apply the acquired knowledge are another important part of any professional curriculum.
As for the content of different levels of training a distinction has been made between environmental health and environmental medicine. Both are described separately.

Environmental health
For as many countries as possible, academic and other institutions delivering public health and other (masters) programmes were identified in annex report 'Overview of existing trainings' annex 1- of this project. It has been assumed that the core public health skills are present in designated public health programmes. Therefore basic public health research skills (epidemiology, statistics, qualitative research, professional skills related to critical analysis and research presentation) as well as general public health skills such as health promotion are assumed to be present in the programmes. These core public health skills are also core for those medical professionals who will work full time in Environmental Health. Medical professionals who will deal with environmental health on top or as part of their medical speciality will need to be trained in specific themes within environmental health.

The international available curricula use different titles for a range of themes. Based on the judgement of several experts, out of the curricula of trainings in the Netherlands and the UK a compilation of themes has been made (PHEEDUNET, 2010). The themes that are identified as specifically relevant are:

- Environmental Science
- Environmental Epidemiology
- Environmental Public Health / Environmental Health
- Toxicology
- Risk Assessment (including health impact assessment)
- Risk Communication
- Policy and environmental law
- Project Management / Research Management Skills
- Crisis (Disaster) Management

In the next paragraph two examples from the UK and the Netherlands with a content driven approach are shown. Based on the work of the PHEEDUNET project these two countries stand out on their available information (PHEEDUNET, 2010). These are described in detail here.

UK
The programme itself has the following components:
- Basic epidemiology
- Basic statistics for public health and policy
- Introduction to health economics
- Principles of social research
- Issues in Public Health (PH stream obligatory component)
- Environment, Health and Sustainable development (E&H stream obligatory component)
- Environmental Epidemiology (E&H stream obligatory component)
- Environmental health Policy (E&H stream obligatory component)
- Principles and Practice of Public Health (PH stream obligatory component)

This leaves three component choices from a wide ranging list of options. From the previous competencies, the notable gaps are in risk assessment and risk communication and project management.

Comparing the available programme with the competencies described for environmental public health (it fits health protection as it is made to do), formal gaps in toxicology, risk assessment, teaching (skills) and management and leadership (skills) seem to exist assuming one has used all the options in the Masters programme to do environmental science and epidemiology and that these are available at all schools of public health. At this time it is not obvious that such modules are available at other schools of public health.

Netherlands
The programme is operationalised by the main provider NSPOH (the Netherlands School of Public and Occupational Health)(NSPOH, 2012). The Public Health (Environment) ('Medische milieukunde')(PH(E)) training is seen as a 2nd phase of the public health programme ('Arts & Maatschappij'). The basic 2 year training on Public Health is the training which all medical doctors in Social Medicine in the Netherlands have to follow in order to get their Master Degree in Public Health. On top of those two years a medical doctor can specialise in different fields, such as youth health care, epidemiology, infectious diseases or environmental health. This structure is chosen to be

compliant with the Bologna criteria. The total Master in Public health with specialisation in one direction is conducted over a 4 year period.

The Public Health combined environmental health course has training programmes as follows:
Speciality foundation modules:

- Public health: dealing with the evidence
- Health promotion: strategies and interventions
- Professional standard, attitude and quality

Plus fundamental themes (together 20 days):

- Insight in the health situation
- Strategies for prevention and intervention
- Communicative skills
- Organisation and finance
- Professional qualities

Environment components (together about 3 weeks, possibly internationally taken):

- Environment and Health
- Environmental Epidemiology

Other specific themes

- Toxicology and risk assessment taken as modules for the postdoctoral programme for toxicology: introduction to toxicology, clinical and forensic toxicology, mutagens and carcinogens, occupational toxicology and other modules of choice
- Risk assessment in toxicology
- Risk communication
- Policy and environmental law
- General environmental health
- Health effect screening/health impact assessment (where there are options)
- Disaster management
- Public health aspects of crisis and disaster management
- Preparation, intervention and health investigation for disasters course
- Environmental components: course to be assembled themes: live-surroundings, air, soil, water, noise, odour, radiation, measurement tools and models
- Insight into the network

There are modules available at the NSPOH to choose from in the physician's speciality training ('Arts & Maatschappij') or the MPH (NSPOH, 2012). This gives a wide range of options with, given the competencies, notable presence of risk communication (media training), project management and professional qualities. Any environmental health and advanced environmental epidemiology course has to be found outside the NSPOH. Some of the themes can be found as courses at other Dutch institutions such as University of Utrecht (IRAS), Nijmegen and Wageningen and some internationally (IRAS, 2013; Radboud University Nijmegen, 2013; Wageningen, 2013). Thus far, during the last 10 years, most of the trainees have gone to regularly available advanced epidemiology and environmental health courses mostly in the US.

The training has now a history of more than 25 years of delivering medical doctors to the public health domain. The amount of medical doctors being trained has not been huge, but the participants

have been very involved in the development of the curriculum. The environmental health physicians are considered an asset in the public health domain in the Netherlands.
The structure of the curriculum forms the basis for the proposed structure for a Belgian curriculum in environmental health for medical professionals.

The competencies for the medical specialists trained in environmental health can be found in the annex 4 of the annex report.
The regulations on access to the professions and the workforce supply can be found in the annex report.

In the annex report annex 18 another example of a curriculum of a Master course is given. This is a two years Master Programme: *"Environment and Health. Capacity building for decision making"* which trains scientists, medical staff, non-expert professionals (civil servants) to develop professional skills that will enable them to deal with environmental impacts on health (NKUA, 2013).

3.4 Results

3.4.1 Curriculum prioritisation

The content of the curricula at the different levels should be feasible and effective. For each topic in a curriculum an identified need should be clear in reference to the daily practice. The running trainings in other countries served as basis for a selection of course topics. These topics have been used in practice in several official trainings in the United Kingdom or the Netherlands (PHEEDUNET, 2010).

In the annex report annex 4 for each topic a prioritisation is given for inclusion of material in the proposed curricula.

A medical professional who has to deal with environmental problems needs to have knowledge about a range of environmental exposures, the distribution of environmental contaminants, the intake by humans and the health effects caused by these factors. In order to deal with the different steps in the exposure-effect chain the professional needs to have epidemiological and toxicological knowledge. In addition, the medical professional needs to have skills to diagnose environment related diseases. Both the medical professional as the non-medical environmental health specialist need to have (risk) communication, organisational and research skills. These skills are needed to participate in the optimal collection and use of data related to environmental problems, to have a clear understanding with patients or community groups and to have the ability to conduct work within an innovative and interactive setting.

The use of interactive training methods based on case studies has proven to be an effective way of training in environmental health. The environmental health problems which occur in society are dynamic and change over time. The case study approach guarantees a link to daily practice of the participants. This option is mainly important for the specialists (including general practitioners) and the non-medical professionals.

3.4.2 Levels of training

The project looks at two kind of educational domains: environmental health and environmental medicine.

Within these domains there are different levels of training and professionalization available.

Medical doctors

- Level 1= basis level (medical degree – 6 years): the medical doctor receives a number ending with "000": he cannot consult nor prescribe (except for his own family). Shifting at this stage for a master in environmental health or medicine would direct the students mainly towards research or public health activities. He would not be able to open any consultation but could follow the certificate in Environmental health and medicine and also be involved into public health or research in the field of environmental health and medicine..
- Level 2 = 3 to 6 years of specialisation: the INAMI/RIZIV number is updated to reflect the specialisation (GP's, paediatrician, gynaecologist …) as well as the professional title and allowing the practitioner to prescribe accordingly certain additional examinations or treatments (of which some are reserved to specific specialists).
- Level 3 = special skills: if the medical practitioner continues completing his competencies with particular competencies such as for example endocrinology that is accessible to internal medicine specialists, his number and title are again upgraded to reflect this newly acquired particular competences.
- Level 4 = certificate level used to avoid new specializations but at this stage no existing complementary certificate can illustrate this level.

Specific reimbursement processes have also been developed by INAMI/RIZIV outside these main levels of training. We illustrate this with the examples for spirometry and tabacology, as published by INAMI/RIZIV in the "Infobox: La réglementation décryptée pour le médecin généraliste" (INAMI, 2009).

Spirometry
The nomenclature number for spirometry (114133, 114155) can be attested by agreed GP's after completion of a specific training of at least 10 hours and accepted by the managing group for accreditation (p. 47 Infobox)(INAMI, 2009).

Tabacology
The Royal Decree of 31.08.2009 plans an INAMI/RIZIV intervention of 30 € for a 1st consultation over a period of 2 civil years (pseudo code 740434) and 20 € for the following ones (with a maximum of 7 consultations) over a period of 2 civil years (pseudo code 740456). The intervention is of 30€/consultation for pregnant women with a maximum of 8 consultations/pregnancy (pseudo code 740471).
Who would be concerned among the health care professionals? GP's, specialists and tabacologists. Tabacologists are professionals with a diploma in psychology (licence/master) or health care professionals who have followed the agreed training in tabacology and succeeded at the final exams. Physiotherapists and health care professionals use the usual INAMI/RIZIV reimbursement documents, the psychologists use another model of document established by the INAMI/RIZIV insurance committee (www.INAMI.fgov.be: assistance au sevrage tabagique). GP's and tabacologists have to keep track of the consultation according to a specific document in conformance with the established model and include this document in the file of the patient (cf. anamnese document as mentioned by Prof. Bartsch, ULg).

Apart from the 4 levels, specializations exist without giving rise to a specific title or recognition inami/riziv: for example the specializations in epidemiology, allergy, etc.. The SPF has then no dealing

with it and the training program is not fixed. It is left to the initiative of the universities. Occupational medicine, public health or social medicine, insurance medicine, school medicine are master after master trainings not referring to RIZIV/INAMI codes. For occupational health however, the recognition is temporary.

Nurses and midwives
The training of nurses and midwives can be summarized according to the following scheme, although some differences exist between both communities in Belgium.

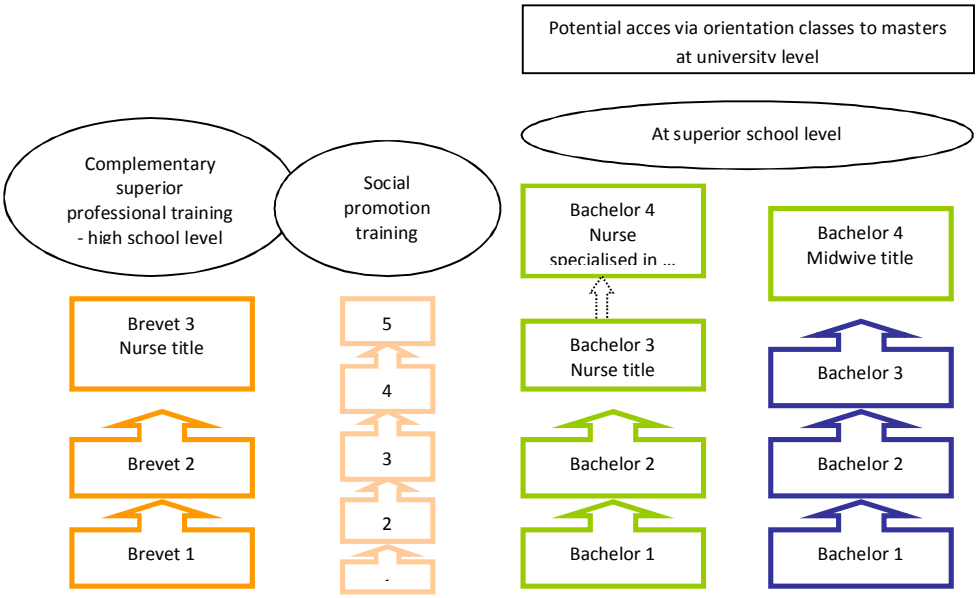

Figure 1: Scheme of training of nurses and midwives

These levels are used for additional clarification in the tables.

3.4.3 Proposal of curricula

Environmental health
Environmental health can be seen as a supporting discipline for different health care professionals. These health professionals will use environmental health in conjunction with their own main discipline or specialisation. The training is built into the different levels of training. The table in annex 4 shows the different levels of training or education needed for health professionals.

In this table also an outline for training of non-medical professionals is provided.

The curriculum on environmental health is built upon four parts:

1) speciality foundation modules,
2) fundamental themes,
3) environment components,
4) specific themes.

For different health professionals it is indicated which of these parts should be included or are already included in the current training. Furthermore, the table indicates which kind of competencies are being trained by these modules.

For each item it is indicated if the topics within each part are necessary or wanted and at which level of training which is indicated by an hourly course load and competencies. See Annex 4 & 5 in the annex report: 'Topics for different levels of training or education needed for health professionals' and 'Topics for different levels of training or education needed for health professionals in hours and competencies'.

Continuous Professional Development (CPD)

General practitioners[10], specialists and other health care professionals (such as midwives and some specific diploma in nursing) are encouraged to attend courses for Continuous Professional Development (CPD), in Belgium called 'Formation Continue' or 'Navorming; permanente vorming'. It is in some cases a condition to keep the registration for their profession. The March 25th 2010 ministerial circular published by the SPF/FOD underlines that midwives have to follow 75 hours of CPD over 5 years (Belgisch Staatsblad, 2010). This training has to be approved by the Federal Council for midwives. Midwives who do not fulfil this requirement receive a warning. One year after the 1st warning, if the concerned midwife still did not start attending any CPD, he/she might lose his/her title.

Environmental health is most of the time not included within the CPD and when it is, it covers only a small part of the CPD. In any case, this is not part of any mandatory item. For medical doctors for example, like insurance medicine, trainings in environmental health/medicine are included within the 'Economics and Ethics' module. It is advised to have a course on environmental health, consisting of 4 hours per year, in a cycle of once in 5 years included in this CPD.

For the professionals (either medical or non-medical) working in the public health domain this CPD should be more frequent and more complete although no specific framework regulates such continuous training and it is then left to each professional own will. In the Netherlands for example medical professionals have to do 40 hours of CPD each year to keep their registration in environmental health (within social medicine register). For non-medical professionals no such requirement has been established yet.

For Continuous Professional Development (CPD) an overview with desirable yearly hourly numbers is presented in annex report annex 6. This training should fit within general CPD requirements for any medical registration.

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For the present time, INAMI/RIZIV recognizes 3 categories of GP's for reimbursement:

- GP's with « droit acquis » (qualified before 1995 and not having any complementary certificate in General Medicine (codes 001 et 002): they can fill in the DMG and their consultations are partially reimbursed
- Agreed GP's are specifically trained as GP's (code 003 ou 004): they can fill in the DMG and their consultations are totally reimbursed
- Accredited GP's attend regularly continuous trainings.
-

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Part 2: Feasibility aspects regarding implementation of environmental health and medicine

Between dream and action

In order to strengthen the focus on environment, it is important to make realistic proposals and thus judge the feasibility of suggestions for the training of medical professionals. What are the organisational, financial and institutional constraints for the embedding of environmental specialisation in the training courses? What are the windows of opportunities? The feasibility was explored by means of documentation on procedures, by interviews and round tables with environmental specialists in medical education and with stakeholders. The insights gave the suggestions for further training.

The introduction of new masters (minimum of 60 ECTS) turns out organizationally not to be feasible in the medium term. Medical doctors can acquire 2 masters: in addition to their first master an additional one as a GP or specialist (advanced master). To set up a specialization in environmental medicine as a separate training would be another complementary master. This is best done in an international context (Joint master) and within existing funding frameworks such as the EU strategy Horizon 2020. These international initiatives can go through essentially lighter procedure for accreditation in Belgium.

From experience with limited domestic student numbers in related master-after-master's programmes such as Occupational Health is not to be expected that an offer of a master in the environmental medicine will find a sufficient market. Nowadays, universities are sensitive for a quorum of minimal student numbers given the distribution rules in the finance structure of the education system. The relevance of environmental medicine and environmental health could possibly be recognized, but the theme would be in competition with specializations for which the inflow is greater. The approval for a new training by the Ministry of education is also a demanding procedure; the training could only be fully operational after a few years. The Federal Minister of Public Health and the National Institute for Health and Disability Insurance (RIZIV/INAMI) have to approve as well, amongst some more institutional bodies in case of professional requirements. Essentially, the standards related to the performance of a new speciality (including the pricing policy and health insurance) have to be regulated at a Federal level. By contrast, the availability, the quality and the management of trainings are arranged by the communities (similar as for the health care facilities and health policies). If one wants to streamline the objectives of training in the various communities content wise, separate from this administrative complexity, then it is appropriate to 1) define a profile with the desired competences of the medical professional and any subject content while promoting these at the educational institutions through their deans and directors; 2) to provide financial incentives for such coordination or harmonisation and; 3) to build a platform for the exchange of expertise on environmental health and environmental medicine between the communities, their institutions and occupational groups (expert-exchange programme).

Surrounding countries face the same problem: is it better to invest in basic training and to increase awareness around environment and health at all levels of trainings for physicians and nurses or is it better, that a few – whether or not during their study career – specialize in this field? Foreign research indicates that one specialized environmental doctor per million inhabitants may suffice. For the wider group of environmental health specialists a tenfold number is suggested. In any case it is indicated that the efforts for new training courses are out of proportion to the numbers of specialists to be trained.

Given this complexity is better to look for ways to seek synergies for the environment theme in existing courses (as in Occupational Medicine and Public Health for doctors, but also for non-physicians, as interdisciplinary training in, for example, environmental health). These trainings could be intertwined with existing content, for example with the help of environmental cases in education, with guest speakers, practical work and internships with environmental doctors or organizations with environmental health as expertise. Experts found that the generic treatment remains essential: there are no pathologies that are purely related to environmental exposure. It might not be necessary to create new titles 2 and 3 for doctors (separate INAMI/RIZIV-numbers).

Short courses, without public funding and less formalities, are even easier to realize. A certificate for any professional in environmental medicine or environmental health can attest (nationally and internationally), similar to the presentation of the EUROTOX's ERT accreditation for toxicologists (European Registered Toxicologist). In addition, the continuing education offers many opportunities: environment there appears to be not prominent and is hidden within the section ' economy and ethics'. It

is certainly important to look at the age pyramid of the group to be trained medical professionals, in addition to continuing education for new graduates.
The overloaded study programmes (at doctors due to the reduction of course time from 7 to 6 years; at nursing by competitive topics such as elderly care, pharmacy) it is difficult to create enough space for specialization in environmental health in the existing curricula. The institutional and organizational developments, both in the Dutch and French-speaking education, offer opportunities for cooperation around the environmental medicine and environmental health education. The incorporation of training within the geographic associations and the masterisation ' of the nursing education (can) provide more cooperation between universities and superior schools, also in the nursing and midwifery field, including the continuing professional education. In addition an agreement of the minimum environmental training to raise of awareness around the subject would mean a step forward. Education experts point out that the alertness to the environment factors is more important than knowing all about it. You can do this in an even more flexible and integrated way, without the reformation of the curricula. In this changing educational landscape, we also see opportunities for sensitization via the greening of the healthcare sector itself (attention to the ecological footprint of this sector and the operations of hospitals), and the transverse focus on sustainable development in all education (education for environment and sustainable development).

Finally, there are also cultural elements of interest. These play in the practice of medicine and the medical health care. More spontaneous attention to public health and prevention is by some – against the tide – seen as a must and win-win for environmental health. The curative and clinical health care appears to be dominant in education and research (the body of knowledge); that is seen in professional practice and lack of interest on the market. Environmental medicine is perceived as ' soft ' medicine. Moreover, doctors do not like to be manoeuvred into local and politically sensitive situations (the expansion of industrial areas, the problem of busy traffic and fine particles). Local issues and hot spots are however an ideal way to raise public awareness and to create political sensitivity for the theme. To date, nor general practitioners or neither specialists are required to be trained in environment and health; also continuing professional education is not developed.

This can become more binding when the INAMI/RIZIV adds a separate registration number for environmental health actions, linked to a criterion DMG++/MGD + + and a distinct and recognizable section ' medicine and environment ' in the group of activities of continuing professional education. These acts should then be consistent with the acts of the different specialties. Most positions (with different job titles) in the sphere of environmental medicine and environmental health such as monitoring, advice and networking are government dependent. Stimulants for building interdisciplinary knowledge and individual health risk profiles could break this vicious circle of little attention in education or little attention in medical practice.

1. Introduction

<u>What is and when to use a feasibility study?</u>
From a management perspective, a project feasibility study is an exercise that involves documenting each of the potential solutions to a particular problem or opportunity. Feasibility studies can be undertaken by any type of business or project.

The purpose of a feasibility study is to identify the likelihood of one or more solutions or options meeting the stated project requirements. In other words, if one is unsure whether the solution will deliver the outcome one wants, then a project feasibility study will help gain that clarity. During the feasibility study, a variety of 'assessment' methods are undertaken. The outcome of the feasibility study is a confirmed solution for implementation.

At a first stage the project needs are analysed, information about project participants is collected, and the requirements for the system are gathered and analysed. The expectations for system implementation are studied and the proposed solution is offered. During the feasibility study stage, the project's goals, parameters and restraints are agreed upon with the client including:

- Project budget and rules for its adjustment;
- Project time frame;
- Conceptual problem solution.

Feasibility studies address things like location, resources availability, connectivity, etc. They provide information about the project to determine if and how it can succeed, and serve as a valuable tool for developing a winning project plan.

The dimensions of a feasibility study then normally are:

- **Description of the project:** The product or services to be offered and how they will be delivered.
- **"Market" feasibility:** Includes a description of the current domain, anticipated future domain potential, competition, output projections, potential students, etc.
- **Technical and organisational feasibility:** Technology selection, resources availability.
- **Financial feasibility:** How much resources are needed, returns on investment (economic benefits for the health care system), etc.

We also added: policy **feasibility (ethical issues, legal regulatory requirements, etc.).**
(Source: adaptation of http://www.mobiusengineering.com/Feasibility_reports.aspx)

These feasibility dimensions very well reflect the types of contexts that matter for a successful implementation. Feasibility not only has to do with figures of costs and graduates. Going in depth into the contexts means that the institutional perspective on implementation issue is given priority.

In this way, a feasibility study also works the other way around. 'The project' is not given; it is rather the appraisal of the context that inspires for an optimal project. The "market" conditions, technical and financial aspects are not mere context variables, they model the optimal project. This perspective has gained field in the state-of-the-art of policy sciences and complements the mere political and management perspective. As a consequence, this chapter will pay attention to factors of success and failure and not only to costs and decision paths: different types of institutional barriers and opportunities.

In fact, 3 possible perspectives on the issue of implementation are open.

- In the first, the goal rational perspective, an optimal solution or scenario is mainly based on the substantial knowledge or evidence on the problem: new curriculum elements and striving for additional student capacities is the main goal because the gap and needs are clearly diagnosed; insight in the context might help to succeed.
- In a political perspective, the support of key actors and means for possible solutions and risks that come along with the implementation are identified. This is the second perspective, oriented towards 'acceptance' of a solution for the problem or a project.
- The third perspective takes path dependency into account as actors always respond in line with tradition. A reform is not a one shot phenomenon. It never starts from a blank page. Is the context suitable and adequately equipped for the project? This leads us to insights on the translation of projects in other countries. Projects in the Netherlands, Germany or the United States do not necessarily match the Belgian context. The recent debate on the official educational assessment results of the medicine programs in Belgium illustrates such institutional divergence (discussion on model behind the benchmark). We even have to recognize that the implementation path in the different Belgian regions or the different communities might be different.

Box 5: perspectives on the issue of implementation

2 Methodology

In order to be as much practical as possible while considering the feasibility aspects and stay close to the evolving reality, we organised meetings with high level stakeholders.

The partners HVS-HPH met the General Inspector of Education of the Hainaut Province, Mr. Diseur, (on November 14, 2012). The objectives of the project have been presented and some key actors have been identified to develop the next steps of the project. We should take into consideration recent reforms such as the reviewing of the education of nurses (according to the EU Directive) and the reformed proposal by the Minister Marcourt (for the French speaking part of Belgium) supporting more collaborations between universities and Superior schools within the different geographical centres.

Another meeting with Mr. Lothaire, chairing the National Council of nurses has been organised. The objectives of the project as well as the coming implementation steps have been presented. The discussion has brought up new key persons in order to make the link between trainings addressing medical professionals and nurses, ensure the feasibility and the flexibility of the deliverables of the project and respond as well to the coming reforms regarding the "masterisation" of the training of the nurses for 2013. Furthermore, considering the development of geographical educations centres in the French speaking part of Belgium (Brussels, Brabant-Wallon, Liège and Luxembourg, Namur and Hainaut), the collaboration between universities and Superior schools within the Hainaut centre is already quite effective and includes collaboration between UMons, Condorcet, HEH, HESA, HELHA and UCL (Louvain in Hainaut). This partnership wishes to develop a centre for continuous training. Environment and health could therefore be proposed among the thematic topics. Also in the Flemish educational landscape the structural collaboration between universities and the superior schools is operational.

Two roundtables were organised (on January 28th 2013 and May 7th 2013).
The first one gathered experts from the different regions and communities in charge of teaching roles in environmental medicine and/or in environmental health labeled previously (cf. § 1.2.3, Part 1) as 'forerunners' and the members of the steering committee. 26 participants attended this first meeting. The project was presented as well as some proposals of curriculum for health care professionals (medical doctors, nurses, etc.). Separate discussions per language community were organized. The following questions have been addressed to the assembly: Whom addresses your program in environment and health? Which argument did you use to set up such a course? Which obstacles, supporting elements or opportunities did you meet? How many students follow your course and how does their number evolves over time? What is the profile of your students? If you have medical doctors or nurses among your students, what has been their motivation? How would you motivate health care professionals to environmental health issues? Towards which kind of job did your students turn to after following your course and more particularly health care professionals? Has your course evolved over time? And if yes, how? Do you get a feedback from your students? Which knowledge should be integrated into the basic and continuous training of health care professionals? Is there any interest to organize a trans-universitary or trans-Superior schools training in this field? What would you propose to consider this topic into the basic training, a potential specialization or the continuous training?

The second workshop was open to concerned teachers or courses coordinators within Superior schools, universities and professional associations. Internet sources were used to compile an overview of stakeholders in the NEHAP project, in the national context as in the 3 Belgian regions/communities: the 'groupement des Unions Professionnelles Belges des médecins spécialistes' (http://www.gbs-vbs.org/gbs/index.asp) and the e-portal of the Public Health administration (http://www.health.belgium.be/). In global, more than 40 organizations and advisory boards have been invited. As decided at the steering committee meeting of January 2013, the project focused on priority professionals: medical doctors (GP's, pneumologists, allergologists, cardiologists, gynaecologists and paediatricians), nurses (generalists, health promotion and paediatrician nurses) and midwives. 36 participants attended this second meeting. To open the discussion, the project coordinators within the consortium and within the national cell and external invitees gave a presentation. The external invitees presented:

- Mr. Geert Messiaen presented the motivations of the Mutualities for this topic and their action plan;
- Mrs. Santucci from the Superior school Ilya Prygogyne presented her collaboration with a school of nurses in Canada;
- Prof. Bartsch, pneumologist/allergologist from the University of Liège shared his experience regarding the development of a specific consultation in environmental medicine;
- Mrs. Fontaine introduced the work done in France in the framework of the national environmental action plan with regards to the training of GP's.

The presentations were followed by separate discussions per language community. The following questions have been addressed:

- About operational aspects:

What would be the most feasible? Inclusion of new courses/modules in existing masters – reservation for other European Credit Transfer System (ECTS) – replacement? Or including content in existing courses? With potentially a reorganization of the course. What would be the topics to include in the basic training? With or without guest speakers? How about internships locations? Which are the easy topics to implement?(EDC's?)

- About the external triggers for operational / attractiveness aspects:

What would be good triggers in terms of regulation of courses and professions? In terms of accreditation (profession? degree?)? What would be the role of a model/branding of the

profession? What would be effective tools e.g. including environmental items in personal patient files?

- About financial aspects:

For the development of course or speakers? For development of tools/instruments within education? For the setting up of interdisciplinary research funds (already applied?)

The agenda and reports of both roundtables are joined in the annex linked to this part of the report.

In addition and as already mentioned in the first part of the report, face to face meetings with representatives from the different universities, Superior schools and professional associations of the targeted health care professionals (cf. decision of the steering committee in January 2013) were organized between February and August 2013. The reports of these meetings are joined in annex.

4 Description of the project

4.1 Developing a course

4.1.1 Academic decision making

The development of a new course involves a process which can be different at each educational organisation and at each education level (master's degree, complementary master or certificate). We first describe here the process in the United Kingdom at the Imperial College to highlight the hurdles which need to be taken into account.
In the case of the development of a specific master in environmental health or medicine targeting medical doctors, midwifes or nurses, this would never be a 1st master. Most of medical doctors would already have 2 masters in hand (1 for their basic training and 1 for their specialisation). Midwives follow on their side a 4 years training and already have a 1st master in hand. The situation for nurses is different but at this stage also unclear since a process of "masterisation" of their curriculum has started or is under discussion.

In such situation, 3 solutions arise:
- the development of a complementary master,
- the integration of the field of expertise in environmental health and medicine into an existing master addressing only medical doctors such as for example into occupational health,
- the integration of the field of expertise in environmental health and medicine into an existing master addressing a wider public such as for example the master in public health.

A joint complementary Master's degree has to cover 60 ECTS (which corresponds to one year full time training). It is an official, recognized diploma that has to be organised in collaboration with other universities. Any new complementary Master's degree put to the test is then estimated 5 years later. See box 6 for an example of setting up a Master course.

Example from UK:
One of the major processes required for setting up a new Masters course or a short course is getting approval from the College/ Dean of the university. The Imperial College in the UK has put together the following information as a guide to getting a new Masters course approved or a new short course approved.

Approval for new Masters programmes
Applying for approval to establish a new Masters programme is a four-stage process requiring approval of the host Department, the Faculty of Medicine, the College's Graduate School, and Senate. The latter two institutes might be differently organised at other universities. The whole process can take up to 18 months and so it is strongly advised that one discusses an application at an early stage both with Graduate School staff and the host Department's Education Manager (or an equivalent person), since they can often identify potential problems or controversial areas. The Department will also need to consider how the new course would fit into its existing portfolio.

The Director of the Graduate School is willing to meet new Course Organisers. The Departmental Education Manager will be key in steering the paperwork through the system.

Having discussed the proposal informally with the Graduate School and the Department, prepare the application for approval by completing a relevant template. Such a template has been developed for all the relevant guidance by the Imperial College and can be found at
http://www3.imperial.ac.uk/graduateschool/qualityassurance/newcourseproposal

Some universities will have a Departmental teaching committee. The committee will typically make recommendations to refine the application before it goes forward to the Graduate School.

Once the Department and Faculty have approved, the application will be submitted to the Graduate School. They will send the application to all its members/board and most likely to an External Reviewers committee.

Subject to possible revisions (which may need to be agreed by a further Graduate School meeting) the course will then be forwarded to Senate for approval. Once the course reaches this stage one can probably start advertising it. The final stage is Senate approval.

Box 6: Setting up a Master course (Imperial College, 2012)

The macro-efficiency check concerns the issue whether a proposed new programme should be funded by the national authorities. The following questions play an important role during this procedure: Is the same or a similar programme already offered in the country, region or city? Is there a demand by the professional field to offer this programme? Is there a demand in the labour market for additional graduates from this programme? Several other elements are of course also taken into consideration.
In Flanders, a macro-efficiency check takes place before the initial accreditation procedure. Institutions that receive public funding should submit an application for a macro-efficiency check regarding a new programme to the Recognition Commission. Only after a positive macro-efficiency decision, institutions can submit applications for initial accreditation to NVAO (Nederlands-Vlaams Accreditatie Orgaan)(NVAO, 2013).
The macro-efficiency check is not necessary for *joint programmes* that receive or will receive European funding (e.g. Erasmus Mundus, curriculum development, EIT). Additionally, new programmes offered by institutions that don't receive public funding do not need to undergo a macro-efficiency check and can immediately submit an application for initial accreditation to NVAO.
To start the programme in a given academic year (e.g. 2014-2015), the application needs be submitted before 1 March of the preceding calendar year (in this case, 1 March 2013).

Box 7: Macro-efficiency check

4.1.2 Short course approval – Certificates

In Belgium there has been put no accreditation system in place for short courses/ certificate (except for example for free registration of the more than 20 ECTS programs in the register for Superior education in Flanders; nor a formal quality assurance process. Some universities however do formalize (internal) conditions for new programs. In most of the cases the courses are developed at the faculty or department level. In other situations, a postgraduate centre facilitates and coordinates the courses at the university level. However, the collaboration between universities for a certificate is not mandatory and is quite flexible in its organization, particularly if the competences and courses already exist within the university.

In case of the evolution of a certificate towards a recognized master, the legal recognition process has to go through the different steps for decision making. The Bologna Decree recognizes the master in Public Health with different orientations. Inserting a certificate in environmental health and/or medicine in this official master would facilitate the recognition process.
See additional information on accreditation and Continuous professional development in box 8 and box 9.

Initial accreditation

Initial accreditation concerns proposals for new programmes. Programmes are considered new programmes if they are not registered in the official register of the relevant country (i.e. the CROHO in the Netherlands or the Higher Education Register in Flanders).

Initial accreditation relates to the assessment of the potential quality of the programme including, when possible, a focus on achieved quality. In Flanders and the Netherlands a macro-efficiency check takes place before the initial accreditation procedure (but only for programmes offered by publicly funded institutions).

The initial accreditation procedure consists of three consecutive steps: the programme proposal, the external assessment and the initial accreditation:

1. Programme proposal
The first step in the initial accreditation procedure is the programme proposals. The institution is responsible for the proposal and therefore assembles a dossier regarding the proposed programme. The programme proposal contains a full description of the programme. This is done according to at least the standards (and criteria) of the relevant frameworks for initial accreditation in the Netherlands or Flanders. In addition, the proposal indicates and substantiates the level and orientation of the programme. The institution submits an application for accreditation of a programme to NVA by sending in the programme proposal.

2. External assessment
The second step in the initial accreditation procedure is the external assessment. NVAO convenes an assessment panel that will be responsible for the external assessment of the programme. The assessment panel assesses the potential quality of the proposed programme and whether the programme fulfils the criteria of the initial accreditation framework. The panel follows the assessment framework (which contains all the standards) and the assessment rules as laid down in the initial accreditation framework. The external assessment focuses on learning outcomes. The panel writes down their (objective) findings, (subjective) considerations and conclusions in their assessment report. The report contains an explicit proposal to NVAO to take either a positive or a negative initial accreditation decision.

3. Initial accreditation decision
The third step in the initial accreditation procedure is initial accreditation decision. NVAO evaluates the assessment report and the overall conclusions expressed in it. This means that NVAO verifies whether the programme has the potential to offer generic quality.

Subsequently, NVAO takes an initial accreditation decision and lays down its findings in an initial accreditation report. Finally, the panel's assessment report and NVAO's initial accreditation report (including the initial accreditation decision) are published by NVAO.

If the initial accreditation decision is positive, the programme is initially accredited. This means that the programme is included in the relevant official register (i.e. CROHO or Higher Education Register). This registration means that the degree awarded by the programme is recognised by the national authorities. In addition, initially accredited programmes are eligible to receive public funding (but only when offered by publicly funded institutions and when granted a positive macro-efficiency check). Additionally, the students enrolled in these programmes are eligible for study finance (e.g. grants). However, public funding and study finance are normally not available for programmes offered by private institutions.

Box 8: Initial accreditation

There are no formal University award or non degree-awarding credits associated with it.
A course typically designed for professionals either as individuals or companies for the purpose of continued professional development and/or up-skilling.

These courses can be open to all on a fee-paying basis. In some cases modules from MSc courses may be offered as a freestanding short course, not leading to an award.

Types of short courses could include:

- CPD short courses offered externally
- Weekend courses (modular delivery)
- MSc Modules for CPD
- Bespoken courses for companies
- Collaborative programmes
- Stand alone online courses
- Executive Education

Quality assurance approval procedures that are put in place for short courses are intended to monitor and enhance the quality of short courses offered by the departments. The process also ensures that short courses are appropriately funded, that the courses meet the needs of the target customers, that professional standards associated with developing and running courses are considered, and that course evaluation processes are in place for feedback purposes. Quality assurance is also an essential part of maintaining good practice across the College and to protect the global reputation of the College, as well as ensure the experience of the participants. In addition, the process can ensure all short courses are publicised in a consistent and professional image following the College publicity guidelines.

Some universities might have a Continuing Professional Development Quality Committee (CPDQC) in place which instigates the approval process and is responsible for the review of existing short courses and for the approval of new proposed short courses that are branded under the College name.

Box 9: Continuous professional development

4. "Market" feasibility

4.1. Acceptance and embeddedness of attention for environmental aspects

It might be relevant to look at the landscape around innovation, at the outside of the faculties. Some of the respondents in this project expected minor changes from the inner circle (even if remunerated) and expressed their hope that societal relevance might be gained by social pressure and research opportunities.

4.1.1. Cultural barriers that come along with the medicine's body of knowledge – scientific developments

The body of knowledge in medicine is mainly oriented to the way organs and systems operate in the human body. As a consequence, the content of trainings will less focus on insight in the drivers behind health risks and disease. A clear exception is the knowledge on endocrine disruption, an actual phenomenon in environmental health as well. Some of our interviewees underlined the general lack of attention and even disinterest for health prevention aspects in classical medicine. What might bridge both fields of interest, is the generation of knowledge on the relevance of environmental factors in individual health risk profiling. Epidemiological knowledge, constructed at a population level, can by means of the profiling become more relevant for clinical medicine. However, this niche requires innovative research opportunities.

In the academic practice, the nexus of 'education and scientific research' gains increasing attention. Today, academic professionals not only have to be good teachers but also successful in their scientific research. This also goes for teachers in medicine. In the case of environmental health research topics, researchers are confronted with controversial issues and with persistent uncertainties. In particular, these issues are difficult to tackle in an evidence based tradition where insights of epidemiology are considered subordinate because the causality with environmental exposure is not clear. One of the interviewees expressed it this way: "Men are not trees: you never can get certain about the source of the contamination because people move." That is exactly the point where epidemiologists tend to get stuck. At the universities and Superior schools, also physicians can explore these complex but very policy relevant problems. The insights gradually will grow into the training's content. These kind of educational reforms go slow but have the advantage that they grow bottom up, via new emerging insights and embedded in the knowledge base.

Also in terms of environmental medicine, while considering the opportunity to develop such a specialisation for medical doctors, Prof. Bartsch analysed the content of equivalent initiatives in Europe and worldwide. If the approach of environmental health was usually coherent and integrated into existing curricula, other approaches developing the treatment and detoxification process lacked rigorous scientific validation. Official initiatives would therefore be necessary to guarantee such scientific validation of the work experience and support the related educational reform.

4.1.2. Cultural barriers in the practice of the professional

How to overcome possible social exclusion due to the stigmatization of attention paid to the environment within the practice of the individual practitioner? Physicians are trained to 'cure', to suggest treatment for the complaints patients have. Reference to prevention activities is not always

seen as solving the patient's problems. Practitioners are not very eager to behave as an agent in policy action, unless they can act with peers, in a group or at a collective level. A subsidy to study or tackle local environmental health impacts for residents with a group of engaged local practitioners, might be stimulating.

In Belgium, patients are fully insured by the compulsory health insurance (except for co-payments) and prices are fixed for GPs. A supply induced demand for environmental health could match a gap in the market. Given the many hot spot regions in Flanders, Brussels and the Walloon region the potential is there, but hard to imagine that lower income groups, as overrepresented and concentrated in these poor quality areas will be sensitive for spending in additional medical services. On the other hand, upper and upper middle class people are generally speaking more sensitive for environmental pollution issues as well as relatively more exposed to the new emerging pollutants (dioxins, PCB's, flame retardants, personal hygiene substances). Anyway, the focus groups and interviews revealed that physicians seem to receive a significant amount of questions from patients.

4.1.3. Institutional barriers/opportunities?

Study reforms

The former reform of medical bachelor-master training at the universities has not yet been digested. It can be expected that the educational institutes are not waiting for additional changes in their curriculum structure. However, the shift of topics within the curriculum can also be an opportunity to bring new issues at the table.

On the other hand, an opportunity might be created by this same reform as evaluation procedures will have to be put in place. They might offer openness for other kinds of innovation. An example might be the continued move of training in clinical capacities towards advanced or complementary master programs. This creates more openness in the bachelor and master's program for general, basic insights such as environment and health.

Another 'window of opportunity' is the reorganization of degrees within the Superior Schools in Flanders given the Decree of July 2012. From 2013-2014 on, the bachelors and masters in the study areas of Health care and Social Health care for instance, will be integrated within the university or will be the result of a collaboration between universities and Superior schools. This rationalization makes it more obvious to streamline the content of the programs, for instance between medicine and nursing. Only professional bachelors will remain within the Superior schools.

In Wallonia the Decret Marcourt (still under discussion) would create an equivalent window of opportunity by encouraging collaboration between universities and Superior schools within geographical poles. However, such decree might also create some confusion if Superior Schools extend their competencies to the organisation of master's degree and block therefore universities in one of their major role.

Also the EU Directive 2005/36/CE updating 15 EU directives such as the Directive 77/453/CEE of June 27, 1977 and regulating the activities of the nursing and the Declaration of Bologna implies a review of the organisation of the training of nurses from a professional Bachelor to a master training or at least a 4 years training. This review would probably then suppress the A2 training level in high schools. Though the implementation of the Directive at the Belgian level is possibly slowed down by different views between both communities.

A hypothesis that was put forward during the interviews was that Flanders prefers to safeguard the A2 Brevet training level and the professional associations in the Federation Wallonie-Bruxelles

wishing to line up with the other European French speaking countries such as France and Switzerland, these countries having already implemented the EU Directive. Extending the curriculum of the nurses from 3 to 4 years would constitute a great opportunity to include new courses related to environmental health and medicine. Nevertheless, respondents of superior schools complained about an already overloaded program and competition of several other emerging topics, although they recognized the important role of nurses in environmental health and the particular role they could play within hospitals.

A barrier can be the scattered competencies in case of centralized initiatives.

Cross border, EU and International initiatives
During the face to face meetings and the workshops, some partners highlighted the interest to develop international collaborations. These could be supported through the mobility of researchers and teachers, as reinforced by the EU strategy Horizon 2020. Such cross fertilizing collaboration is a good way to enhance teachers, students and researchers competencies but also participates to the education process. In a more and more globalized world, exposure to air or water pollution, to EDC's or heavy metals does not have any border. In response strategies and action plans in the field of environment and health have been developed at different levels (EU SCALE Strategy; EU Action plan on environment and health 2004-2010; WHO Frankfurt (1989), Helsinki (1994), London (1999), Budapest (2004) or Parma (2010) declarations; UNEP Programmes) and WHO Task Force Health & Environment.

Common tools to support health care professionals in their day to day practice or to support the public health sector in order to better understand environmental health risk factors and related health effects have been developed in different countries: "Green ambulances" have been set up for example in France, Germany or Luxembourg; air quality databases responds to related EU Directives; EU HBM COPHES and DEMOCOPHES projects have developed common procedures. Therefore any support to strengthen cross border or international collaboration in the development of a dedicated certificate, specialisation courses or research activities in environmental health and medicine would also be a good way to optimise resources in term of education, medical practice, public health understanding and in response in the proposal of more efficient recommendations, policies and actions.

4.2. Prerequisites

Any scenario that aims to improve the training situation in environment and health needs to meet the prerequisites. Without accomplishing these prerequisites further actions will not be effective since they are the basis for further actions.

4.2.1. Prerequisite I – Defining environment and health

A clear definition of what environment and health is and what it is not is one of the prerequisites for improved training in Environmental health and medicine.

4.2.2. Prerequisite II – Determining the amount of professionals

Information on the amount of professionals currently active and the amount of professionals needed throughout Belgium in the field of Environmental health is one of the prerequisites for improving training. These numbers need to be determined. It is then possible **to determine the scale of training** needed throughout Belgium. The question has been raised at the first roundtable organised in the framework of the project in January 2013. According to the participants if the number of students

following environmental and health courses within Public Health schools is stable or slightly increasing, the job offers afterwards are generally not specific to that topic. The motivation to follow these courses is rather to complete their training and most of the students usually keep the same job after the training but have increased their competencies.

Among specific professional outlets, the following ones have been highlighted: project coordinator in environment and health within local, regional or international governmental or nongovernmental organisations or within enterprises. According to this it seems that mainly job opportunities in this field depend on public funding.

Concerning the development of a specialisation in this field (a specific master in environmental medicine), the determination of the number of professionals active and needed should be identified. This should be done by the Federal government in cooperation with the Regions, Communities and with educational organisations taking into consideration potential further developments (for example as proposed into the tool section of the project report). Data can then be grouped and used to determine the number of professionals that need to be trained.

Concerning the development of a certificate and of continuous professional trainings on this topic, the specific age structure of practising physicians is an important element to keep in mind. The training does not only address to incoming medicine students but also to the stock of physicians (and their retirement). How large is the group of physicians that still face a career of more than 10 years? The age pyramid for GP's us up-side down.

4.2.3. Prerequisite III – Competences of professionals

According to the role that will be given to health care professionals either by the authorities (ex. data collection) or through his practice (risk communication, cluster identification), the level of training and the competencies will be different. Extra competencies could be brought in case of specific local exposure (Avis du Conseil Supérieur de la Santé n°8738 'Un développement réflechi de l'énergie éolienne pour préserver la santé publique').

For Doctors (mostly GP's), they are regularly confronted to questions by their patients either due to some local issue or raised by the media. This situation is confirmed by the enquiry organised by the National Institute of prevention and education for health in France (INPES[11]). According to the results of the study "Médecins généralistes et santé environnement", GP's are indeed more and more confronted to issues regarding environment and health and don't feel well prepared to answer to the questions. The results plead for a training of GP's in environment and health.

4.2.4. Prerequisite IV – Competences of the teachers

According to the gap analysis undertaken as a first step of the project (cf. part 1 of the report), competencies necessary to develop trainings in environment and health to address specifically health care professionals are existing in Belgium. However collaboration between universities or between universities and professional associations might be necessary to address more particularly medical doctors or specialists.

Integration of Environmental health competencies in existing courses on public health

Instead of creating a whole new training, one can opt for integration of the environmental health competencies in existing masters on public and environmental health. This will decrease the differences between different educations. The main advantage is that the existing infrastructure can

[11] INPES: Institut National de prévention et d'éducation de la sante www.inpes.sante.fr

be used for training. Another opportunity is the opening up of the consultations days of environmental medicine specialists for internship credits (see for instance Prof. Ben Nemery, *Toxicology & Occupational Medicine, Department of Public Health, Occupational, Environmental & Insurance Medicine*).

Collaboration with professional medical associations

Collaboration with associations such as the ABEFORCAL[12], the Belgian association for continuous training in allergology and the BelSACI, Belgian Society for Allergy and Clinical Immunology[13] would be for example interesting to approach notions of immunology. Environmental exposures during prenatal and early postnatal development have been linked to a growing number of childhood diseases including allergic disorders and leukaemia. Because the immune response plays a critical role in each of these diseases, it is important to consider the effects of toxicants on the developing immune system (Duramad, 2007). In the US, some schools of public health (e.g. Johns Hopkins Bloomberg School of Public Health) are already developing courses on immunology of environmental diseases. This aims to examine the effect of natural and chemical environmental agents on the immune system that result in chronic diseases like cardiovascular disease, cancer, allergy, asthma and autoimmune diseases like diabetes.

4.2.5. Creating a functional structure for cooperation

In order to solve trans-boundary issues as well as keeping knowledge up to date it is essential for stakeholders in different member states to be able to cooperate. In the current situation there are no facilities for doing so. In problem oriented situations they do work, for instance the Dutch-Flemish collaboration on Cadmium in the Kempen. It is left to the educational institutes to cooperate ad hoc or to use their own knowledge institutes. A vision should be developed on (the need of) coordination between the local communities. Should initiatives be similar or is an autonomous path of each of the local communities/regions the best option to achieve common goals?

4.2.6. Integrating environmental health in associated disciplines

Having health care professionals, that are trained in environment and health, is not enough to tackle all aspects of an environmental and health issue. Other disciplines (architects, engineers, economists…) need to be trained or sensitized regarding health effects of environmental factors. This increases attention and focuses on E&H issues and could increase the involvement of E&H in problem solving.

5. Organisational feasibility

5.1 Legal procedures and regulations

5.1.1. Medical education in Belgium

In the past Belgium was one of a very few countries with an oversupply in medical workforce. This is remarkable as education is very expensive and oversupply might be thus undesirable. On the other hand oversupply causes more competition among specialists and might beat down the price for treatment. In the last years the situation in Belgium changed from far going self-regulation to more public influence. According to the enforcement theory (Shleifer, 2005), Belgium made a shift towards more regulation (Berende, 2009).

[12] Association belge de formation continue en allergologie : http://www.abeforcal.org/

[13] BelSACI http://www.belsaci.org/home/

The structure of training of medical professionals at universities and Superior schools in Belgium is described in the Annex report.

In order to be able to practise, a physician needs a licence granted by the Federal Minister of Public Health. Further training is needed to become a medical specialist and therefore obtain this accreditation. Students wishing to become specialists follow training from four to six years, depending on the specialty. Their choice can be constrained by the small number of training posts available at teaching hospitals. Specialisation is restricted to a limited number of candidates. To be eligible for specialisation, a student has to submit a training plan indicating the name of the supervisor with whom they want to specialise and the in-service department where they want to work, together with the agreement of the supervisor and the in-service department. The training plan has to be approved by the licensing commission for the specialty concerned. There are 30 recognised specialties. Those wishing to practise general medicine undergo two years of training (Berende, 2009), now becoming three years. (DIRECTIVE 2005/36 du Parlement européen et du conseil du 7 septembre 2005 relative à la reconnaissance des qualifications professionnelles)

The authenticity of diplomas is verified by provincial medical committees of the Federal Public Service Public Health, Food Chain Safety and Environment, which register all physicians, dentists, pharmacists, physiotherapists, nurses, midwives, etc. with an authentic diploma. Anyone who is not properly registered is not allowed to practise. The licence is given for an unlimited time, that is, once healthcare professionals have been given the right to practise, they do not have to apply again to keep that right. However, they need to fulfil a number of criteria to maintain this right. Also in cases of malpractice, licences can be withdrawn (Berende, 2009).

To be accredited for providing health services within the context of the compulsory health insurance, health care professionals need to notify the National Institute for Health and Disability Insurance (RIZIV/INAMI). To ensure a higher level of reimbursement they have to comply with the CPD-requirements and obtain credits on a regular basis.

In order to get a new speciality, e.g. environmental health, recognised, the above mentioned institutions need to be supportive to a new speciality: the Federal Minister of Public Health, provincial medical committees of the Federal Public Service Public Health, Food Chain Safety and Environment; and National Institute for Health and Disability Insurance (RIZIV/INAMI).

The initiative for an educational program remains with the universities and Superior schools (on condition of accreditation by the Ministry for Education).

5.1.2. Governmental regulations

For a clear overview, one has to distinguish regulations of the federal and the communities' authorities. In rough, regulations with regard to the standards for a medical profession are with the federal government, including the regulation of prices policy and health insurance and the protection of the patients; regulations with regard to the supply, quality and management of the education are with the communities. Health care facilities and health policy on the other hand, are a competence of the communities as well.

Regulations in the educational system

The Flemish Community is responsible for education in the Flemish Region and also for the Flemish institutions within the territory of the Brussels-Capital Region. The French Community is responsible

for education in the Walloon Region and also for the French institutions within the territory of the Brussels-Capital Region.

Education at the Superior level is organized according to the following scheme (figure 2):

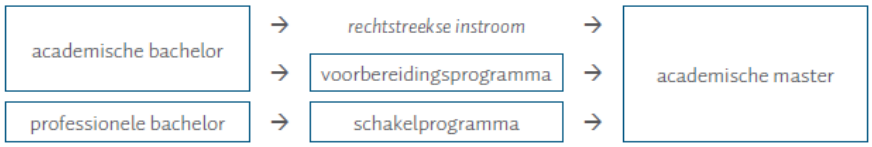

Figure 2: scheme of education at Superior school level

Decision-making on new programs or program reforms of the universities and academic colleges take place within faculties or departments (after advice of the Commission of education) and the board of the institution. A certain level of formalization for educational reforms is obvious.

Given the bottom-up development of new programmes (initiatives are with the faculties and departments), it is not to be expected that the 3 regions in Belgium or the 3 communities would end up with a similar reform although each of them recognizes very clearly the need for environmental health training.

Harmonization could be facilitated by introducing a financial incentive for institutions that include courses on environmental aspects in their medicine programmes. Incentives can be accompanied by prerequisites on its content. There are similar multi-level incentives in the funding of Urban-projects by the European Union although this international community does not interfere in local matters (of the member states). An idea might be to subsidize local health specialisation for emergency planning and intervention, being a federal competency with no direct interference with the regional and communities' competencies but factual cross-cutting environmental issues that are coming in the picture (water contamination during peak flooding; alarms on toxic releases and disposition).

On the other hand, rationalization forces universities and university colleges in a reduction of the differentiation of trainings.

Examples:
Advanced masters have been discouraged at the central level (the macro efficiency check; reduced public budgeting), and within the institutions themselves (universities' policy plans). Other reforms, such as the accreditation of 120 ECTS degrees in the natural sciences, have been agreed with a political package deal on the reduction of the number of advanced masters. Given these drastic reforms, it is not to be expected that new needs will appear easily on the academic agenda. The new quest is finding synergies between programmes.

Harmonization can also be facilitated by requirements/prerequisites at the professional level. In case prerequisites come along with a professional title the universities and Superior schools will tend to embed them in the training's programme in order not to lose their market share.

Regulations on the professional's accreditation and practice

The federal government has set up several bodies to influence the quality of education of the medical training but, given the distribution of competences between the federal state and the

communities only indirectly, via the professional context. These tasks are performed by the Management Council and the Authorisation Commission.

Management Council (E.g.. De Hoge Raad van geneesheren-specialisten en van huisartsen/Conseil Supérieur des Médecins spécialistes et des médecins généralistes)

In 1999 a law was passed to determine general criteria for the acknowledgement of medical specialists. This law is assisted by the Management Council.

The Management Council consists of a Dutch and French speaking department of each 52 members. The chairman of the council is a physician chosen by the ministry of Public Health. The duties of the council concerning for example the medical specialists consist advising the minister about the criteria one must comply to be acknowledged as medical specialist and about the guidelines and recommendations concerning the authorisation commissions. Equivalent councils exist for the others health care professionals.

The two departments have the responsibility to reach a verdict concerning the appeals against the advice of the authorisation commission. Another responsibility is to decide over the advice of the authorisation commissions concerning education and recognition of medical specialists (portal.health.fgov.be).

As already described in point 3.4.2., after completion of their studies, each specialist/GP receives a unique INAMI/RIZIV number referring to its competencies for reimbursement and his professional title.

- After 6 years of training (level 1 of training), the medical doctor receives a number ending with "000": he cannot consult nor prescribe (except for his own family). Shifting at this stage for a master in environmental health or medicine would direct the students mainly towards research or public health activities. He would not be able to open a consultation but could follow the certificate in Environmental Medicine and also be involved into public health or research in the field of environmental health and medicine.
- After 3 to 6 years of specialisation (level 2 of training), the INAMI/RIZIV number is updated to reflect the specialisation (GP's, paediatrician, gynaecologist …) as well as the professional title.
- If the medical practitioner continues completing his competencies with particular competencies (level 3 of training) such as for example endocrinology that is accessible to internal medicine specialists, his number and title are again updated to reflect this newly acquired particular competences.
- A fourth level of training also exists but at this stage no complementary certificate can illustrate this level.

Outside these 4 levels, diploma-awarding trainings exist without leading neither to a particular professional title nor to a revised INAMI/RIZIV number (ex. Epidemiology, Allergology). The federal level (FOD/SPF) does not have then any control on the programme which is therefore left to the initiative of the university.

Creating new level 2 or 3 titles implies the publications of Ministerial decrees defining the criteria for the agreement and the creation of the related agreement commission. The titles are protected by criteria and prescriptions are linked to specific INAMI/RIZIV numbers. Demands for new titles are introduced regularly. As an example, the last speciality that has been created is the title for medical oncology. Such demand should be introduced to the Superior Council of Medical Specialists and General Practitioners and respond to the following questions: Why a new title (what are the needs for the society and what is the added value)? What's the objective? What is the demand in terms of

public health? Which are the scientific evidences? Does any other practitioner fulfil that function (even partially)? If yes, would it be possible to build up on the professions already existing, integrate the topic into the existing training and adapt the related criteria? Which specialisations are concerned?

A feasibility study within the working group "title" is undertaken and their advice presented to the Superior Council. The decision of the Superior Council is then transmitted to the Minister in charge of Public Health. Depending on the demand such decision implies a quorum of the GP's and specialist. If the Minister gives a favourable notice a Ministerial decree précising the agreement criteria is published. At EU level, The European Union of Medical Specialists has also established for some specialities European criteria's.

If we intend to create a new specialisation in environmental medicine, it has to imply new technical acts and exams not covered by the already existing diplomas. A request has then to be introduced to INAMI/RIZIV to create the related number.

Another alternative would be to upgrade the competencies of already existing specialities (level 1, 2, 3, and 4). The Royal decree of November 25 1991 defines the particular professional titles. For each title a Ministerial decree defines the criteria's to fulfil. So that when a new title is created the 1991 decree is updated.

The current review of the criteria's of the 40 existing titles of level 2 specialists could represent an opportunity to include criteria's regarding environmental health and medicine into these specialities. This kind of review is indeed not a regular procedure. To complete the process, the content of the related masters will also be reviewed.

In terms of criteria's, some should also be defined for the recognition of the location of the internships as well as to maintain the title or in case of failure the process to retrieve a title or agreement. As an example, to maintain his practice a GP needs to fulfil 4 criteria: sufficient practice, record keeping of the medical files, participation to the "be on call" services and continuous training.

Autorisation commission (Erkenningscommisie/Commission d'agrément)
The Royal Decree of November 25, 1991 established the foundation of an authorisation commission for each medical specialty as well as for other health care professionals (portal.health.fgov.be). The commissions consist for example for medical specialists of 6-16 members of which 3-8 are acknowledged specialists of the concerned specialty and who have an academic background and are nominated by their faculty. The other 3 to 8 members are medical specialists who are nominated by their professional organisation. The duties of the commissions consist - among others - of giving motivated advice to the minister concerning the applications for acknowledgement of medical specialists and related matters.

Regulations on access to the profession and the workforce supply

The overall number of registered physicians almost doubled in the last 25 years, going from 22,763 in 1980 to 42,176 in 2005, including 21,804 GPs and 20,372 specialists (KCE, 2008).

Registered physician numbers are commonly used by international organisations, such as OECD or WHO, to compute the physician-to-population ratio. On the basis of these figures, in 2005, OECD ranked Belgium third in terms of physician/population ratio (4.0 physicians per 1,000 inhabitants). Compared to its neighbouring countries (France 3.4, Germany 3.4, Luxembourg 2.5 and the Netherlands 3.7), Belgium had more physicians per 1,000 inhabitants in each year between 1970 and

2004. Also compared to all EU Member States, Belgium has a high ratio of physicians per 1,000 population.

KCE (2008) makes, however, an important distinction between registered physicians and active physicians.[14] Not all registered physicians are professionally active, and only a proportion of active physicians provide curative health care, other fields of activity being scientific research, administrative service, employment in pharmaceutical companies and insurances. Between 2002 and 2005 the number of active specialists increased by 7% while the number of GPs stayed roughly the same.

The Committee of Medical Supply Planning, which duty is to predict the "right numbers" of doctors to respond to future health needs is responsible for formulating proposals to the Federal Minister of Public Health on the annual number of candidates per community that are eligible for being granted the professional titles of physician, dentist or physiotherapist, after obtaining the relevant diploma. Furthermore, the committee has to evaluate on an ongoing basis the impact of its proposals on the training for these professionals. An annual report is drawn up on the relationship between needs, studies and moving on to practical training with a view to obtaining the special professional titles of physician, dentist and physiotherapist.

For more complete information on this paragraph, please refer to the annexes related to part 2 of the report in the separate annex report.

5.2 Opportunities for international streamlining

Master course recognition

Recognition of the trained health care professionals

A system of recognition for professionals working in the field is needed. Having a (mandatory) international recognition will ensure that professionals that have obtained this accreditation can work together independent of background professional training. The system can be used for different levels of training, e.g. for non-medical Environmental health professionals and for environmental health physicians.

A similar system is already in place for toxicologists in the form of EUROTOX's ERT (European Registered Toxicologist) accreditation[(8)]. The main advantages of accreditation are the creation of a job title and harmonisation between acquired competencies among professionals. It will be easier for employers to recruit accredited professionals: the accreditation and job title provide a good insight for the employer in skills and competencies.

The accreditation for medical professional follows the Bologna Process.
The Bologna Process is a European initiative to bring about transparency and compatibility of higher education across Europe. It formally involves the establishment of a European Higher Education Area

[14] Active physicians are physicians currently working in the country (alive, not dropped out and not retired) and they include GPs and specialists. Practising physicians are GPs or specialists performing at least one contact a year to at least 50 individual patients. Accredited physicians are practising GPs reaching at least 1,250 contacts a year. To obtain and keep the accreditation, the practitioner has to complete a Continuing Medical Education program, keep medical records for each patient, respect specific guidelines in practice and engage in a minimum level of activity. For specialists, the minimal level of activity is determined by specialty, and takes into account visits, consultations and technical acts. This accreditation, a quality label which is financed, is voluntarily requested by physicians who would like to be recognized for their activity levels as well as for their continuous training.

(EHEA) by 2010 in which all degrees offered share a number of common features - with the aim of enhancing the mobility and employability of students, and the transparency and competitiveness of European higher education.

It defines three cycles of higher education: Bachelor's, Master's, and doctoral. An important aspect of enabling student mobility, and particularly moving on to a further degree in another country, is a system of credits, used for recognition and accumulation - the European Credit Transfer and Accumulation System (ECTS). The typical credit ranges are 180-240 units[15] for the first (Bachelor's) and 90-120 units for the second (Masters) cycles; for the latter, a minimum of 60 units must be at second cycle level. There is no credit range for the third cycle.
Source: http://www3.imperial.ac.uk/graduateschool/qualityassurance/bologna

5.3. Barriers and opportunities with regard to decision making

5.3.1. Political sensitivity/support

Given the many competencies on and complexity of the launch of new programmes or specialities, political triggers are essential. The political level - and by preference more than one political actor – has to appeal for and pull the initiative.

High or low interest of policy makers?
At a political level there has not been much support for establishing training on environmental health or environmental medicine. The politicians have endorsed international declarations which call for more professional training, but there have been limited efforts made at the strategic and operational level to comply with the declarations (Stassen, 2012). One can say that there has been interest at policy level, both federal as regional level, to provide some educational support in the environmental health field (Stassen, 2012). On environmental medicine in particular no support has been seen until. The NEHAP recommended the necessity to support the development of courses and specific trainings on the relations between environment and health and until the CIMES/GICLG supported the set up of the project "Health care professionals and environment". Several educational institutes have established courses for a broader audience than the medical professionals. Others developed advanced initiatives such as the thematic module in environmental health of the University of Antwerp within the course 'Arts en Maatschappij' (Annex 12 of the annex report, since 1999), that however could not resist the pressure of other reforms and has been reduced given other priorities, for instance the 7 to 6 years reform in the medicine training (in 2012).

Controversial issue and stakes?
A major challenge for a firm reform might be the necessary cross-boundary collaboration of different competencies in Belgium. Administrations and politicians sometimes suffer from the non-intervention principle: if I do not intervene in another's policy domain others will respect my territory as well. Interference always is a delicate subject. Mutual collaboration as an answer on the other hand, is hard to achieve.

Local or area-specific issues (hot spots) trigger political attention for environmental health issues: contaminated areas, contested permits for industrial activities, impacts of historical pollution. Stassen (2012) narrates the history of the joint efforts of public health and environment to become a new policy field from agenda-setting to new policy arrangements. Advocates of additional training programs might benefit politically from **local cases** and from **new emerging environmental issues**.

[15] ECTS User's Guide . © European Communities. Luxembourg: Office for Official Publications of the European Communities, 2009 ; ISBN: 978-92-79-09728-7 ; 2009

Environmental policy and sustainability issues sometimes are perceived as too political. Solutions indeed urge for trade-offs and political choices. Professional circles might be reluctant to enter this political arena because they want to position as **objective and foster neutrality**. Advocates of environmental health policy such as the 'Artsen voor het Volk' are marginalized as they are linked to political action and even transformed in a political party in some cities. Practitioners and specialists, focusing on public health or prevention are labeled as 'soft' by the 'hard' core practice of medicine.

The former reform in the bachelor-master format discourages a next reform. University staff (more at universities than at Superior schools) experiences educational management tasks as necessary but as hampering their research activities. An evaluation of the 3+3 reform is scheduled for the near future.

5.3.2. Stakeholders consciousness and support

In general, stakeholders agree that there is an added value of actions at the national level concerning the training of professionals in environment and health. Among the reasons for this added value are a lack of harmonisation between educational institutes, difficulties in tackling complex issues, the need for scale enlargement in order to efficiently train environmental health professionals, and the need for structural cooperation and information sharing between stakeholders of different organisations.
In point 3.1.1, the importance was highlighted of (arguments on) societal relevance of any new educational program within the appliance of the macro efficiency assessment (for a new bachelor or master program). One could say that if environmental health and medicine do not enjoy the right public attention from professors and politicians in this specific domain, the appeal for forcing educational reforms will be insufficient as well. A plea and pressure of stakeholders might help as public awareness is essential for getting issues on the political agenda. The evolution and mechanisms in environmental, health awareness in scientific, societal and political circles, at the international as well as on the local level; is described in Stassen (2012).

5.4. Competencies

5.4.1. Regulation on the competencies of teachers

Within the academic bachelor and masters teaching, holding a PhD is a prerequisite. A specific teacher's degree is however not required to be involved in teaching at university.

The integration of the academic degrees of the Superior schools in the Flemish universities in their hinterlands since 2012 installed a differentiation at the Superior schools.

- Those teaching in an academic program will have to accomplish the academic requirements and standards of the universities. This means in practice: obtaining a PhD degree.
- The teachers involved in a professional bachelor can act as:
    - 'Praktijklectors' (bachelor level required), familiar with the professional field.
    - Lector having a master degree (but not necessarily a PhD although a certain amount has acquired this title).

The specific teacher's degree is however common practice for teaching positions in the teacher training, but even in that specific study domain not required.

Few respondents in the study underlined the importance of perceived social status in training situations within medicine. To train the trainers, the best option is to have trainings by physicians and specialized physicians. The reason behind this is the reluctance to receive lessons from non-

medical staff although most research experience in the environmental health field is concentrated within biomedical sciences, biology, environmental sciences and their research centers. As a consequence, the already few 'green doctors' face the risk to be solicited again: lung specialists on fine dust, specialists in endocrine disruption, epidemiologists and occupational medicine.

The formulation of competencies

The Royal Dutch Medical Association has produced competency profiles for trainer/directors of training programmes/supervisors of medical professionals since 2009. The text is reproduced in the annex from the work of the working group on competencies.

5.4.2. Students – Competencies to be learned

The master course for public environmental health in the UK has served as an example for the competencies to be trained as medical students. This example is followed by a Dutch example of competency groups for medical specialists. These groups represent a wider range of competencies which can also be used in the curriculum of environmental health physician.

To see the operationalisation of all the competencies mentioned in these examples, the programs for the MPH (The Master of Public Health programme of the London School of Hygiene and Tropical Medicine[16]) have been used as an example only, not as standard. The MPH consists of several streams. For this comparison it is assumed one follows the 'Environment and Health stream'[17] and if further choices are possible, as much as possible the 'Public Health' stream'.
At the end of these 'streams':
For public health (PH) the students should be able to demonstrate ability to apply knowledge of the core disciplines of public health, consisting of statistics; epidemiology; health economics; and social research, to real health problems. In addition, they should be able to:

- critically assess key public health functions;
- demonstrate knowledge and skills in a range of topics related to public health;
- formulate, implement and evaluate appropriate policy responses to public health problems;
- show competence in critically evaluating and communicating research evidence.

For the environment and health (E&H) stream students should be able to demonstrate ability to apply knowledge of the core disciplines of public health, consisting of statistics; epidemiology; health economics; and social research, to real health problems. In addition, they should be able to:

- describe the principal concerns in environment and health (pollution of air, water, and land; the urban environment; sustainable development; risk perceptions)
- interpret and evaluate risk assessments and risk management strategies as applied to environment and health concerns
- show a theoretical and practical understanding of the design and analysis of studies in environmental epidemiology

[16] London School of Hygiene and Tropical Medicine Public Health (Environment & Health) available at (accessed on 06.03.10)

- analyse the political and social contexts in which an environment and health policy is made, the factors that lead to policy change, and in particular, the role that research plays in policy change
- show competence in critically evaluating and communicating research evidence in relation to environment and health issues.

The produced competencies are not different than those for most other medical professions. It is feasible to comply with these competencies for students that will do a master course in environmental health

Additionally, we can also refer to a recent initiative of the Flemish authorities for Education and for the Environment. They cooperated on the formulation of the **generic competencies**, required in any educational program with regard to the specific perspective of **Sustainable Development**, the 'Referentiekader Duurzaam Hoger Onderwijs' (Vlaamse overheid, Departement Leefmilieu, Natuur en Energie Afdeling Milieu-integratie en –subsidiëringen, Dienst Milieu-integratie Overheden & Maatschappij, Ecocampus , 2013). This framework will function as a kind of benchmark and is meant to strengthen attention for the different pillars in the knowledge and capacities of graduates. This benchmark however, is neither formalized nor compulsory.

The framework and the competencies are to be found at:
http://www.lne.be/doelgroepen/onderwijs/ecocampus/literatuur-presentaties-beeldmateriaal/literatuur/referentiekader-web.pdf

6. Effectiveness and efficiency of the training/course including budget issues

6.1. Estimated number of applications per year

Training system
The lack of insight in the number of trained professionals needed, together with the expectation that this number will be relatively small, makes it difficult for educational institutes to set up a successful training. It is not feasible for them to set up training for only a few people. From the TOP project it was recommended to set up an international training system that is expected to aid in harmonising the field of Environmental health as well as in training professionals in the same competencies.

No functional structure
There is a lack of structure on both national and regional level. Training may be available in an educational institutes but the coordination between training providers may still be missing. It is felt that a lot could be gained by improved cooperation on the national and regional level. This cooperation could consist of the sharing of knowledge, environmental data, and discussing the latest developments in the field in order to stay up-to-date. Furthermore there are possibilities for cooperation in solving this problem by an expert-exchange programme. In short there is no functional structure in place to achieve this. It does not exist on the national level.

Different training objectives
Each educational institute has its own training objectives. Disciplines and competencies in which future environment and health professionals are being trained have little in common throughout the institutes. Professionals may be trained in toxicology, but not in risk communication in one organisation and vice versa in another institute. There is no single set of competencies that trained

professionals should master. As a consequence, it is difficult for employers to know what can be expected from professionals.

Medical curriculum
Environmental health became at a handful of universities a topic to be included in the medical curriculum since the 1990's. In those universities the topic was dealt with only for a couple of hours as part of some education in social medicine. Currently there are a few universities which educate their students or interns about environmental health for a couple of hours. These trainings are limited to an overview of the broad field of environment and health. Diagnostics or special risk assessment tools are usually not part of these trainings.

General practitioners
General practitioners are not trained in environmental health. Some areas which are related to infectious diseases might be dealt with. Examples are legionellosis, Lyme disease or other vector borne diseases which originate in environmental settings. Diagnostics tools and treatment possibilities with regard to environmental stressors are not part of the education of general practitioners. Trainings in environmental medicine for general practitioners were conducted ad hoc a few times in Germany and Luxemburg. No structural trainings for general practitioners in Europe have been identified.

Medical specialists
In Germany in the nineties of last century it was initiated that medical specialists could do an additional training in environment and health. This training lead to an additional Diploma and the title of "Umweltärzt" (Environment-Doctor). In recent years this training has not been active anymore.

In hospitals there are no specific clinics for environmental diseases. For acute incidents with exposure to environmental stressors patients will be referred to poison centres which are established in most EU countries. For chronic environmental diseases there are no specific clinical facilities identified in the Member States. One exception is the Paediatric Environmental Health Speciality Units (PEHSU) in Murcia and Valencia, Spain. These units are organised after American examples. Other physicians can refer patients to these policlinics for diagnostics and treatment of environment related diseases in children. On an individual level there are sporadic some clinicians (dermatologists, paediatricians) who have specialized themselves in environmental health related diseases.

In several countries the Medical Associations have highlighted environmental health as a feature in their knowledge transfer to their members by articles in journals or by seminars.

Insufficient Effectiveness of Current Training courses

There is no standard curriculum identified for professionals in environmental health. The social medicine profession is trained according to the Bologna criteria, but in environmental health no common curriculum has been established. There are a few examples of what a European curriculum in the field of environment and health could look like. It was obvious that the only two established curricula are based upon the fact that basic training arranged on competencies is preferred and actually should be a key issue in any curriculum. Since various degrees of experts are needed (from people with basic knowledge on environment and health to highly trained professionals), a curriculum could also have different layers, ranging from a core training to a high level of specialisation in certain areas. In the Netherlands the Ministry of Health decided to train medical doctors in environmental health. It was decided that it was better to train doctors to become specialists in this field, rather than train the whole medical profession. In other countries the public health officials, including some doctors, were trained in a similar fashion.

6.2. Job titles

Professionals who are trained in the field of environment and health currently operate under a number of different job titles and functions. This issue is related to the lack of knowledge on the amount of professionals and the differences in training objectives. It is important to have job titles associated with the different disciplines, since this promotes harmonisation between European countries. These job titles should be clear to potential employers.

6.3. Minimal capacity of professionals

Currently there is no clarity on the number of professionals that are already trained and active in the field in the European Union. Neither is there clarity on the actual amount of trained professionals needed. Estimates differ and there is not enough information available on the subject. This should be revised in more detail within the background scenario.

The examples of the Netherlands, Germany (Bavaria) and the UK were used to come to an estimate on the minimum amount of professionals needed. When looking at current situations and rationale of capacity planning, the number of citizens that can be covered by 1 environment and health physician is approximately 1,000,000. This would mean that about 500-1,000 of these experts are needed within the EU or about 10 in Belgium. In addition, a number of other specialists (e.g. biomedical scientists, nurses) are requested. When taking into account the number of non-physician experts in the UK and Netherlands, their number would be about 10 times higher than the number of environment and health physicians. Hence, a minimum of 5,000 – 10,000 experts would be needed within the EU spread over the different countries.

6.4. Availability of trainers

Some of our respondents state that a growing number of specialized physicians is needed in academic positions to train the trainers in environmental health. This however is a chicken-egg problem: what comes first? Being able to rely on a large group of biomedical scientists, toxicologists etc in Belgium the question is how to involve them in medical trainings. A trigger might be the development of additional interdisciplinary research programmes on environmental health topics, in which physicians, involved in research and trainings and other scientists cooperate. In such a context, scholars will be eager to learn from each other. The investment for such additional research could be compared with the salary costs, necessary to enlarge the group of trainers. Enhanced research activities offer a win-win for the country or its communities on the short term. In Belgium the mere full cost of a 100% time post-doc position is at least 85.000 Euros a year; a professorship costs approximately 100.000 Euros in Belgium.

6.5. Financial aspects

6.5.1. Costs

It is difficult to calculate what additional costs are needed for a new course on environmental medicine. There are some studies which show the costs of university hospitals. This gives some insight in the distribution of costs.

University hospitals receive financial funds for their academic activities from different sources.

In the research the following costs types were identified:

- direct costs: all instruments and expenditures directly related to research and education
- value: salary costs which are related to academic tasks of doctors, and are financed by some other organisation than the hospital. (When comparing the hospital's expenditures and the received funding, this amount is not considered. However, value has to be involved in the calculations when identifying the total expenditure on research and education.)
- indirect costs: expenditures that are only indirectly related to research and education
    - pure indirect costs: costs of services provided by the university departments of the hospital that can be assigned to research or education
    - indirect costs of the structure: costs of the general services and overhead – a part of these cost can be assigned to the education and research
- induced costs: extra costs due to the "overuse" of some services (pharmacy, laboratory, radiology) like the parallel usage of traditional and new/ experimental medical practices or the "efficiency loss" in the work of doctors due to the time spent on education. Induced costs are not tangible, and therefore hardly definable.
- opportunity costs: incomes that would have been generated if the hospital uses their sources in a different way than teaching or research

6.5.2. Sources of financing

University hospitals receive funding for their academic activities from four different sources. The most significant is an additional budget (besides the general hospital budget) offered by the government (referred as part B7). The budget considers the direct and indirect costs of education and scientific research, and binds the support of hospitals to requirements.

The Fund for Scientific Research (Fonds voor Wetenschappelijk Onderzoek, FWO/Fonds pour le Recherche Scientifique, FRS) offer support to researchers (postgraduate and post doctorate) in all fields of science. The funds for physicians (before their postgraduate education) and specialists make it possible that doctors devote a part of their time on scientific research. The fund covers a portion of their salary diminishing the financial burden on the university hospital.

Universities and private funds also contribute significantly to the education and research costs. Figure 3. shows the proportion of different sources in hospital resource for academic activities.

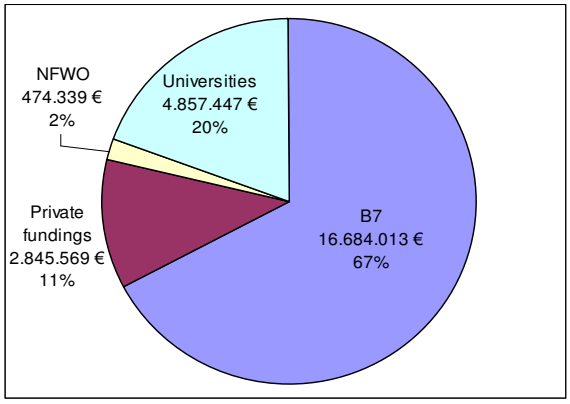

Figure 3. Sources for academic activities: example FWO (2002)
Source: Antares Consulting, 2003

6.5.3. Allocation of budget[18]

The part of the budget that is available for scientific research and education is distributed across the academic activities as follows:

- 25% of the amount is devoted to support and encourage scientific publications. In order to be entitled to this fund, university hospitals have to realise minimum 3 publications per 10 beds in three years preceding the year of the support.
- 15% of the amount is spent to cover the costs of medical education. Teaching hospitals receive a capitation fee based on the number of teaching physicians and residents.
- 60% of the amount covers the indirect costs of the academic activities. The sum allocated to each hospital is proportional to the budget intended to cover the costs of hospital services.

Further conditions to receive the funding are:

- The hospital has to be approved for complete education programmes in de most important specialties.
- There has to be minimum one resident (with an approved curriculum) per ten approved beds and the hospital itself has to pay the compensation for residents.
- The hospital has to employ minimum one physician (in FTE) per three approved beds.
- It has to be proved that the 70% of the medical activities is performed by full-time working physicians.
- More than 70% of the physicians (in FTE) have to receive a salary rather than a fee for service reimbursement.
- Quality assurance of medical education in Belgium.

These requirements are difficult to fulfil for a specialist in environmental medicine. The number of patients that is hospitalised for environment related diseases will be small. The number of patients visiting a policlinic might be larger. But it is not clear if a specialist can raise enough funds based on a practice with a focus on outpatients.

The organizations involved in environmental health, could request reimbursement from insurance companies for environmentally related health care services provided to patients and could lobby state legislatures and state insurance boards for such coverage. It is known that medical insurance companies influence medical practice. If services are reimbursable, they are more likely to be offered to patients. Fellowships can be funded in part from service-related income.

In Flanders, the budget for universities does not depend on the initiatives they develop but on their quantitative output in terms of student numbers and credits taken up and their research output (Decree on the financing of superior schools and universities in Flanders, Flemish Parliament 5.3.2008; BVR 14.3.2008). Room for new trainings has to be found within the institutions themselves and imply an internal shift with existing trainings or budget costs. Only after a few years, when the number of graduates of a new training is assumed to stabilize, the 'trekkingsrecht' follows as the global envelope is distributed between the universities on the base of several growth parameters, the number of students being one of them. As a consequence, any new public funded academic program has to pass a formal macro-efficiency check, assessed by an external panel installed by the Flemish government before the application for accreditation (see above). Are not explicitly mentioned criteria: the pricing of enrollment and other budgetary aspects or conditions such as the

[18] Based on: Koninklijk Besluit, 2002.

period to bridge to a financial break even. The concerned Decree (in Flanders) does not define what macro efficiency means. Compulsory items within the check are the assessment of the demand by the professional field; a demand in the labor market for additional graduates from this program; the competitive position (existing programs or similar programs and their numbers of students); and last but not least the societal relevance of the program. Given the ratio behind any efficiency assessment (see also public means for education), a reflection on the monetary aspects is nevertheless expected. At least a convincing commitment of the Rector on the program's means is necessary and a prospection of at least 20 regular students (for a 60 ECTS program) is more and more becoming the norm. The better a new initiative demonstrates its societal relevance and its uniqueness, the more easily the external commission will be convinced.

A well-known methodology for calculating the efficiency in the higher education domain is Activity Based Costing (the ABC principle). Forerunners in using this model are the UK and the Netherlands. "ABC consists in the fact that certain activities are defined (basis activities are education, research and services) and that for each activity the main costs factors or the so called 'cost drivers' are set. Potential 'cost drivers' are the number of labour hours, the number of square meters, … The identification and calculation of all direct and indirect costs of the university activities are important for both internal as external goals"[19] .

Within the educational column of academic services, student numbers are a key indicator. A standard is at least 15 (till 2012-2013) to 20 students (from 2015-2016 on) as inflow in the first (or only) year of a master program, which corresponds with 1200 ECTS being taken up (20x60).

We consulted the administration file of a recent application in the field. The estimated student-staff ratio of the 120 ECTS Master in Epidemiology at the University of Antwerp[20] is: 0,28 (2012-2013); the prospected number of students a year: 15.

Within the University of Brussels, about 15 to 20 students follow the 120 ECTS master in Public Health and Environment. At the University of Liège, there are also about 20 to 25 students attending the option "Promotion of health and environment" within the master of Occupational Medicine or Public Health. In both cases (ULB or ULg), the students have various backgrounds (journalists, economists, nurses, doctors, etc.). It is not clear how many students come from abroad (ex. France, Africa). This inhomogeneity constitutes sometimes a barrier to approach the different topics in a thorough manner and would plea to develop some specific modules addressing health care professionals.

Other numbers:

- For a programme of 60 ECTS a staff of 2 FTE professors is considered the standard.
- The parameters "FTE-level" and "student/staff ratio" were due to a different structure for the training at Superior schools not elaborated
- A programme of 60 ECTS normally implies 2 full academic semesters of 15 weeks. In each week, about 20 contact hours are offered. With for instance 10 courses in total, one course of 6 ECTS implies 15 weeks of 3 (college) contact hours.

[19] UA, Beleidsverklaring Rector UniversiteitAntwerpen2009

[20] Source:
http://www.hogeronderwijsregister.be/files/504de4ff0817e_advies%20UA%20master%20Master%20in%20de%20epidemiologie.pdf

7. Discussion and recommendations

The procedure to develop a full and recognised master is quite heavy. Besides the insight in the number of trained professionals needed is lacking, this number seems to be either limited, either mainly depending on public funding. In addition it is at this stage also difficult to ensure a minimum number of medical students, nurses or midwives attending such specific master.

According to this and further to our consultations with Superior schools and universities, it appears that the implementation of training and specialisation of health care professionals in environmental and health medicine could be done step by step.

As a first stage, we would suggest to focus on the basic training of the health care professionals, the integration of environmental health within the different specialities, the development of a certificate of 80 to 120h (about 12 ECTS) and the translation of the different proposed contents into continuous training sessions.

Since various degrees of experts are needed (from people with basic knowledge on environment and health to highly trained professionals), a curriculum could also have different layers, ranging from a core training to a high level of specialisation in certain areas.

The current review of the criteria of the 40 existing titles of specialists could represent an opportunity to include criteria regarding environmental health and medicine into these specialities. This kind of review is indeed not a regular procedure. To complete the process, the content of the related masters will also be reviewed.

Taking into consideration existing "windows of opportunities" here are discussed possibilities for the integration of the environmental health and/or medicine topic within the programmes of medical doctors, nurses and midwives.

Basic training of Medical Doctors

In the context of the reform from 7 to 6 years for the master in Medicine, the compression reduces the potential to develop new courses on environmental health and medicine in the basic training. However, according to our discussions with the deans of the different universities and to what's already done in some universities, the potential exists to ensure the integration of a minimum of awareness raising in this field into existing courses such as health and society, pneumology, cardiology, obstetric and paediatrics. Indeed some is already done although it doesn't necessarily appear in the inventory since it is left so far to the initiative of the teacher. For example, the course "Problems of health and environment" delivered at the University of Brussels (ULB) (10 hours) includes already all the elements proposed in the 1st point of the specifications (as presented in annex) but also in the course of pneumology, the impact of the pollution on the prevalence of asthma and allergies, the impact of moulds on allergic alveolites or of professional exposures on lung cancer are already part of the course content.

The proposal has then been done to send specifications to the deans for content to take into considerations into the basic training as a checklist to ensure awareness raising of future practitioners. This would be like a framework so that if the concerned teachers already respond to these specifications, they won't have to change anything in their course. If not, they would have to adapt their content and a minimum of literature has been proposed as a first support.

Basic training of nurses and midwives

Since the file regarding the "masterisation" of the training of nurses is still pending, it seems so far quite difficult to make a proposal for short term implementation. However initiatives already exist within some Superior schools and strong request from some of them have been expressed to push forward the inclusion of this field of expertise in the basic training of nurses and midwives.

As a first step, in line with the specifications proposed for medical doctors, specifications and a profile of competences could be drafted for nurses and midwives. Besides the health aspects, specific considerations regarding conditions within the hospital would have to be included in order to share a vision of a health care sector that does no harm, and instead promotes the health of people and the environment. Nurses and midwives could indeed play an important role to implement ecologically sound and healthy alternatives to health care practices that pollute the environment and contribute to disease. The huge scale of the health care sector worldwide means that unhealthy practices such as poor waste management, use of toxic chemicals, unhealthy food choices and reliance on polluting technologies have a major negative impact on the health of humans and the environment. Nurses and midwives can therefore help shift the mind set toward sustainable, safer products and practices without compromising patient safety or care.

Also in the Federation Wallonie-Brussels, a work group (at inter educational network level) on the harmonisation of the training of nurses in community health has been established and the potential to integrate topics related to environmental health and medicine could be foreseen in this revision process. Ecocampus is another initiative (of the Flemish administrations of environment and of education) for the inclusion of sustainability in curricula.

Development of a certificate

As a first step the most flexible proposal would be to develop a certificate. Creating a certificate would give a lot of autonomy to the universities for the development of the program, with or without collaboration between universities, between universities and Superior schools, between communities or even at the international level (interregional, European or international). As already mentioned earlier some content may be already available and the new quest would be in finding synergies between programmes and extend the existing to complementary topics. At this stage following the certificate would simply extend the competencies of the practitioner.

In order to bring more support to the certificate, recognition from the INAMI/RIZIV could be foreseen. Such recognition might request a minimum of training (ex. DMG++) and the subscription to continuous training. The interest to create a specific INAMI/RIZIV number for environmental health and medicine would even give more visibility to this field of knowledge. In this case if INAMI/RIZIV fix the prerequisites, the Communities would have to enter the approval process of the programme.

In the future development of the programme, the development of a complementary master could be considered, in line with the Declaration of Bologne or outside the line of Bologne. In this last case, the process would be much more complicated, first, because the creation of a new master is quite a complicated process and institutions today have to account for potential enrolment numbers but secondly, international negotiation would be necessary for its development.

The certificate could address health care professionals with different backgrounds but also provide specific modules addressing only medical doctors. It could be fully integrated into the master programme of nurses with orientation in community health in the framework of the "masterisation" process.

Therefore, complete specifications demonstrating that the content exists for 120 to 150 hours of training should be addressed to INAMI/RIZIV and the College of deans.

Continuous training

In order to maintain their registration for reimbursement by INAMI/RIZIV some practitioners (GP's, midwives, etc.) have to follow regularly continuous training under different headings. Medical doctors (GP's) have also to participate to 3 mandatory GLEM/LOK per year. So far any training in environmental health and medicine would fall for medical professionals under the heading "Ethics and economy". To give more visibility to this emerging field of expertise and set it as mandatory in the CPD (for example 4 hours/year), we would suggest introducing to the Superior Council of Medicine (*Conseil Supérieur de Médecine*) and INAMI/RIZIV arguments regarding the need to include this field of expertise in the continuous training of GP's and specialists and to create a new heading "Medicine and environment". Such a wide heading would give the opportunity to include trainings regarding the individual or public health but also trainings regarding for example risk communication. These arguments as well as a proposal of specifications for the CPD could then been introduced to the different institutions (universities (ECU), Superior schools, professional associations, GLEM, other organisations) delivering continuous training programs. The new heading "Medicine and environment" would then been used by these providers of CPD programmes.

For nurses and midwives, the development of arguments highlighting the interest to develop continuous training in this field would probably support their inclusion in the agenda. Such argument would have to be proposed to the following councils: the federal council of nurses, federal council of midwives, CPSI and professional associations organising CPD programmes.

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Part 3: Instruments and tools in environmental health

An inventory of tools or instruments supporting health care professionals in their practice while facing environment and health issues and increasing their expertise in the field of environmental medicine is made. The identified instruments or tools have been categorised in three groups:

- Tools for diagnosis and support to health care professionals with individual patients;
- Tools at an organisational level (networks, etc.);
- Tools for public health.

Each identified technical tool has then been categorised according to its nature with respect to its diagnostic capacity and treatment in the medical practice:

- Database (environmental monitoring results, health data, environment and health data, …)
- Assessment tool
- Frame of reference or judgement (norms, standards, guidelines)
- Communication
- Network
- Exposure level reduction
- Tool for public health or to support health care professionals in case of an emerging local issue.

Any tool ultimately is designed to realize health benefits. In practice however, there can remain a distance between providing a knowledge base and effective action or change. With regard to intended changes or encouragement to realize health benefits, a tool can also be defined as a policy instrument: a formal or informal measure; a response to intervene or solve a problem that is described as a target or policy goal. For instance: a regional network of environment professionals for facilitating cooperation between peers by pooling their knowledge and experiences for an effective diagnosis, a hot line for complaints and questions in order to increase awareness, a procedure for gaining expert advice, a procedure for process guidance of local community initiatives, a subsidy for quality screening, a procedure for the interpretation of controversial health risks, an advisory council, standards, etc.

All collected instruments have been described following a common format: tool category, tool description, relevance for health care professionals, availability in Belgium, actions potentially needed for further development, financial aspects and references related to the description of the specific tool.

Among the described tools that could bring some support to health care professionals in their practice with individual patients, we identified databases such as the air quality IRCELINE database, the pollen and other allergens surveillance program, the TEDX Critical Windows of Development website, the global medical file (DMG, DMG+/GMD) and the DES database. Others are rather assessment services or tools called, used or referred to better understand the environmental exposure of a patient or a cluster of patients and propose remedial actions to reduce exposure: the so-called “green ambulances” (CRIPI/SAMI/LPI), the SQuATe tool, the MMK network, human biomonitoring, reference values, risk analysis processes, geographic information systems, the web tool cadmium risk, the Asthmapolis device, the specialised inhalation exposure facility and the radon day. Specific tools to share and exchange information or to develop a communication process have also been highlighted: the communication platform GERICO, networks (network of « médecins vigies/huisartsen peilpraktijken », network of laboratory vigies, the UK THOR-gP research network of General Practitioners), or organisational structures such as the local centres for Health Promotion (CLPS/LOGOS) and VIGEZ.

Other interesting tools for public health could show an interest in environment and health if integrating environmental items. Collected data and information would strongly support research in this field, the highlight of priorities, the elaboration of appropriate strategies and actions but also health care professionals facing an emerging issue. The BE-MOMO (Belgian Mortality Monitoring) and Standardized Procedures for Mortality Analysis, the Belgian Health interview Survey, the cancer registers, the EUROCAT epidemiologic surveillance of congenital anomalies, the Guide to health in spatial planning or the PEP network. Other tools existing at the international level have also been reported in the annexes.
Many tools already exist in Belgium and the need to create new tools doesn’t seem to be the highest priority. However in order to better develop knowledge and support in a field participating to the increase of chronic diseases some existing tools could be extended to integrate environmental items. In addition, the stakeholders consulted within the framework of this project have expressed a demand to maintain the network so brought together.

1. Introduction

The original aim of this part of the project is to make an inventory of tools or instruments[21] , meaning, according to the call for offer of the project, any source of information (information tool) or service (service tool) supporting health care professionals to increase their expertise in the field of environmental medicine. For instruments, already introduced in other countries, both in European countries as at the international level (USA, Canada), the potential to adapt them to the Belgian context had to be assessed. Which instruments are relevant? The instruments will be evaluated on their relevance in a scientific and structured way traced in publications, recognition by experts, etc., qualified as types and with different organizational contexts. The unit cost is specified where available, the way these instruments are financed and how they possibly can cover their costs.
Major instruments for the interdisciplinary environmental-medical diagnosis are history, risk determination, on-site inspection, biomonitoring and ambient monitoring but also networks of professionals. The definitive diagnosis of an environment-related disease usually requires a joint evaluation of toxicological, somatic and psychosomatic findings and a multidisciplinary approach.

2. Methods

The project team has made a first proposal on the structure of the inventory of instruments. This proposal has been discussed with the steering committee on January the 29th, 2013. The Steering Committee agreed with the proposed structure. The focus of the inventory of instruments is not restricted to the field of environmental medicine. A broader scope of instruments is used given the added value of multidisciplinary insights.

The inventory for national instruments has been made by the following steps:

- Known instruments which are being used by the experts within the consortium;
- Instruments identified on the internet (using Google and Pubmed);
- Instruments identified by experts (questioned by telephone, meeting or workshop);
- Instruments discussed in applied courses on environmental health;
- Instruments that we considered as missing and could be developed.

The key words used for the internet search are: environmental health/medicine tools/instruments.
Each instrument is described according to a common format.
The instruments from international sources which are supportive for (Public) Health Impact Assessment or decision making in environmental health have been collected from the EU-funded project HENVINET. These instruments are presented in annex 1.

3. Inventory and Analysis

The topic of instruments or tools to be used in the environmental health/medicine field is a very broad topic that could include instruments as varied as technical, regulatory (legally or not legally binding) or social instruments (informing, awareness raising, education, training, labelling, risk communication, voluntary agreements), economic incentive (market based, subsidies, fees and taxes) or professional networks.

[21] Definition instrument: point 23. of the call for offer n° DVZ/cel L&G/YN/2011-001

According to the definition of the call for offer, we considered in the inventory, any source of information (information tool) or service (service tool) supporting health care professionals to increase their expertise in the field of environmental medicine and complete their diagnosis of environmental related health symptoms. We also considered tools ensuring a better understanding of the relation between the individual health of a patient in a broader public health context (individual level versus population and community level).

We used the following description of a tool or instrument.
The instruments or tools identified to support health care professionals in their practice while facing environment and health issues have been categorised in three groups:

- Tools for diagnosis and support to health care professionals with individual patients;
- Tools at an organisational level (networks, etc.);
- Tools for public health.

In first order, for technical tools, we categorised the tool according to its nature with respect to its diagnostic capacity and treatment in the medical practice. The following tool categories have been identified:

- Database (environmental monitoring results, health data, environment and health data, …)
- Assessment tool
- Frame of reference or judgement (norms, standards, guidelines)
- Communication
- Network
- Exposure level reduction
- Tool for public health or to support health care professionals in case of an emerging local issue

Any tool ultimately is designed to realize health benefits. In practice however, there can remain a distance between providing a knowledge base and effective action or change. With regard to intended changes or encouragement to realize health benefits, a tool can also be defined as a policy instrument: a formal or informal measure; a response to intervene or solve a problem that is described as a target or policy goal. For instance: a regional network of environment professionals for facilitating cooperation between peers by pooling their knowledge and experiences for an effective diagnosis, a hot line for complaints and questions in order to increase awareness, a procedure for gaining expert advice, a procedure for process guidance of local community initiatives, a subsidy for quality screening, a procedure for the interpretation of controversial health risks, an advisory council, standards, …

After having completed the inventory, we looked back on the distinct incentives that come along with the tools. Are these tools mainly technical instruments and knowledge products or are they also a) regulatory instruments aimed to change a practice; b) economic incentives (market based, subsidies, fees and taxes); and c) social instrument (informing, sensitization, education, training, labelling, risk communication, voluntary agreements) ? We have to admit that only 25 to 30% of the tools have such a steering quality (cf. a, b and c). The majority of the tools can be understood as available information and knowledge, technical tools and infrastructure: as such they do not represent or promote health benefits. The types of incentives are mentioned in the descriptions as well.
We have excluded from the inventory: pure internal policy instruments to administer and finance E&H policy (infrastructure and management, public administration, budgets within authorities, general regulatory aspects). These tools seemed too generic to be included in an inventory addressing health care professionals in their daily practice.

Finally, we look at instruments that are missing and which should be developed.

The collected instruments have been described according to the following format

1. ***Tool category (for technical tools)***
☐Database (environmental monitoring results, health data, environment and health data, …),
☐Assessment tool,
☐Frame of reference or judgement (norms, standards, guidelines)
☐ Communication,
☐ Network,
☐Exposure level reduction,
☐Tool for public health or supporting health care professionals in case of an emerging local issue.

2. ***Tool description***: describing the content of functioning role of the tools.

3. Relevance of the tool for health care professionals: explaining how the tool can support health care professionals in their practice. What is the added value of such a tool in environmental health and medicine.

4. Availability of the tool in Belgium and if the tool is available, its accessibility and conditions of access.

5. Actions potentially needed for further implementation
This includes considerations about dispatching the tool to other professionals or to further extend the scope of the tool.

6. Financial aspect

7. References
This section includes references in the literature supporting the interest of such a tool in environmental medicine and health.

3.1. Technical tools to support diagnosis by the health care professional with an individual patient

3.1.1. IRCELINE

Tool category: Database, Exposure level reduction

Tool description:
The IRCELINE website http://www.irceline.be (based on VMM, IBGE, ISSeP continuous outdoor air quality monitoring networks) informs on the outdoor air quality and synthesizes the results into an air quality index. The outdoor air quality index provides a number allowing a global understanding of the ambient air quality indicating a level of health risk associated. The indicator is quite visual and easy to understand which makes it a strong tool for awareness raising. Its scale ranges from 1 (excellent air quality) to 10 (terribly bad air quality). The index gathers as one representative number the concentrations of several pollutants in ambient air. The computation is performed by using data obtained from the telemetric networks that measure continuously the air quality in the 3 Regions. The index is based on the concentrations of O_3, NO_2, SO_2 and PM_{10} particles. A "characteristic value" is computed every day for these 4 pollutants and then compared to a concentration scale. The concentration scales are based on the European guidelines concerning the assessment and management of ambient air quality. Based on the number of allowed exceedances of the new European limit values (the target value for ozone), an index value of 6, 7 or 8 is assigned to that limit value. The other scale divisions were defined by evaluating the range of concentrations measured in the telemetric networks of the three Belgian Regions. Since the European limit value are also the results of an economic compromise, the limit values the index is referring to are not necessarily fully protective for the whole population but tend to.

Table 1: Outdoor air quality index

Pollutant		Concentration µg/m³									
SO_2	Mean value 24h	0 - 15	16 - 30	31 - 45	46 - 60	61 - 80	81 - 100	101 - 125	126 - 165	166 - 250	> 250
NO_2	Daily maximum of the hourly average	0 - 25	26 - 45	46 - 60	61 - 80	81 - 110	111 - 150	151 - 200	201 - 270	271 - 400	> 400
O_3	Daily maximum of the 8 hours average	0 - 30	31 - 45	46 - 60	61 - 80	81 - 100	101 - 120	121 - 150	151 - 200	201 - 270	> 270
PM_{10}	Mean value 24h	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 70	71 - 100	101 - 150	151 - 200	> 200
Index		1	2	3	4	5	6	7	8	9	10
Appreciation		excellent	really good	good	quite good	average	mediocre	very mediocre	bad	Really bad	Execrable

Besides the air quality INDEX, the website presents detailed data and maps on the levels of SO_2, NO_2, O_3, PM_{10}, $PM_{2.5}$ and black carbon.
It makes the link towards the related website of other European countries.

Relevance for health care professionals:
Depending on their properties, the different outdoor air pollutants can be responsible for different health problems. Patients already suffering from respiratory or cardiovascular disorders but also pregnant women, elderly and young children are at higher risk. Adequate recommendations when the levels of air quality exceed a trigger value or when the air quality INDEX is bad can seriously reduce the potential health effects. A subscription to the website informs any practitioner (ex. GP's, pneumologists, paediatrician, allergologists, cardiologists, gynaecologist, nurses and midwives) through SMS alerts and Twitter when concentrations of pollutants are too high.
As the information is (free) available on a website, and - in case of risks–largely communicated via the media, IRCELINE also might increase the arousal level for environmental health of professionals and even the public at large. Sensitizing information can also be qualified as a *social instrument*.
The recommendations that practitioners give to their patients depend on the situation of exposure. Short term exposure to high concentrations of ozone or particulate matter can be avoided by advising not to participate in activities of exercise (sport, hard labour). Long term exposure to high concentrations of pollutants related to for example traffic should be avoided especially by persons with respiratory problems, pregnant women or children (Gehring, 2013).

Availability in Belgium:
The legal base for this tool is a European Directive, on data delivery of the member states (2002/3/EG) and an agreement between the 3 Belgian regions on alarm situations (1994). The agreement between the different Belgian Regions regarding air quality monitoring and data management provides an efficient service to the population (cf. Open source system).

Action potentially needed for further implementation:
The service already existing responds to related EU Directives. The platform could be considered as a good base to rely on to potentially extend its services to more environmental and/or health data.
This service (via sms) is probably not well known among GP's and other health care practitioners, a quick survey within the SSMG for example could be interesting to assess their level of awareness or at least organise awareness raising campaigns, conferences and/or brochures on supportive tools such as the IRCELINE service.

Financial aspects:
No extra cost is needed at this stage.
Some investments might be necessary if we want to extend the service to more parameters or data.

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3.1.2. Pollen surveillance program

Tool category: Database, Exposure level reduction

Tool description:
The "pollen surveillance program" is a network of aerobiological surveillance in Belgium including 5 stations: Bruxelles, De Haan, Genk, Marche-en-Famenne et Tournai. It provides a quick and weekly updated information on the level of allergens in the air at the 5 stations (level of pollens and moulds concentrations), information on the pollenic and fungal calendar and a newsletter. The information is accessible on the following web pages:
- http://airallergy.wiv-isp.be/sites/airallergy/fr/default.aspx (Home page in French)
- http://airallergy.wiv-isp.be/sites/airallergy/nl/default.aspx (Home page in Dutch)
- http://www.province.luxembourg.be/fr/pollen.html?IDC=4375 (for the station in Marche-en-Famenne)

As the information is free available on a website, and - in case of increasing exposure- communicated via the media, the Pollen network also strengthens the arousal level for environmental health of the large public. Sensitizing information can also be qualified as a *social instrument*.

Relevance for health care professionals:
The aim of the program is to provide to health care professionals and patients information regarding the level of allergens in the air. This in order to support the diagnosis and to protect sensitive patients during high risk periods. There are some recommendations which practitioners can give to their patients, if they know that they are sensibilised to specific pollens, based on the data from the pollen surveillance program. For example:

- minimize your exposure to pollen. Check pollen counts before planning outdoor activities.
- Avoid being outdoors in the early morning, when pollen is most widespread.
- Wear sunglasses to protect your eyes from pollen.

- Have someone else mow your grass. Don't rake leaves during pollen season. If you must do garden work, wear a mask.
- Going on vacation? Look for a place where pollen is low, such as the beach, or take your medications with you.
- Change your clothing when you come indoors. Shower and wash your hair first.

Availability in Belgium:
The programme of aerobiological surveillance in Belgium has been created in 1974.
The surveillance program, supported by the 3 regions in Belgium and the Province of Luxembourg (Service Public de Wallonie – Cellule Permanente Environnement Santé, Bruxelles Environnement – Institut bruxellois de Gestion de l'Environnement (IBGE-BIM), Vlaams Agentschap Zorg en Gezondheid and Province de Luxembourg - Service Prévention Santé) is managed by the Service Mycology-Aerobiology of the Scientific Institute of Public Health (ISP-WIV).

Action potentially needed for further implementation:
The service already existing is efficient with an increasing demand due to the increasing prevalence of respiratory allergies within the population.
Geographic information of exposure levels could be made available by sms or an App, especially for the most allergic vegetation, in order to be able to focus on a local area and better understand the local exposure risk.

Financial aspects:
At this stage, the partners sponsor on a yearly basis to maintain the program.

References :
- Service public de Wallonie et Institut Scientifique de Santé Publique, "Surveillance des pollens et spores fongiques dans l'air en Région Wallonne en 2012" Résultats de l'enquête.
- D'Amato G., Baena-Cagnani C.E., Cecchi L., Annesi Maesano I., Nunes C., Ansotegui I., D'Amato M., Liccardi G., Sofia M. and Canonica W.G., "Climate change, air pollution and extreme events leading to increasing prevalence of allergic respiratory diseases", Multidisciplinary Respiratory Medicine 2013, **8**:12, February 2013.
- Pawankar R., Baena-Cagnani C.E., Bousquet J. , Canonica G.W., Cruz A.A., Kaliner M.A., and Lanier B.Q., State of World Allergy Report 2008: Allergy and Chronic Respiratory Diseases, World Allergy Organization Journal (WAO Journal), Supplement 1, June 2008.

3.1.3. SQuATte

Tool category: Assessment tool, Exposure level reduction

Tool description:
The SQuATte tool is available for free at the following web link:
http://www.bruxellesenvironnement.be/Templates/Professionnels/niveau2.aspx?maintaxid=11688&taxid=12110.
For each health aspect and/or suspected responsible pollutant, it relates diseases to environmental factors regarding indoor environment and exposure through the following steps:

- S for Suspect, the responsible pollutant,
- Q for questions, questions to raise concerning the setting (habitat, day care centre, office,…),
- A for Analysis, for Analysing the situation (what to look at in the house ? which test or chemical analysis to perform ?),
- T for treatment: the measures to take and the advices to give as a first intervention.

6 health problems potentially linked to a polluted indoor environment are developed according to this 4 “S > Q > A > T steps”:
- problems at the inferior respiratory tracts,
- digestive problems,
- conjunctivitis and problems at the superior respiratory tracts,
- dermal symptoms,
- general symptoms,
- neuro-psychic symptoms.

Relevance for health care professionals:
The purpose is to gain better insight in the relation between a defined health problem and indoor pollutants which might be the source of the problem. SQuATte is not an exhaustive list of pathologies and environmental pollutants but it is a practical tool where the following health problems have been selected:

- chronic diseases,
- diseases where the scientific literature shows clear evidence of potential environmental aetiology,
- with high prevalence and regularly encountered by GP’s in their day to day practice.

It proposes a 4 steps process (cf. tool description) with some questions that can highlight during the anamnesis the potential link between the symptoms and the indoor environmental risk factors. For example it takes into consideration the chronology of the symptoms (in which circumstances did the symptoms appeared ?, where there any recent change in the indoor environment (renovation, … ?), do the symptoms disappear or are they reduced during vacations ?...) as well as the complaints of the other inhabitants (do other occupants present similar symptoms ?).

Availability in Belgium:
The tool is available for free on the web site of the Brussels Region:
http://www.bruxellesenvironnement.be/Templates/Professionnels/niveau2.aspx?maintaxid=11688&taxid=12110
A plasticized format of the tool is available to carry to do a site visit.

Action potentially needed for further implementation:
The tool has been developed and is available on the web site. However new scientific evidences regarding health issues or indoor environmental risk factors might lead to some updates.

Financial aspects:
No extra costs needed at this level. However, some funding might be necessary to update the tool to include new scientific evidences regarding health issues or indoor environmental risk factors.

References :
- American Lung Association (ALA), US EPA, Consumer Product Safety Commission and American Medical Association, Indoor air pollution : an introduction for health professionals, 1996
- Carrer P. and al., EU EnVIE Project: Final report Deliverable 1.1, WP1 Technical Report - Health Effects, 2008

3.1.4. “Green Ambulances” (SAMI/LPI/CRIPI-Brussels)[22]

[22]SAMI : Services d’Analyse des Milieux Intérieurs, LPI : Laboratoire d’études et de prévention des Pollutions Intérieures), CRIPI : Cellule Régionale d’Intervention en Pollutions Intérieures/Regionale Cel voor Interventie bij Binnenhuisvervuiling in the Brussels Capital Region ; LOGO : Lokaal Gezondheidsoverleg ; MMK : Medisch Milieukundigen

Tool category: Assessment tool, Exposure level reduction

Tool description:
Green Ambulances (SAMI/LPI/CRIPI) represent a risk assessment tool supporting medical doctors when pathologies (asthma, allergies, headaches, dermal reactions, etc.) are suspected to be linked to indoor environment. This multi-disciplinary service aims to assess indoor pollution in the population habitat of the patient. The services are able to undertake some direct tests on site (CO, CO_2, T°, Humidity Rate,[23] radon, formaldehyde, wall T°) or to take some samples for further biological, physical or chemical analysis in a certified laboratory (VOC's, formaldehyde and acetaldehyde, lead in paintings, radon, asbestos, mould on surface and in the air, cockroach and legionella, etc.).
For the SAMI/LPI/CRIPI, the prescription of a doctor is necessary for their intervention. A preliminary diagnosis by a health care professional is essential to objectify the health issue and the intervention.

Relevance for health care professionals:
Depending on their properties, the different indoor air pollutants can be responsible for different health problems. Patients already suffering from respiratory or cardiovascular disorders but also pregnant women, elderly and young children are at higher risk. The doctors suspecting that symptoms might be linked to indoor environmental conditions send a prescription to the SAMI/LPI/CRIPI "green ambulance" services. These services question the patient to better understand his behavioural patterns, visit the house in order to better understand the potential exposure responsible of the diagnosed health symptoms, undertake some direct measurements and take appropriate samples for further analyses.
Each visit leads to a report of the observations, analytical results and recommendations addressed to the patient and the prescribing doctor.

Availability in Belgium:
The services SAMI/LPI/CRIPI have one service point in each province in Wallonia and Brussels.
Some differences between the French and Flemish organization and positions on best practices in an integrated approach of housing quality are described in (Mainil, T., Willems, S., De Maeseneer J., Gent, 14.11.06, 'Onderzoek gezondheid en wonen'. Pistes voor een geïntegreerde terreinbenadering/ 'Recherche 'santé et logement'. Pistes pour approche de terrain intégrée'; Onderzoek in opdracht van POD/SPE Maatschappelijke Integratie/Integration Sociale. http://www.mi-is.be/sites/default/files/doc/eindrapport-sant--logement_nl.pdf

Action potentially needed for further implementation:
No particular action is necessary at this stage. These services work pretty well and show good results. Although there are no recent data to analyse the use by practitioners. There is however a presentation available on the internet which gives an overview of ten years of practical experience. The action of these services probably needs to be regularly reminded to GP's. Eventually a survey on their level of awareness could be foreseen while keeping in mind that increasing the level of awareness would probably increase the amount of demands.

Financial aspects:
For the SAMI/LPI/CRIPI, the service provided is free (costs are covered by the Provinces for the SAMI/LPI and the Brussels Region for the CRIPI) on a medical request (the service costs in fact from 500 (most of the time) to 2500 € (if many rooms and few visits are necessary)). The free access operates as an incentive.
With respect to operational costs, this type of services (Ambulances and MMK) has been compared with other facility scenario's in a federal study. They are qualified as expensive given the fact that

[23] HR – Relative Humidity

additional staff has to be engaged. (source: http://www.mi-is.be/sites/default/files/doc/eindrapport-sant--logement_nl.pdf

References:

- Mainil, T., Willems, S., De Maeseneer J., Gent, 14.11.06, Onderzoek 'gezondheid en wonen'. Pistes voor een geïntegreerde terreinbenadering, Recherche 'santé et logement'. Pistes pour approche de terrain intégrée, Onderzoek in opdracht van POD/SPE Maatschappelijke Integratie/Integration Sociale, http://www.mi-is.be/sites/default/files/doc/eindrapport-sant--logement_nl.pdf
- Dewolf MC, The INDOOR AIR MONIT harmonisation framework project: Harmonised template for indoor air monitoring objective 2 (*Investigations in response to health and comfort complaints in buildings*), Workshop Pilot Indoor Air, DG JRC – DG SANCO, Brussels, December 2012.
- Hainaut Vigilance Sanitaire – Hygiène Publique en Hainaut : Rapport d'activités – La Santé – Laboratoire des Pollutions Intérieures : http://hvs.hainaut.be
Presentation on practical problems encountered during visits & overview of 10 years experience:
http://www.ibgebim.be/uploadedFiles/Contenu_du_site/Professionnels/Formations_et_s%C3%A9minaires/B%C3%A2timent_durable_-_sant%C3%A9_et_confort/GEZ_COMF_1_120419_2_BIN_VERV_NL.pdf

3.1.5. Medisch Milieukundigen (MMK)

Tool category: Assessment tool, Exposure level reduction, Public health or to Support health care professionals in case of an emerging local issue.

Tool description:

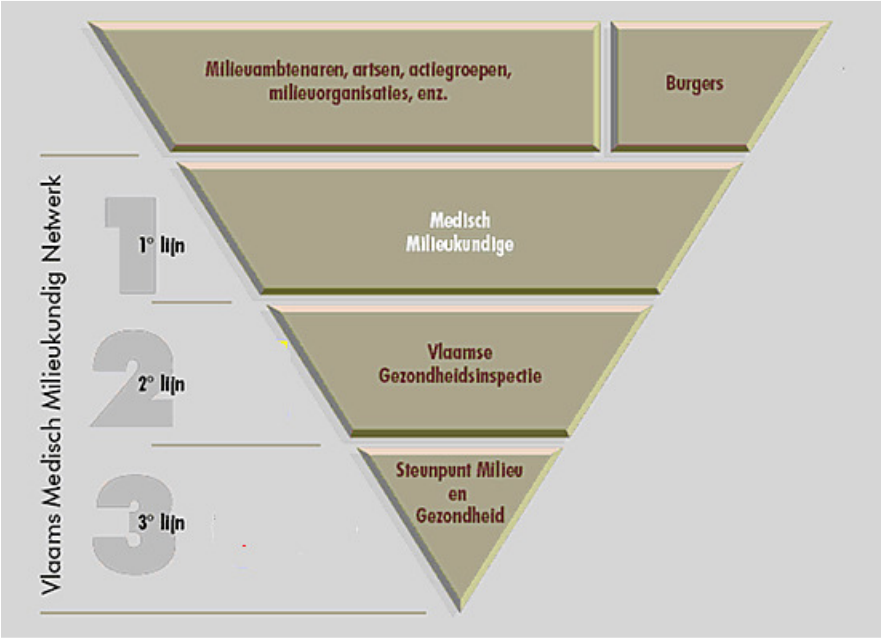
"The Flemish Environmental Health Network consists of three sub-networks:

1) the local environmental health officers (…), Medisch Milieukundigen (MMK)
2) the Flemish Health Ministry and the Flemish Environment Ministry (…),
3) the Flemish Centre of Expertise on Environment and Health (...)".

(Stassen, 2012, p. 220 and Stassen, Gislason& Leroy, 2010**)**.

The competence on environmental health complaints and issues of concerns has been added as a seventh tasks of the intermediary local health organisations LOGO, of which general practitioners are members.

The three sub-networks are labelled networks but should not be confused with levels as each network takes up a specific combination of roles within the functions of knowledge development, policy making and communication. At the local level, Medisch Milieukundigen are appointed with the LOGO's, where also non-environmental services are networked between health care professionals and their organizations. MMK take up communication and prevention tasks, but also are trained to assess individual and local concerns and issues.



Relevance for health care professionals:
Practitioners contact the MMK in case of environmental health concerns of their patients or the MMK can take the initiative (mainly, but not only, in contaminated regions, areas under environmental pressure and in urban agglomerations). Individuals cannot contact the MMK themselves for an audit of their house; only the following intermediaires can do so :

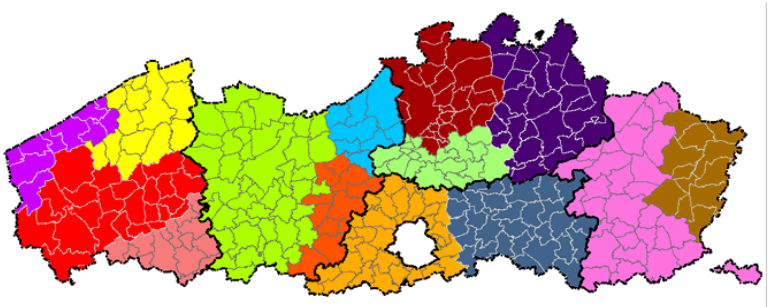
- the municipality
- the social service of the municipality (OCMW)
- the local housing officer
- the regional civil servant
- regional civil servants with an environmental competence
- practitioners
- nurses
- social workers

MMK are the first to address for environmental health questions of health professionals and prevention professionals. MMK also take up public health and prevention tasks and are invited to bring in their real life case experience in academic and professional medical trainings. A scheme clarifies the procedure in case of an audit of a dwelling and in particular a health concern. See annex report annex 14.

The partners in the Medisch Milieukundig Network (which is larger than the service of the Medisch Milieukundigen, see pyramid above) also cooperate in the distribution of a newsletter, 'GezondMilieu', on a regularly base to sensitize intermediary organisations and extend their knowledge on specific and actual environmental health topics. In this way, the network also operates as an incentive, a kind of *social instrument***.**

Availability in Belgium:
Available in Flanders: founded with the Flemish Decree on Preventive Health Policy ('Decreet betreffende het preventieve gezondheidsbeleid', November 21st, 2003, published in het Belgisch Staatsblad 3 Februari 2004) and the 'Binnenmilieu besluit' of 11.6.2004 (published BS 19.10.2004). See for additional information annex 16.

Today, 15 Flemish Logo's cover the territory. There is no Logo in the Brussels-Capital region. The overview is to be found at www.mmk.be/regionaal.



Action potentially needed for further implementation:

It could be interesting to extend this tool to the whole Belgian territory, especially given the facility of environmental health advice to the practitioners with concerns about their patients, combined with the multi-disciplinarity of the LOGO/MMK-team and its extensive local network.

Financial aspects:

For an assessment at home, the research costs as well as the intervention costs are (conditionally) renumerated by the Flemish community[24]. The free access operates as an incentive. We characterize this tool as well as a *financial instrument*.

Each Logo-team consists of a coordinator, staff members and an administration. A qualified environmental health officer (1 FTE) costs approximately 75.000 Euros per LOGO-territory per year (operation costs included). LOGO's in large urban agglomerations are entitled to engage more than 1 environmental health officer. The task profile of an MMK deviates from a regular LOGO-staff member: he or she invests more time in first line contacts and has more interaction with general practitioners (although difficult to reach). About 30 to 40% of the MMK time should be devoted to individual and intermediary contacts in the field.

References:

- Stassen, K., R. (2012) Environment and Health in Flanders: 40 Years of Institutional Struggle, PhD, Radboud Universiteit Nijmegen, 2 juli 2012.
- Stassen, K.R., Gislason, M., & Leroy, P. (2010). Impact of environmental discourses on public health policy arrangements: A comparative study in the UK and Flanders (Belgium). Public Health, 124(10), 581-592.
-http://www.mmk.be/afbeeldingen/File/BimibrochureMMKLimburgweb.pdf.

3.1.6. Biological analysis and Biomonitoring

[24] Binnenhuismilieu besluit: Art. 8. § 1. Onderzoeks- en interventiekosten van de Vlaamse Gezondheidsinspectie en van de medisch milieukundigen (MMK) bij de Logo's zijn, volgens de beschikbare middelen ingeschreven in de begroting, ten laste van de Vlaamse Gemeenschap. De metingen en de laboratoriumkosten zijn, volgens de beschikbare middelen ingeschreven in de begroting, ten laste van de Vlaamse Gemeenschap, tenzij dat anders is overeengekomen met de aanvrager of met derden.

Tool category: Assessment tool, evidence for exposure level reduction (Tool for public health or to support health care professionals in case of an emerging local issue)

Tool description:
The biomonitoring is the measurement of the body burden of toxic chemical compounds, elements or their metabolites in biological matrixes such as blood, urine, hair, human milk, exhaled breath, etc. in order to estimate the amount of these substances that entered the body (biomarkers of exposure) or understand how they affected the body (biomarkers of effect) in a population where an emerging issue is or could be arising. Biomonitoring is an efficient method of monitoring exposure and uptake of either individuals or groups as it can provide information on exposure that could not be provided, for example, by air or water monitoring alone. Biomonitoring uses measurement in body tissues or excreted materials as a mean of assessing exposure if the sources of the substances are known. Human biomonitoring also facilitates monitoring and surveillance in case of unknown or dispersed sources and exposure to cocktails of pollutants. As a combination of exposure and effect markers, it does not predict health and disease risks, but fulfils an early warning role. In addition the number of detectable pollutants increases more and more. Making the link between defined pollutants should also lead in the future to a better understanding of the relation between sources, exposure and potential health effects.

Relevance for health care professionals:
Biological analysis and Biomonitoring offer the opportunity to analyse the actual internal levels of bodily substances from all potential routes of exposure at one time, which may contribute to improving risk assessments but also to complete or confirm the diagnosis of a patient when an environmental agent is suspected to be the source of a pathology or to affect a population.
Quite a few biomarkers (of exposure and of effect) have shown their efficiency and appropriateness to highlight environmental causes of diseases. Although the duration of exposure that the biomarker represents should be relevant to the effect of the suspected substance and its half-life (or the half-life of its metabolites) in the organism (biomarker reflecting recent and non cumulative exposure, reflecting long term exposure …).
Lead poisoning for example of children or adults can have disastrous health effects, even at really low levels. In 2008, in The Hainaut Province about 2.4% of the children below 6 years old screened among the population where still showing blood lead levels > 60 µg/l. In Flanders, thanks to several large scale biomonitoring campaigns the Cadmium exposure in the Kempen was confirmed and was linked to biomarkers of effect; in rural areas persistent compounds (PCB's but even DDT/DDE) were elevated in adolescents, in elderly and in cord blood of mothers (or babies). Dietary measures have been based on the findings and a campaign was started to collect old pesticides. In case of emergency, human biomonitoring has also been used to assess the exposure of the population and manage the crisis situation: example of the train accident in Wetteren in May 2013.

Availability in Belgium:
Concerning biomarkers of exposure, most of the biological laboratories agreed for analysing parameters for Occupational Health Medicine are able to do biological analysis for environmental purposes. Although, the biological analyses for environmental purposes need to be able to detect lower levels of exposure. Techniques used and analytical methods developed should then ensure to reduce their level of detection and quantification limits.
Concerning biomarkers of effects, most of the biological laboratories have the techniques and competences to undertake the testing.

In terms of Biomonitoring, different studies have been carried out at the National level in Belgium, in the framework of wider studies or campaigns (WHO biomonitoring campaign POP's in Human milk, EU COPHES-DEMOPHES project).

In Flanders, the Flemish Biomonitoring campaigns are continued for the period 2012-2015. The focus is to build reference values on the one hand; assessing the situation in hot spots on the other hand.

> "The human biomonitoring survey is still the core research activity of the Flemish Centre of Expertise on Environment and Health (Steunpunt Milieu en Gezondheid). One of the new research goals is to obtain reference values for the Flemish population obtained in a representative population sample for a broad series of pollutants, not only for the traditional pollutants, but also for newer emerging chemicals (for instance Bisphenol A, Brominated flame retardants, and Phthalates) (www.milieu-en-gezondheid.be, September 16, 2011). These reference values would be useful when comparing the general Flemish data with international studies, or the results from high risk populations living in hot spots (strong polluting point sources) or characterized as vulnerable groups.
>
> A transparent and deliberative procedure is developed for the identification of hot spots, taking into account different stakeholders and knowledge bases and not merely experts (for more details, see Keune, Morrens, Croes, et al., 2010)."

Source: Stassen, 2012, p. 229

In Wallonia, Biomonitoring activities have been set up in order to assess the exposure of the population around hot spots (Ath, Charleroi, Farciennes, Frameries, Tournai). These have been one shot studies, with eventually some follow up activities, but are not part of a continuous process.

Action potentially needed for further implementation:
Pilots at the European level can demonstrate the feasibility to generalise, streamline biomonitoring activities and ensure comparability at a wider scale between different populations exposed or not to similar environmental emissions.
An assessment of biomonitoring and population surveillance activities already implemented in Belgium would be useful in order to highlight strength, forces but also weaknesses and threats from previous campaigns and build up harmonised human biomonitoring protocols and communication plans.

Financial aspects:
Costs depend on the range and choice of selected biomarkers. A combination of markers for old and new emerging pollutants in a campaign, approximately costs 1000 Euros per person (source: Flemish Human Biomonitoring campaigns 2001-2006; 2007-2011 and 2012-2015). In addition to the laboratory and data management costs, a multidisciplinary staff has to guide the fieldwork and the research process including the communication aspects.
No specific reimbursement is foreseen for a General Practitioner for the follow up of a patient participating to a biomonitoring program. In the case of the (inefficient) medical surveillance program set in Mellery (contaminated landfill site in Wallonia), a budget to fund the act to answer to a small questionnaire and undertake a non standardised clinical exam was provided.
In the case of a suspected pathology linked to environmental exposure, an INAMI reimbursement is foreseen for analysis if covered by a medical prescription for the diagnosis of the patient, the treatment or the follow up of the intoxication (ex. Lead cf. CHU Liège website : http://www.chu.ulg.ac.be/jcms/c_587224/plomb-sang)

References:
- InVS, Inserm, "Saturnisme – Quelles stratégies de dépistage chez l'enfant ? Expertise opérationnelles, Juillet 2008.
- Koppen G, Caeyers T, Govarts E, Van de Mieroop E, Dewolf MC, de Cremer K, Pirard C, Covaci A, Vanermen G, DEMOCOPHES, "National Report On Human Biomonitoring In Mothers And Children », Belgium, September 2012.
- 4ème campagne OMS sur le lait maternel: Les POP dans le lait maternel – les résultats belges anno 2006, Mai 2007.

- The Interdepartmental Group of Health Risks from Chemicals, "Guidelines for good exposure assessment practice for human health effects of chemicals", Institute for Environmental and Health, UK, 2004.
- J. Van Loco, K. De Cremer, S. Fierens, I. Van Overmeire, M. Van Hoegaerden, A. Van Nieuwenhuyse, H. Van Oyen, "The set up of a biomonitoring survey of the residents and the rescue workers for acrylonitrile after the train disaster in Wetteren" (Belgium), 5èmes journées internationales de toxicologie, Liège ,0ctobre 2013.

3.1.7. "Reference" values

Tool category: Assessment tool, Judgement of acceptability, Communication

Tool description:
"Reference" values represent an interesting assessment and communication tool when interpreting environmental and biomonitoring data because they intend to regulate (and thus trigger to intervene). Some reference values, guidelines, targets, already exist for different pollutants in the environment and in biological tissues. These proposed values should be reviewed to consider health effects (health base values) and the up-to-date knowledge regarding environment and health (endocrine disruptors (EDC's), low dose effects (U shaped curb), long life chronic exposure, multiple exposures).

Relevance for health care professionals:
Reference values are good indicators for doctors to evaluate the state of health and exposure of his patients. They can easily interpret them and know when a risk is not acceptable. It eases their communication with the patient to eventually lead the patient to apply targeted recommendations, adapt behavioural habits,
However, we note that often directives and decretal decisions propose values that are not necessarily coherent between each other (example: guidelines for formaldehyde) and/or don't mention the rationale behind the proposed "reference" values: are the proposed values health based, statistical or mixed values? This complementary information is essential to health care professionals to complete their information and interpretation of the results.

Availability in Belgium:
Outdoor exposure: different EU Directives define sampling and analytical methods as well as limit values and alert thresholds for different parameters (SO_2, NO_2, Benzene, PAH, CO, some heavy metals, PM_{10}, $PM_{2.5}$). However, these thresholds are not fully be perceived as health norms as they are the outcome of negotiations and decision making taking into account trade-offs and thus are 'acceptable' risk levels (technical and economic feasibility). Other international outdoor air quality guidelines have also been published: as an example in 2005, the WHO air quality guidelines: global update.
Indoor exposure: The Decree on Health Prevention was implemented in the Binnenhuis milieubesluit (Flemish government 11.6.2004, published BS 19.10.2004) which contains guide values and intervention values in the annex. However the process to define these values is not given. WHO published guidelines for selected pollutants for indoor air quality in 2010. Other reference values for indoor air quality have been edited in France, Germany, Canada, etc.
Biomonitoring: Germany has defined some health based values for some heavy metals and different biological matrixes[25]. Prof. Lauwerijs defined some reference values for occupational medicine but

[25] website Umweltbundesambt

also for the general population. These proposed values however consider the population as a whole and doesn't target specifically children or foetus.

Action potentially needed for further implementation:
In order to ensure appropriate interpretation of environmental and biological analyses by health care professionals, authorities should ensure more transparency regarding the rationale used to elaborate these values.
One should ensure that vulnerable populations (for example pregnant women and children) are taken into account when defining and using reference values.
If possible, more health based values should be elaborated and mixtures of pollutants should be considered.

Financial aspects:
Establishing norms, standards and targets requires formal decisions (for instance on which risk level is accepted) and these procedures can be time-consuming and expensive.
Reference values, once transposed in regulation, get a command and control character. In this way, they promote attention for environmental health (*regulatory instrument*).

References:
- Dewolf MC, Charlet F, Scheers H, Int Panis L, Van den Heuvel R, Integration of existing approaches towards biosurveillance in relation with indoor and outdoor "air quality", Final report. Brussels: Belgian Science Policy 2012, Research programme Science for a sustainable development.
- Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.
- Wilhelm m., Ewers U., Schulz C., « Revised and new reference values for some trace elements in blood and urine for human biomonitoring in environmental medicine », International journal of Hygiene and Environmental health, volume 207, Issue 1, Pages 69-73, 2004.
- WHO, WHO air quality guidelines: global update, 2005.
- WHO, WHO guidelines for indoor air quality: selected pollutants, 2010.

3.1.8. Communication platform GERICO – GEstion du RIsque et COmmunication

Tool category: Communication, Network

Tool description:
GERICO is a secured platform to exchange information between practitioners and other defined actors in case of a local emerging issue. The goal of this tool is to ensure multidisciplinary solutions to deal with environmental and health problems between actors (doctors, scientists, policy makers, local authorities…). Its aim is to:

- create an intermediary platform of communication,
- improve awareness raising of the concerned actors and targeted publics,
- create an expertise and decision making tool in order to favour the drawing of consensus solutions and positions.

The access is limited to targeted actors who need to exchange information in the impacted zones and to experts (Doctors/health care professionals, sociologists, economists, jurists, environmentalists…) or selected actors invited to join. GERICO provides the possibility to upload articles and data to create expertise and publicise consensus. The access is given only on request and after an agreement for the concerned issue.

The methodology proposed complies with Aarhus Convention's requirements, Convention on access to information, public participation in decision-making and access to justice in environmental matters and the recommendations of the national environmental and health action plan (www.nehap.be).
The methodology is a 2 step process: learning about the facts and the participation to the discussion forum.

- Facts are presented in 3 levels of reading (briefs, summaries and complete documents) that can be sorted according to different key words (methodology, key elements, environment, health, advice from actors, and information to the public) and are open to comments from participants.
- Discussion fora are managed by issue with the support of a moderator and aim to draw multidisciplinary solutions that will be integrated as new facts.

Each participant can share questions, comments or documents with other participants.
Being a member of the GERICO platform needs to be motivated (how much are you involved in the concerned environmental and health issue?) and to the agreement to deontological conditions, including confidentiality. Then a login and password provided by the moderator allow the participant to have access to all information and to participate to discussion. The concept is graphically shown in annex 15 of the annex report.

Relevance for health care professionals:
Emerging issues at the local level have shown the importance to ensure coherent messages addressing the population. The local authorities are encouraged to take measures and health care professionals (and more particularly GP's or nurses) are referred to for more information, a diagnosis and advice.
Doctors and actors concerned by a local issue can consult the platform and exchange information (questions, comments, documents, data, etc.) in order to draw multidisciplinary solutions and ensure coherent communication towards the public. Progressively when data and interpretation are validated, information can target a wider population.
The availability of the information enhances the arousal level for environmental health topics. This is a sensitizing and thus a *social instrument***.**

Availability in Belgium:
The platform has been developed by the association HECTOR with funding from the Pharma foundation and is ready to be used. The platform is operational and can be provided as a concertation and communication tool to medical/health care professional associations or local authorities if requested. The integration and the management of such as tool within societies of general practitioners would confirm the communication role of GP's in case of an emerging issue.

Action potentially needed for further implementation:
The platform could be used first as a case study.

Financial aspects:
Some funding is necessary to manage the platform, the forum and draw some common messages when the platform is activated as well as for the decision cell supervising each issue. The platform could be managed by already existing structures such as the SSMG, regional or local environmental and health platforms.

References:
- Dab W., "Le praticien et l'environnement – un ouvrage collectif sous la direction scientifique du Professeur William Dab", Mars 2010.
- http://www.hector-asbl.be/gerico-1
- United Nations Economic Commission for Europe (UNECE) Website:
http://www.unece.org/env/pp/welcome.html

3.1.9. Risk analysis, assessment and management in case of diagnosed health effects

Tool category: Assessment tool, Exposure level reduction, Tool for public health or to support health care professionals in case of an emerging local issue

Tool description:
Risk analysis, assessment and management in case of diagnosed health effects of individuals or a cluster in the population is a systematic and comprehensive step by step approach aiming to analyse and assess (http://en.wikipedia.org/wiki/Risk) associated with a technology, industrial process or a product. Its aim is to bridge the individual health care to a more public health approach by characterising source-pathway-individual or population exposure linkages. The different sources of potential exposure are considered and if necessary analyses of the media (air, food, water, soil…) undertaken. Some behavioural patterns are identified in order to better understand the duration and frequency of exposure and therefore predict the intake of the individual or population concerned. Some models can eventually support the process.

Relevance for health care professionals:
Some of these tools can be used to support practitioners facing a cluster of diseases suspected to be related to environmental conditions in a population (at the local, regional or at a wider scale level). Risk assessment can provide complete information to risk managers (health care or environmental professionals or policy makers) to draw the best possible recommendations and take the appropriate decisions.
Besides, the social dimension needs to be considered while facing such emerging issues. Among the communities, emotions arise and the population gets strongly involved in the process, because its close environment and own health are in danger. Solving the issue is not limited to the scientific developments but also includes social and political aspects. Health care professionals such as GP's for example are mobilized by their patients to listen to their concerns, to communicate appropriately (GP's benefit from a high level of confidence from the population) or to contact the authorities for further investigations (Source: William Dab).

Availability in Belgium:
Provincial and regional authorities have services able to cope, in collaboration, to respond to any local request.

Action potentially needed for further implementation:
The development of multidisciplinary teams trained to work in collaboration is essential. Their quick "activation" in case of an emerging issue is a condition of success. Furthermore a "place" where possible environmental clusters could be reported is not clearly defined.

Financial aspects:
Organising and implementing a full risk assessment is costly but important for the concerned population for environmental and health reasons but also social and political reasons.

References:
- Dab W., "Le praticien et l'environnement – un ouvrage collectif sous la direction scientifique du Professeur William Dab", Mars 2010.

3.1.10. Geographic Information Systems (GIS)

Tool category: Assessment tool, (evidence for) Exposure level reduction, Tool for public health or to support health care professionals in case of an emerging local issue and, a basic layer for individual

consultation tool in cases of for instance IRCELINE on ambient air quality, the Flemish Waste Organisation OVAM on contaminated soils and the Géoportail in Wallonia.

Tool description:
Geography has always played an important role in our understanding of environmental conditions and medical sciences. The INSPIRE (Infrastructure for Spatial Information in Europe**)** directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe. The spatial information considered under the directive is extensive and includes a great variety of topical and technical themes.
According to the HELI initiative (Health and Environment Linkages Initiative**,** a global effort by WHO and UNEP), maps and spatial information technologies have three main advantages:

- *they can be a means of recording and storing information* (about the environment, the location of natural resources, populations, demographic trends, health conditions, …);
- *they can be used to identify and investigate spatial patterns*: maps draw attention to spatial relationships, for example the distribution of a pollution and affected areas and populations or in relation to other information such as specific diseases or symptoms so that once these relationships are recognized, we can start to analyse them and search for the underlying causes and processes, which in turn can be useful in improving action;
- *they are effective in presenting information and communicating findings*: maps allow us to convey information and findings that are difficult to express verbally, or to condense messages that would be lengthier to describe in words; they are often more memorable, because they have colour and shape; they can be used to demonstrate relationships in a way that is more striking – by showing the intensity of a problem in one area relative to the intensity in another area, or by showing the change in distribution of a resource over time.

The scale of the data registration provides different and complementary information. So that Geographic information systems (GIS) are not only an interface to geographical data but also a tool to for decision making at different levels (local, regional, national or international). The GIS has also a real interest in epidemiology with the recognition of maps as useful tools for illuminating potential causes of disease.

Relevance for health care professionals:
The GIS is a tool that could support health care professionals facing a cluster of diseases or an increasing prevalence of a specific disease. Linking environmental and health data and highlighting potential spatial relationships supports the analysis of the issue, the search for sources and exposure pathways and develop appropriate actions. In turn, health care professionals such as GP's, for example, will be able to respond to their patients concerns and anxiety.

Availability in Belgium:
In order to ensure the implementation of the INSPIRE Directive, various reciprocal agreements with the regions, provinces, local authorities and between federal public administrations eases the sharing of information. In Flanders, all Flemish public authorities are obliged by decree to input their geographical data into the Agentschap Geografische Informatie Vlaanderen (AGIV-GDI). Data sharing within the Walloon authorities is regulated through specific licences.
A short Flemish pilot to merge epidemiological and environmental data (Steunpunt M&G, Epidemiologisch Luik, KUL 2001-2006) in one GIS system and user friendly interface, did not succeed.

Action potentially needed for further implementation:
The implementation process of the INSPIRE Directive is still ongoing, the Directive came into force on 15 May 2007 and will be implemented in various stages, with full implementation required by 2019.

Information at different scale levels should be considered in order to provide complete information supporting analyses and decision making processes at the local, regional, national or international levels.

Financial aspects:
Financial aspects are part of the reporting process to the Commission for the Implementation of the EU Directive.

References:
- Durand M., Wilson J., "Spatial analysis of respiratory disease on an urbanised geothermal field, Environmental Research 101 (2006) 238-245.
- Haley V., Talbot T., "Geographical Analysis of Blood Lead Levels in New York State Children", Children's Health, Environmental Health Perspectives, Volume 112, number 15, November 2004.
- Boudet C., Grammont V., « Guide pour la conduite d'une étude de zone : Impact des activités humaines sur les milieux et la santé », Environnement et Santé, INERIS, 2012.
- Miranda M., Dolinoy D., Overstreet M., "Mapping for Prevention: GIS Models for Directing Childhood Lead Poisoning Prevention Programs", Children's Health, Environmental Health Perspectives, Volume 110, number 9, September 2002.
- Waller L., Gotway C., "Applied Spatial statistics for Public Health Data", Wiley Series in probability and statistics, Canada, 2004.

3.1.11. TEDX Critical Windows of Development Website Tool

Tool category: data base

Tool description:
TEDX Critical Windows of Development is a website tool (in English) for viewing scientific research on endocrine disrupting chemicals (http://www.criticalwindows.com/go_display.php). It is a unique interactive webpage that pairs normal human development in the womb with laboratory research showing where and when low-dose exposure to bisphenol-A, phthalates, dioxin has effects,,…. It makes the link between:

- step 1: events in human prenatal development (with scientific references)

- step 2: a chemical

The display comprises a series of horizontal bars, each depicting a specific system or organ for the full 38 weeks of human pregnancy (central nervous, female reproductive, male reproductive, endocrine and other systems). Corresponding time points in rodent development are indicated along the top of the screen. Tick marks along the bars indicate studies done at specific time points corresponding to points in normal human development. Another series of tick marks indicates EDC studies performed

in the laboratory. Clicking on a mark brings up a concise summary of the study details with a link to the PubMed record. All chemical studies notated on the timeline are original research using rodent or human cells or tissues. Exposures of parts per million or less to an EDC must have occurred during a time point equivalent to some point in human pre-natal development (cf. Biomonitoring studies in the population).
The timeline fills several needs at once: 1) a basic reference for normal development in both humans and rodent models – 2) a useful tool to determine areas where research is needed and how to plan new studies to refine the timing, doses, and end points of future studies – 3) inspiration for scientists to take a broader view of endocrine disruption and possibly promote collaboration across systems.
Source: Julia Barrett

Relevance for health care professionals:
The scientific information highlighting developmental effect is transparent and the table has been developed in a user-friendly graphic format, quite visual. The table is easily accessible, interactive and well referenced to respond to many questions raised by health care professionals seeking for further information regarding critical windows of development during pregnancy.

Availability in Belgium:
The TEDX Critical Windows of Development website tool is freely available at the following web page: http://endocrinedisruption.org/prenatal-origins-of-endocrine-disruption/critical-windows-of-development/timeline-test/

Action potentially needed for further implementation:
Promote the use of the tool by health care professionals.

Financial aspects:
Not applicable.

References:
Barrett J., "Endocrine Disruption: Developmental Picture Window", Environmental Health Perspectives, 2009 March, 113(3): A101

3.1.12. Interactive Webtool Cadmium risk

Tool category: Diagnostic tool

Tool description: Online web application (in Dutch) for the search of Cadmium pollution and exposure risks, assisted by GIS.

Relevance for health care professionals:
Practitioners or individuals themselves can look up addresses in order to check the exposure risk in relation to health complaints or concerns.
As the tool provides feed-back to the individual respondent on personal action or intervention (next to the exposure risk that has been assessed), its diagnostic value is extended to health promotion and as such to be qualified as a *social instrument*.

Availability in Belgium:
Locally restricted geographical application (territories of Mol, Balen, Lommel, Overpelt, Neerpelt of Hamont-Achel)

Action potentially needed for further implementation:

The deliberate process behind the construction of such a web application with experts and stakeholders, was a necessary step because modelling data have their restrictions and information on parcels touches on privacy aspects and the market value of property.

Financial aspects:
This tool is a co-production of the Vlaams Agentschap Zorg en Gezondheid, the Departement Leefmilieu, 'Natuur en Energie' of the Flemish government, OVAM, the municipality of Overpelt and the medisch milieukundigen (MMK) at the Logo's. For its development several research and consultative steps have been budgeted and commissioned.

References:
http://www.zorg-en-gezondheid.be/cadmiumwebtool

3.1.13. Global medical file (Dossier Médical Global (Informatisé) (DMG, DMG+ and DMI)/(Elektronisch) Globaal Medisch Dossier (GMD)

Tool category: Database

Tool description:
The Global medical File DMG contains administrative and medical information (background and behavioural information, analytical data such as symptoms and treatment, tension, vaccines, main problems, family medical history, mammography, operations, chronic diseases…). Analytical data can be directly downloaded from a specific server, including reports from specialists through meXi/MediMail[26]. Data from different items of the DMG can be treated to highlight potential trends regarding for example thyroidal hormones or cholesterol. Symptoms are linked to international ICPC codes (comparable across the world and the different existing equivalent programs). Since 2011, INAMI proposes the DMG+ offering to each patient between 45 and 75 years old to benefit from exclusively preventive consultations (check-up).
Through the interface meXi/MediMail, it is possible to transfer field data from the practitioner to a central platform.
Some of the agreed software provides the possibility to create "new sessions", for example to include environmental items.

Relevance for health care professional:
The goal of the DMG is to insure the quality and the coordination between healthcare providers:

- medical data are centralised and managed in one spot,
- the knowledge of the health state of the patient is improved,
- superfluous exams and treatment can be avoided,
- the exchange of data between health care professionals becomes easier.

Availability in Belgium:
The DMG is available to any patient in Belgium if he requests it and his doctor participates to the process. The majority of GP's uses computerised information technologies, but not all of them use approved programs.

Action potentially needed for further implementation:
Environmental items are not included neither in the DMG or DMG+. Since some of the agreed software gives the possibility to create new sessions, the development of a specific session considering environmental risk factors and an environmental anamnesis could be considered to create a "General DMG++" and eventually specific ones such as a DMG++ for pregnant women and

[26] MeXi and Medimail are secured solutions for exchange of medical data

children. The centralisation of the data set would then represent and powerful tool to support health care professionals in case of an emerging issue or an effective tool for public health for prioritisation of actions and decision making.
To encourage patients and practitioners to take the time to fill in a new module, an application could be developed for tablets so that patients could already fill in some items while waiting.
An explorative literature study has been elaborated by the University of Ghent into "de invloed van milieufactoren op de gezondheid van (chronische) patiënten, met het oog op de integratie van omgevingsfactoren in het elektronisch medisch dossier van de huisarts" (communication9/1/2013 of Prof. Dr Dirk Avonts, Jan De Maeseneer and Diego Schrans, Vakgroep Huisartsgeneeskunde en Eerstelijnsgezondheidszorg Family Medicine and Primary Health Care University of Ghent). FOD-Volksgezondheid commissioned the research project.
Exchanges between equivalent platforms could also be considered at EU level to strengthen the results of the observations.

Financial aspects:
The DMG is free, the patient pays a contribution that is reimbursed. Besides, it gives the possibility to increase the reimbursement level of the consultation. The rate of reimbursement depends on the category of patient depending on the age, type of disease (chronic or end of life) …). INAMI has also created a specific code for the DMG (code 102771: 29,57 € reimbursed by INAMI) and DMG+ (code 102395: 10,65 € reimbursed by INAMI) for patients from 45 to 75 years old.

References:
- http://www.belgium.be/fr/sante/cout_des_soins/dossier_medical_global/
- http://www.riziv.fgov.be/citizen/fr/medical-cost/SANTH_4_2.htm
- http://www.solidaris-liege.be/mutualite/articles/le-dossier-medical-global-dmg.html
- Vakgroep Huisartsgeneeskunde en Eerstelijnsgezondheidszorg Family Medicine and Primary Health Care University of Ghent (study report to be obtained at FOD)

3.1.14. Asthmapolis inhaler

Tool category: Assessment tool, Exposure level reduction

Tool description:
Asthmapolis is a device tracking asthma symptoms by attaching sensors to inhalers. It maps the user's location every time he takes a puff. It is part of a burgeoning field called geomedicine, which uses GIS to correlate environmental conditions with health risks. The data gathered can provide valuable information on the kind of environmental exposure that tends to bring on asthma attacks. The Asthmapolis mobile application for the iPhone and Android allows viewing the data the sensor captures and gives personalized feedback and education on ways to improve asthma control. Additionally, the Event Log shows details for each event, automatically creating an asthma diary. The technology which Asthmapolis has developed has several objectives: 1) help healthcare workers to treat their patients more effectively (see below), 2) help to develop new methods of researching into asthma.
Researchers can get hold of precise data, dated and geolocated for the places and environmental conditions which trigger attacks. This information could be valuable in helping city health departments, hospitals, clinics and general practices and epidemiologists to focus their research on the places and times which represent the greatest risk to asthma sufferers and identify the environmental factors which influence air properties. To this end, Asthmapolis has, since setting up in 2010, built up a number of partnerships, especially with public-private ventures. The firm is working for example on a project to research into air quality and composition and their impact on asthma. It has also signed up to partnerships with health insurers and medical centres.

Asthmapolis is however not the only company that has launched itself into asthma prevention. The Geckocap startup helps young children to remember when they need to use their inhalers, and researchers at AT&T Labs are now working on a wireless sensor project designed to detect air zones where asthmatics are most likely to suffer attacks.

Relevance for health care professionals:
In the United States, according to the Centres for Disease Control (CDC), around 26 million people suffer from asthma. The annual cost of treating this condition is estimated at $50 billion for medical expenditure, plus a further $6 billion in additional indirect costs resulting from missed school and days off work. This considerable expense is to some degree due to the patients themselves, who do not follow their treatment procedures properly or are not in regular contact with their healthcare providers, who then lack feedback on how the treatment is going and under what conditions attacks continue to occur. It has been calculated that if patient treatment could be better monitored, 80% of all asthma-related hospitalisation could be avoided, and that the mortality rate from asthma could be reduced by 20%. The technology which Asthmapolis has developed has several objectives, one of them being to help healthcare workers to treat their patients more effectively as a result of monitoring their treatment on an ongoing basis and collecting precise data on the environmental conditions under which patients use their inhalers. A small sensor attached to the patient's inhaler is linked to a mobile app and an online platform. Geolocation is integrated into the app, so medical practitioners have access to precise, detailed information on how their patients are using their inhalers. They can also monitor how the treatment is working. Doctors receive this information about their patients on an ongoing basis and can therefore work more closely with them. Moreover, the data collected can indicate those areas where asthma attacks most often occur, thus enabling health practitioners to warn their patients about any danger areas and send them notifications, suggestions and advice on the precautions they ought to be taking. Asthmapolis has also entered into a partnership with Qualcomm Life, so that those patients who do not own a smartphone can be alerted by standard phone call, SMS or email. A pilot study has shown that 60% of all patients who embarked on the project were not monitoring their own condition. After three months, 50% of these patients were able to track and manage their asthma condition proactively.

Availability in Belgium:
Worldwide available for owners of iPhone and Android owners.

Action potentially needed for further implementation:
Promote a better knowledge of the tool by Doctors (GP's or specialists). Submit the process to the Privacy committee.

Financial aspects:
The Asthmapolis Mobile Application is available in both English and Spanish and can be downloaded for free from the iPhone App Store or the Google Play Store.

References:
- Gecko Cap : Simple Asthma Management to Manage Your Child's Asthma Medication: http://www.geckocap.com/about
- Astmapolis: http://asthmapolis.com/our-solution/

3.1.15. Specialized Inhalation Exposure Facility

Tool category: diagnostic tool

Tool description:

An inhalation exposure facility is composed of large or small inhalation exposure chambers and state-of-the-art exposure monitoring equipment. These are used to diagnose airway diseases. These chambers contain an array of specialized equipments for the generation of highly standardized gaseous, vapour, and particulate inhalation atmospheres of different composition, including cigarette-smoke generators (for both main-stream and side-stream smoke). These chambers can also be used for research purposes.
Simple diagnosis: The diagnosis of asthma is established by the presence of reversible airway obstruction. This can be demonstrated, especially in adults, through the use of spirometry before and after the use of bronchodilators or, in select cases, with a nonspecific bronchoprovocation test. Most GP's can perform spirometry to diagnose asthma. Bronchoprovocation tests are performed by pneumologists.

Relevance for health care professionals:
Especially for background pollution.

Availability in Belgium:
Not

Action potentially needed for further implementation:
Inventory on the cost-benefits.

Financial aspects:
Expensive if chambers have to be build. Definite costs depending on size and use.

References :
Example of the inhalation exposure facility in New York. Lung Chi Chen, Ph.D.; NYU Langone School of Medicine; Sterling Forest Campus; Contact email: lung-chi.chen@nyumc.org

3.1.16. Radon Day

Tool category: Assessment, communication and exposure level reduction tool.

Tool description:
To raise awareness of exposure to radon, Walloon Region, the Federal Agency for Nuclear Control (FANC), the Association of Walloon Provinces (APW) and provinces through their specific services for analysis of indoor Environments (SAMI & LPI) organize yearly (the radon day was previously organised by the Hainaut Province in collaboration with the AFCN) a "RADON DAY". This initiative (lasting 1 month) aims to encourage persons to measure radon in their home and undertake any remedial actions when levels are too high. It is possible to order a radon detector via the website www.radonday.be – 0800/11901.

Relevance for health care professionals:
Especially for background information to know about the exposure of private settings. In case of the highlight of geographical exposure zones, GP's (via GLEM for example) and pneumologists should be informed in order to allow them to enhance participation of other patients and to give preventive advises (ex. stop smoking).

Availability in Belgium:
Organised in the Walloon Region. Radon detector can be obtained through the radon day website: www.radonday.be or at 0800/11901.

Financial aspects:

Participation cost is 20 €/participant. The normal cost for such testing is 30 €, Wallonia is taking in charge the complementary 10 €.

References:
Agence fédérale de Contrôle nucléaire (AFCN/FANC) http://www.afcn.fgov.be/fr/page/646.aspx

3.1.17. DES database

Tool category: Database

Tool description:
Since information on Environment & Health (E&H) is fragmentized, the goal of the DES project was to develop a tool which:
- brings together all contacts and relevant information (available via Internet links) on E&H,
- promotes the communication between the different players active in the field of E&H,
- structures the information.

Information on E&H has been integrated in a database. 3 basic modules: *themes, actors, actions* have been set:

- *Themes* are represented by the NEHAP (National Environment and Health Action Plan) themes,

Table 2: Themes as proposed in the DES database

-Sources-	-Quality of the environment-	-Exposure and impact-	-Political actions-
Nanotechnology	Indoor air quality	Combined exposures	Economical analysis
Climate changes	Outdoor air quality	Human biomonitoring	Environmental and health indicators
Urban development	Noise	Vulnerable groups	Communication
Transport	Electromagnetic fields	Social aspects	Training of professionals
Chemicals		Risk assessment	Scientific data translated into policy
		Morbidity	

- *Actors* are people active in the field of E&H,
- *Actions* contain information and events.

Applications of the DES database include searching for experts, information or events related to specific topics on E&H but also propose information or events to share to the community.

Relevance for health care professionals:
Health care professionals are demanding to have access to scientific and independent information regarding environment and health and to be part of a network to exchange information. The DES database provides already a good set of official information databases on E&H easy to access through the NEHAP themes.

Availability in Belgium:

A prototype of the interface and database has been delivered to the SPF/FOD and BELSPO in 2012. Some funding might be necessary to be put online, to update the database and to manage it on a regular basis.
When it will be online, different levels of information will be available to the registered actors according to their status of registration.

Action potentially needed for further implementation:
The prototype interface and database needs to be put online. When on line, it might be necessary to update and a person should be dedicated to manage the flows of information on a regular basis.

Financial aspects:
Some funding might be necessary to be put online, to update the database and to manage it on a regular basis.

References:
- Willems H., Buekers J., Charlet F., Stassen K., Dewolf M.C., Torfs R., Développement d'une base de données regroupant les acteurs et actions (accessible par l'intermédiaire d'un lien Internet) qui ont un lien direct avec les domaines de l'environnement et de la santé, Projet AGORA (Contrat de recherché: AG/00/156), 2011

3.2. Tools at organizational level

3.2.1. Network of « médecins vigies » and "laboratories vigies"

Tool description:
The Network of « médecins vigies/huisartsen peilpraktijken » is a network of sentinel physicians aiming to report on a voluntary basis on specific pathologies through a continuous and systematic reporting and a defined registration form. So far, the process refers mainly to infectious diseases but chronic diseases such as cancers, for example, are also part of such reporting. The information collected through completes the information already existing in other databases.
The collected morbidity data cover health issues highlighted by the participating doctors according to observations among their patients. Only doctors who have been reporting for 26 weeks are considered in the database. The weekly data reporting document include 8 themes. About 180 doctors are participating in this network.

Relevance for health care professionals:
The treatment of the weekly reported data allows providing information on trends and the level of risk for reported pathologies. Collected data focusing on a few specific or priority pathologies regarding environmental related diseases and risk factors could support health care professionals in interpreting potentially increasing prevalence of the same pathologies among their patients.
At a wider scale, emerging issues could be highlighted or confirmed which could lead to further surveillance and preventive strategies and actions. For example in terms of registration of cancers, collected data have improved the understanding of circumstances leading to cancer diagnosis and of the impact of awareness raising campaigns.

Availability in Belgium:
The network has been in existence in Europe and North America for many years.
The possibility to extend the concept of the network of "Médecins vigies" to the concept of "Laboratory vigies".

Action potentially needed for further implementation:

Even if it is regularly possible to integrate new themes of reporting, it is difficult to integrate data regarding environmental health unless we focus on a few specific pathologies or risk factors easy to report by participating GP's. An electronic reporting could improve the efficiency of the process. The data could then be treated much faster in relation with other environmental and/or comparable health databases. Collaboration with other countries at EU level in this field could also be considered.

References:
http://www.hector-asbl.be/documentation/environnement/vigilance/reseau-de-medecins-vigies
http://www.e-sante.be/cancer-medecins-vigies-rapport/actualite/1294
https://biocli.iph.fgov.be/toolkit/login/login.cfm and https://www.wiv-isp.be

3.2.2. Local centres for Health Promotion (Centres Locaux de Promotion de la Santé (CLPS)/ Loco-regionaal Gezondheids Overleg en – Organisatie (LOGO)

Tool category: Networking, (Exposure level reduction (Tool for public health or to support health care professionals in case of an emerging local issue))

Tool description:
The main objective of the CLPS/LOGOS is to anchor strategies proposed in the field of health promotion within the activities of the local field actors in order to support the development of coordinated projects in global health. The CLPS aim to support the emergence and development of local projects in favour of health promotion. As such they provide methodological support and expertise to organisations and professionals developing field activities regarding health promotion and preventive medicine. This includes the provision of health promotion and prevention materials such as brochures, games, trainings, information tools and workshops. CLPS initiate and support the local development of partnerships and intersectorial activities, taking into account the local priorities in terms of health promotion policy. For instance, they play the role of interface between the Federation Wallonia-Brussels and local actors. Their multi-annual actions plans and annual objectives are submitted to the Superior Council of Health Promotion (Conseil Supérieur de Promotion de la Santé) and to the approval of the Government. They coordinate the implementation of the action plan within health as well as a database of projects (cf. http://www.clps-bw.be/presentation-db). In Flanders, the 14 LOGOS implement health projects at the local level and develop integrated health preventive strategies for companies, schools, local authorities and other settings and host the Medisch Milieukundigen. Article 8 of Besluit Vlaamse Regering 29/5/2009 removed environmental health from the task list for the bilingual region of Brussels-Capital (15th LOGO) local institutions and among the target public.

In the Walloon Brabant the CLPS has for example developed a platform gathering different NGO's working in the field of environment and health as well as a database of projects (cf. http://www.clps-bw.be/presentation-db

Relevance for health care professionals:

The CLPS/LOGOS have the competencies and capacity to improve the communication addressing professionals and a wider public. The aspects regarding the impact of the environment on health are part of their missions. However the CLPS are second line actors not directly involved in project management.

Availability in Belgium:
The CLPS are effective. They receive funding from the Federation Wallonie-Bruxelles and from other entities such as the Provinces.

Action potentially needed for further implementation:

Aspects regarding environment and health are still not so well known by the CLPS (except for the Flemish LOGOS). More awareness raising among the CLPS are probably necessary to integrate this field of action. To ensure more equivalence between the CLPS and the LOGO's , a collaboration with a person specifically trained in environment and health would be necessary.

Financial aspects:

The Flemish government subsidizes every LOGO with a basic funding of € 60.000 and a rate of € 0,53 per inhabitant within its geographical scope (article 24). For environmental health tasks, an envelope is added, according to the number of FTE's per region (see the table below). Some expenses require a visa of the Flemish Agency '"Zorg en Gezondheid".
The Funding of the CLPS includes funding the Federation Wallonie-Brussels and in some cases also from the Provinces. Some extra funded can also be acquired through specific project funding.

References:

http://www.vlaamselogos.be/
Decree of 21.11.2003 on the "erkenning, de subsidiëring en de opdrachten van de Logo's" (the so called Decree on Prevention, BS 3.2.2004).
Besluit van de Vlaamse Regering 29.5.2009 (BS 9.7.2009).

3.2.3. Vlaams Instituut voor Gezondheidspromotie en Ziektepreventie (VIGEZ)

Tool category: network, tools for public health (promotion and communication) at the organizational level

Tool description:

VIGEZ is a non profit Flemish expert centre with a staff of more than 20 health experts (about 10 FTE of which 1 FTE Environment and Health coordinator) and occasional project collaborators. These experts develop tailored strategies, advises, trainings and methodologies for health promotion and prevention and as such provide support, coaching and consultancy for private and public health care organizations and professionals. VIGEZ collaborates with the 14 Flemish LOGO's (Loco-regionaal gezondheidsoverleg en -organisatie).

Relevance for health care professionals:

VIGEZ-experts develop evidence based practical tools that can be used by health professionals to promote health, also in environmental health. An overview of the types of tools is available on http://www.vigez.be/webwinkel.
In this work, VIGEZ uses the SONG-scan (SOciale ONGelijkheid) of the Koning Boudewijn-foundation as well as the recommendations of 'Determine', a European project for good practices in reducing the social gaps in health issues.

Availability in Belgium:

Flanders and Dutch speaking professionals in Brussels. The organization is funded for 55 % through an agreement with Flemish authorities and also falls back on external funding for projects.

References:

Vlaams Instituut voor Gezondheidspromotie en Ziektepreventie vzw, Jaarverslag 2012.

3.2.4. The health and occupation Reporting networks (THOR-gP)

Tool description:

THOR-gP is a research network of General Practitioners trained in Occupational Medicine to determine the incidence of occupational disease, work-related ill health and sickness absence burden in UK. One of the main strengths of the group is its research in environmental epidemiology. This ranges from work on air pollution and health, to intestinal infectious disease. Wide ranging epidemiologic methods are used, with different populations, ages and outcomes such as cardiorespiratory mortality or asthma. Some studies involve small panels of scores of people who are intensively investigated while others rely on routinely collected data from hundreds to thousands of people.
http://www.population-health.manchester.ac.uk/epidemiology/COEH/research/thorgp/

Relevance for health care professionals:
The THOR-gP project has developed a website that provides information and resources for GPs participating in the study. THOR-GP data are used to calculate the incidence of occupational disease in the UK, and to examine trends in work-related ill-health. To make these results as accurate as possible THOR-GP cases need to be reported (electronically) by participants according to specific criteria.
Most importantly this is also the portal for the free GP. Continuous Professional Development is available to GPs participating in this project. There is also opportunity for feedback.

Availability in Belgium & Action potentially needed for further implementation:
A similar network could be developed for environmental health and a study on the feasibility of such a network could be initiated by the EU.

References:
http://www.population-health.manchester.ac.uk/epidemiology/COEH/aboutus/

3.3. Tools for public health

Among the tools identified under point (3.1.) "Tools for diagnosis and support to health care professionals with individual patients", some represent also efficient tools for public health. The main ones are:

- **Risk analysis, assessment and management in case of diagnosed health effects:** is a systematic and comprehensive step by step approach aiming to analyse and assess risks associated with a technological, industrial process or a product. Its aim is to bridge the individual health care to a more public health approach. Different tools have been developed to implement risk analysis such as software. Some of these tools can be used to support practitioners in the diagnosis of patients in case of an emerging issue (local, regional or at a wider scale).

- **Biomonitoring**: analysis of a biological matrix (blood, tissue, urine, hair, etc.) to estimate the amount of hazardous substances that entered the body or its effect (through biomarkers of exposure and biomarkers of effect) in a population where an emerging issue is or could be arising.

- **GIS**: Geographic information system (GIS) is a tool that could link environmental and health data and support the health care professionals in the potential identification of an emerging issue (at local, regional, national or international level).

Other interesting tools for public health could show an interest in environment and health if integrating environmental items. This data and information collected would strongly support research in this field, the highlight of priorities and the elaboration of appropriate strategies and

actions. It could also support health care professionals facing an emerging issue. EPA's new website for America's Children and the Environment (ACE), now available at www.epa.gov/ace, presents data on children's environmental health bringing together information from a variety of sources to provide indicators and related information on the environment and children's health in a easily accessible format, with a separate webpage for each ACE3 topic.

3.3.1. BE-MOMO (Belgian Mortality Monitoring) and Standardized Procedures for Mortality Analysis

Tool category: Database

Tool description:
In Belgium, surveillance of all-cause mortality is carried out on a weekly basis by the Scientific Institute of Public Health, Epidemiology Unit: https://www.wiv-isp.be/epidemio/epifr/index.htm and https://www.wiv-isp.be/epidemio/be-momo/.
The monitoring system is designed to serve as a tool for rapid detection and quantification of unusual mortality which might result from epidemic diseases such as influenza or from extreme environmental conditions such as heat waves. A timely assessment of the impact on mortality may be useful to guide or reinforce new or existing public health measures, e.g. national heat plan. Moreover, mortality monitoring can be used to evaluate public health measures by comparisons of periods before and after the implementation of the intervention.
The Be-MOMO website provides figures of currently observed all-cause mortality in Belgium, together with the most relevant public health risks such as influenza, meteorology and air quality indicators (ozone, PM_{10}). Many studies have shown that in temperate countries, the main population-level determinants for all-cause mortality include influenza epidemics, heat waves, cold spells and air pollution. Therefore, information on these risks factors is also collected. Data are updated on a weekly basis, with the exception of population sizes for which the numbers at the 1st of January are used. Analyses are performed on data aggregated by day and by week, stratifying by gender and age groups (including totals). Excess mortality is calculated based on model predictions for baseline values. Increases in mortality are flagged when the observed death count exceeds the upper prediction limit of the expected number of deaths. The RESULTS section presents the actual output in graphs and tables. The graphs allow a visual inspection of mortality patterns in relation to expected values and the upper mortality threshold. Also risk factors are presented, facilitating a rapid screening for potential correlations. The flagged days and weeks with mortality above the threshold are listed together with risk factors under “Alerts”. The “Excel” pages contain tables with estimates for excess/shortage of mortality by week. Outputs are grouped in half-year periods, considered to represent 'summer' (May to October) and 'winter' (November to April). Final excess estimates are provided after some months, when data are complete. The seasonal reports and other relevant documents are available under Publications .
Previously, MORBIDAT was already an overview of databases about morbidity and health related behaviours and the corresponding regulations in Belgium https://www.wiv-isp.be/epidemio/morbidat/. This was a public service managed by the Scientific Institute of Public Health, Unit of Epidemiology, in collaboration with the Flemish and the French Communities. A list of main causes of morbidity was established in collaboration with both Health care administrations (of both Communities). This list was based on the WHO-aims of health 'Health for all in the year 2000'. This inventory is no longer updated, because the CORPH-project is terminated but data are still available.

Relevance for health care professionals:
This tool makes already the link between environmental (meteorological and air quality) and health databases. Extended to new environmental parameters, health pathologies and geographic information systems would support a better understanding of the risk factors associated to morbidity and mortality, locally, regionally or on a country base.

Availability in Belgium:
A database already exists in Belgium for both communities. This database is limited to mortality, population, influenza, meteorological and air quality data. The risk factors considered include Temperature (min and max), ozone and PM_{10}.

Action potentially needed for further implementation:
This database could be further extended to consider other pathologies related to environment factors and other environmental risk factors. Also extended to geographic information systems would support a better understanding of the risk factors associated to morbidity and mortality, locally, regionally or on a country base.

Financial aspects:
Investment and management costs will probably be needed to extend the database to new pathologies and environmental risk factors.

References :
Demaret S., Gisle L., Miermans P-J., Tafforeau J., Van der Heyden J., "Enquête nationale de santé par interview Belgique 2004, Synthèse. Bruxelles : Institut Scientifique de Santé Publique, section épidémiologie.
Godin I., De Smet P., Favresse D., Moreau N., Parent F. Tableau de bord se la Santé en Communauté française de Belgique. Service communautaire en Promotion de la santé SIPES (ESP-ULB), Bruxelles, 2007.

3.3.2. Belgian Health Interview Survey (Enquête de santé belge par interview/ Belgische Gezondheidsenquête)

Tool category: Tool for public health

Tool description:
The Belgian Health interview Survey aims to describe (every 4 years) the health of the population in order to better estimate the prevalence and the distribution of the diseases. In 2008, the Belgian Health interview Survey has started to integrate the noise aspect in his survey and report.
This could be further extended to include emerging diseases or environmental issues reported by the health care professionals. It could also be combined with other tools (GIS, biomonitoring,…) to highlight more potential links between environment, heath and population behavioural habits. https://www.wiv-isp.be/epidemio/hisia/index.htm

Relevance for health care professionals:
The goals of this tool are to:
- identify the priorities in terms of health;
- describe the state of health and the needs of the population in terms of the health;
- estimate the prevalence and the distribution of health indicators;
- analyse social inequalities in terms of health and access to the health care;
- better understand consumption of health care and their determinants;
- highlight the trends over time regarding public health.

The edited reports represent interesting information for public health and health care professionals to know more about the state of health of the population and eventually adapt preventive messages addressing patients, targeted groups and the wider population.

Availability in Belgium:
The Health interview Survey has been organised about every 4 years in Belgium since 1997.

Action potentially needed for further implementation:
The Survey could in the future integrate some items regarding environmental issues (from exposure patterns to health aspects) besides the noise aspect and the report could develop a specific chapter on these issues. Extended to new environmental factors or emerging environmental related diseases and geographic information systems it would support a better understanding of the risk factors associated to morbidity and mortality, locally, regionally or on a country base.

Financial aspects:
The Survey is managed by the Scientific Institute of Public Health(ISP-WIV).

References:
- K. Bayingana, S. Demaret, L. Gisle, E. Hesse, PJ. Miermans, J. Tafforeau, J. Van Der Heyden, « Enquête de santé par Interview », Belgique 2004, Service d'épidémiologie, 2006, Bruxelles, Institut Scientifique de Santé Publique.
K. Bayingana, S. Demaret, L. Gisle, E. Hesse, PJ. Miermans, J. Tafforeau, J. Van Der Heyden, « Enquête de santé par Interview », Belgique 2008, Service d'épidémiologie, 2008, Bruxelles, Institut Scientifique de Santé Publique.
- E. Hesse «Enquête de santé par Interview : Santé et environnement», Belgique 2008 ; https://his.wiv-isp.be/fr/Documents%20partages/HE_FR_2008.pdf

3.3.3. National cancer register / (Stichting) Kankerregister

Tool category: Database

Tool description:
The National cancer registers is a systematic collection of cancer cases http://www.kankerregister.org
It includes also the PRO CARE Project which is a multidisciplinary project on rectal cancer and a TUMOUR BANK which promote transnational cancer research and the collaboration between different cancer researchers in Belgium. The aim is to centralize the data of residual human tumour samples in a database.

Relevance for health care professionals:
The coded version of this central database will be made accessible to research groups, which allow them to perform queries, based on specific search criteria, and trace the samples they're interested in to different local bio banks. This could facilitate the identification for the doctors of new diagnosis or prognostics.
The main objective is to reduce diagnostic and therapeutic variability and to improve outcome in patients.

Availability in Belgium:

"Jarenlange inspanningen hebben geleid tot een databank die voor Vlaanderen als volledig kan worden beschouwd sinds 1999 en voor heel België sinds 2004. Die databank vormt een onschatbare bron van informatie en is sinds enkele jaren het belangrijkste uitgangspunt voor het onderzoek dat de Stichting Kankerregister voert. Door de gezondheidswet van 2006 heeft de Stichting Kankerregister bijkomend toegang gekregen tot een selectie van de gezondheidsgegevens die de ziekenfondsen aanleveren."

Source: http://www.kankerregister.org/Onderzoek

In the province of Limburg, LIKAR (the Cancer Registry of Limburg), managed by the Limburgse Kankerstichting (LIKAS) provides refined cancer records to overcome well known deficiencies. The register is commissioned by the Flemish minister of Flemish Minister for Welfare, Public Health and

Family and supported by the provincial authority of Limburg. The work is financed by the Flemish Government.

Action potentially needed for further implementation:
An option would be to add those cancers which are suspected to have an association with environmental source. Extended to new environmental parameters, health pathologies and geographic information systems it would support a better understanding of the risk factors associated to morbidity and mortality, locally, regionally or on a country base. In case of emerging local issue or clusters, the same developments should be considered to better understand the potential local sources of exposure.

Financial aspects:
The Limburg Cancer Register is commissioned by the Flemish minister of and supported by the Limburg provincial authority. The work is financed by the Flemish Government.

References:
- L. Bleyen, P. Van Landeghem,E. Pelfrene, M. De Vriendt, A. DeSmet, G. De Backer, "Screening for breast cancer in Ghent, Belgium: first results of a programme involving the existing health services", European Journal of Cancer, volume 34, Issue 9, August 1998, pages 1410-1441.
- Laura A., McGuinn, Armen A. Ghazarian, Gary L. Ellison, ChinonyeE.Harvey, Christine M. Kaefer, Britt C. Reid, "Cancer and environment: definitions and misconceptions", Environmental research, volume 112, January 2012, pages 230-234.
D. LOUSBERGH, F. BUNTINX, L. OP DE BEECK, J. RUMMENS, J. VANDEN BRANDE, D. DHOLLANDER, E. KELLEN, K. HENSEN, C. FAES, L. BRUCKERS, E. CLOES, D. LATHOUWERS, E. MEEKERS.
Tien jaar kanker in de provincie Limburg (1996-2005): incidenties, trends en voorspellingen, Tijdschr. voor Geneeskunde, 66, nr. 1, 2010 3, doi: 10.2143/TVG.66.01.2000675.

3.3.4. Eurocat

Tool category: Network information and data base
http://www.eurocat-network.eu/homepage

Tool description:
EUROCAT is a European network of population-based registries for the epidemiologic surveillance of congenital anomalies. It includes surveillance of 1.7 million births per year in Europe, it is present in 23 countries and covers 29% of births in the EU population. It operates in close connection to the WHO. The objectives of EUROCAT are: to provide essential epidemiologic information on congenital anomalies in Europe, to facilitate the early warning of new teratogenic exposures, to evaluate the effectiveness of primary prevention, to assess the impact of developments in prenatal screening.
To provide a ready collaborative network and infrastructure for research related to the causes and prevention of congenital anomalies and the treatment and care of affected children. To act as a catalyst for the setting up of registries throughout Europe collecting comparable, standardised data.
It has a special interest on environmental exposures.

Relevance for health care professionals:
EUROCAT acts as an information and resource centre for the population, health professionals and managers regarding clusters or exposures or risk factors of concern. It is of help to facilitate the identification of teratogenic exposures. EUROCAT results are made available through publications. It contains prevalence data tables updated bi-annually with prevalence rates of 96 congenital anomaly subgroups in each Registry, with the number of cases reported among live births, stillbirths and terminations of pregnancy following prenatal diagnosis and trends in prevalence since 1980.

Extracts of the common database can be requested by researchers, by submitting a research protocol for approval. Protocols are available for cluster recognition

Availability in Belgium:
There are two Belgian registries included in EUROCAT, the register of the province of Antwerp, contact Dr Vera Nelen and the Province of Hainaut-Namur, contact: Christine Verellen-Dumoulin.

Action potentially needed for further implementation:
Implementation only in 2 provinces. Could be expanded in the future. Extended to new environmental parameters such as endocrine disruptors, health pathologies such as neurological pathologies and geographic information systems it would support a better understanding of the risk factors associated to intra-uterine exposure locally, regionally or on a country base. In case of emerging local issue or clusters, the same developments should be considered to better understand the potential local sources of exposure.

Financial aspects:
The joint activities of EUROCAT are funded under EC DG Health Public Health Programmes since March 2004 according to the website of EUROCAT. Additional financial support is provided by Service Public de Wallonie and the Province of Antwerp.

References:
http://www.eurocat-network.eu/

3.3.5. Guide to health in spatial planning

(Dutch National Institute for Public Health and the Environment, RIVM)

Tool category: communication

Tool description: tool, structured questionnaire for facilitating negotiation on health aspects of new emerging projects; the "guide does ask systematic questions and provides an overview of the factors that can positively or negatively impact the health of affected citizens" "This guide **DOES NOT** assess impacts and express them in degrees and numbers. This requires further investigation in later steps of the procedure."The purpose of this guide is to raise awareness about health aspects by screening for them in the initial phase of the spatial planning procedure. By answering the questions, the guide will help you gain better insight into environmental, social, lifestyle and care-related factors that can impact the health of the affected citizens. The guide is a tool that helps pinpoint important health aspects and put them on the agenda for further discussion. The guide uses your answers to generate a summary report with the health-related factors that need attention in the next step of the planning procedure."

Relevance for health care professionals: the tool is <u>not</u> tailored nor a specific tool for health professionals but mainly addressed to actors such as urban planning authorities, municipalities and other professionals or groups, involved in the planning and design of new projects. The purpose is to ex ante provide "better insight into environmental, social, care-related lifestyle factors that can impact the health of the affected citizens".

Availability in Belgium: for free available via http://rivm.ibase.info/isurveyuk/; hosted by the National Institute for Public Health and the Environment (RIVM)

Action potentially needed for further implementation:

References:
The guide to health in spatial planning was developed by RIVM's Knowledge and Information Centre for the Environment and Health (Kennis- en Informatiepunt Milieu & Gezondheid). It is based on the health guide in the environmental impact assessment that was previously developed by RIVM and the commission for the environmental impact assessment.

3.3.6. THE PEP network health

Tool category: supportive tools for network or for policy development support

Tool description:
The Healthy Transport website ('THE PEP-toolbox') was developed to help policymakers and local professionals solve transport problems that affect health and the environment. In addition to tools and promising practices, it contains policy briefs on selected topics and provides access to information from relevant sources. It provides guidance on transport-related health impacts and sustainable solutions with a focus on issues such as road-traffic injuries, air pollution, noise, climate change and physical activity.
This tool is a state of art internet platform and data base designed to facilitate the exchange of information and knowledge across the transport, environment and health sectors in the European region. It has been administrated by UNECE since 2005 and is available in English and Russian.
The clearing house content covers 110 topics relevant to the three sectors.
The following tools are available:

Ecopassenger
Ecopassenger is a tool to calculate energy consumption and emissions from different passenger transport modes (car, plane and train) in Europe. It gives the user the possibility to compare and make informed transport decisions.

EcotransIT
EcotransIT is the first global online multimodal emissions calculator for international freight and logistics services. The innovative EcoTransIT World provides carbon- footprints of logistical chains including all transport modes - rail, road, ship and airplane - on a world level in order to create smart systems where sustainability advantages of the different transport modes are exploited and combined in one joint system.

Online guide to health in spatial planning
The online guide to health in spatial planning is an interactive guide used to assess health impacts in spatial planning, including transport. It provides insight into environmental, social, care-related and lifestyle factors that can impact the health of the affected citizens. The health impact assessment is developed by the Dutch National Institute for Public Health and the Environment (RIVM) and the commission for the environmental impact assessment.

Health Economic Assessment Tool (HEAT) for walking and cycling
The Health Economic Assessment Tool for walking and cycling is a practical tool that allows the economic quantification of the health effects from physical activity due to walking and cycling.

INTARESE
INTARESE (Integrated Assessment of Health Risks of Environmental Stressors in Europe) is a collaborative platform where a team of international scientists in the areas of epidemiology, environmental science and biosciences can work on the development and application of new, integrated approaches to and tools for the assessment of environmental health risks in support of

European policy on environmental health. The tools will be applied and tested in a number of specific policy areas, including transport

HEPA Europe

Case studies have been collected on 'Collaboration between Physical Activity Promotion and the Transport Sector: Examples from European Countries'. This collection of 48 practical examples from 11 countries aims to support member states in the intersectoral promotion of physical activity on the form of cycling and walking.

Economic assessment of transport infrastructure and policies

Methodological guidance for practitioners on the economic appraisal of health effects related to walking and cycling. It can be used as part of a comprehensive cost-benefit analysis of transport interventions or infrastructure projects, or to complement existing tools for economic valuations of transport interventions on emissions or congestion.

Relevance for health care professionals:
Mainly relevant for health care professionals that are involved in transport related issues.

Availability in Belgium:
Online tool which is open to everyone.

Action potentially needed for further implementation:
Open access.

Financial aspects:
No costs for using the tools.

References:
http://www.healthytransport.com/tools-and-projects/

4. Discussion and recommendations

The aim of this part of the project was to make an inventory of instruments which are in particular in support of environmental health. The instruments which are used to make a diagnosis for an environment related disease do not differ from those used in other medical specialities. The causal factors for environment related diseases can sometimes be detected in the human body. However, for many environment related diseases the measurement of exposure to certain environmental factors is the only mean to make an association to a disease. And even then it is difficult as also life style factors and occupational exposure can interfere.

Handbooks are available which give comprehensive information on how to detect, diagnose, and treat the full spectrum of problems caused by occupational or environmental factors, including physical, chemical, and biologic agents (McPhee, 2012, Etzel, 2003, Rosenstock, 2004). Also interdisciplinary collaboration with psychologists that go into the patients disease history in case of conditioned respiratory reactions for instance, is announced as a promising track for treatment of patients.

Many tools already exist in Belgium, some could be extended to integrate environmental items and others could be more promoted. The promotion has to address incentives for the target group of health professionals and physicians in particular. Regulation (command and control), financial

initiatives (subsidies, free assistance) or sensitization (social instruments) can enlarge the group of users of the tool and even raise the awareness of the public at large. Technical or methodological tools, norms and registers, information systems and website tools do as such not enclose this encouraging capacity. The examples we did identify having such an appeal, are the IRCELINE-alarm, the Global Medical File, the facilities offered by the Green ambulances and the MMK-network, Centres Locaux de Promotion de la Santé en het Lokaal Gezondheids Overleg (LOGO'S), the communication platform GERICO, SQuATte.

The participants of the face to face meetings with universities, Superior schools and professional associations and during both organised workshops, expressed a demand to maintain the network brought together within the duration of the project.

There seems to be no urgent need to create new tools but rather to build on existing ones and support their further development and implementation.

We do not foresee any important additional operational costs except of the development costs in case of strengthened integration of environmental aspects in existing tools (e.g. DMG++, Médecins and laboratory vigies, etc.) and for a better promotion of the tools in order to improve their steering capacity (e.g. financial incentive for the use of DMG++, participation of doctors to the surveillance program (Médecins vigies), the promotion of the pollen network).
In order to better understand the promotion needs of the already existing tools among the professionals, a quick questionnaire could be sent through professional associations (ex. SSMG) to all practitioners.

References:

- Etzel RA, Balk SJ. Handbook of pediatric environmental health, (3rd Ed.). 2013.
- McPhee SJ. Current Medical Diagnosis and Treatment 2012. ISBN-13: 9780071763721.
Koren H. Handbook of environmental health and safety: principles and practices. 1980. ISBN0-08-023900-5.
- Rosenstock L, Cullen M, Brodkin C, Redlich C. University of California, Los Angeles, LA (United States). School of Public Health. Textbook of clinical occupational and environmental medicine.2nd ed.2004 Dec 15. ISBN 978-0-7216-8974-6; ISBN 0-7216-8974-4; TRN: 071000169.

General conclusions and recommendations

It is recommended to maintain existing hours spent for environment and health and if not present to insert at least 5 hours in the bachelor or master levels in medicine as well as nursing and midwives education programs as an awareness raising introduction to the thematic field of environment and health.
It is recommended if the setting of specific courses is not manageable in the program, to integrate within existing educational courses at universities and superior schools environmental health and/or medicine aspects related to these courses.

It is concluded that no one can master all of the described skills or competences. This aim is too ambitious. Mastering certain skills should be divided amongst different medical disciplines.
Intra-university and inter-university collaboration must be encouraged for reasons of efficiency, given the budgetary constraints that educational institutions encounter. Although a limited labor market for environmental health/medicine specialists has been identified, a priority is that a large number of professionals, including non health care professionals, should be trained regarding this topic. The most efficient strategy must be easy, non expensive and fast to implement. It should therefore build on existing structures already delivering continuous training.

Because environmental health is eminently a transversal domain, it is recommended that educational trainings are intending to widen health care professionals knowledge to non traditionally medical fields such as sociology (risk perception), risk communication and management, economy (negative externalities),… A real training to multidisciplinary team working and networking must be strongly encouraged, particularly in the cases of crisis management.

According to the WHO country profile for Belgium, the environmental burden of diseases per year would account for 14% of total burden of disease (in Belgium) health care professionals should be able to integrate such determinants in the aetiology of chronic and acute diseases.
(http://www.who.int/quantifying_ehimpacts/national/countryprofile/belgium.pdf)

The competent authorities should invest in ongoing multidisciplinary research in the domain of environment and health because research innovation promotes educational progress, sanitary progress and consequently collective economies.

The project highlighted the following recommendations and priorities:

- Underline the importance of prevention of environmental related diseases in the practice of the medical professionals, nurses and midwives and in general in campaigns addressing the public.
- Continuous training: ensure the set up of a specific RIZIV/INAMI mandatory heading for the continuous trainings (Long Life Learning) of health care professionals in EH & EM (ex. “Environment and Medicine”).
- Ensure the recognition of the new competences of the trained professionals in this field and reimbursement incentives for health care professionals qualifying for a certificate, implementing a complete environmental anamnesis.
- Support existing tools and improve their efficiency in the framework of environmental health. Improve their visibility by health care professionals, their accessibility and use. Some existing tools already represent effective pedagogic material.
- Ensure the registration of environmental items into existing registration systems (for example the DMG+ to expand and create a “DMG++”) in order to produce standardised environmental and medical data and install reimbursement incentives.

- Build on the existing: initiatives within Superior schools, Universities and professional associations already exist.
- WHO validated pedagogic material is available and should be translated to constitute a common training material.
- To ensure effective implementation of the next steps: ensure implementation in collaboration with the network initiated in the framework of the project (representing universities, superior schools and professional associations). Initiatives developed by NGO's at different levels should be taken into account.
- To ensure better interaction across different disciplines: consider other concerned professionals (architects, engineers, social workers,…) and society for minimal training in environment and health.

Glossary Environmental Health Terms

Absorption

The process of taking in, as when a sponge takes up water. Chemicals can be absorbed into the bloodstream after breathing or swallowing. Chemicals can also be absorbed through the skin into the bloodstream and then transported to other organs. Not all of the chemical breathed, swallowed, or touched is always absorbed.

Acute

Occurring over a short time, usually a few minutes or hours. An acute exposure can result in short term or long term health effects. An acute effect happens within a short time after exposure.

Ambient

Surrounding. Ambient air usually means outdoor air (as opposed to indoor air).

Background level

A typical level of a chemical in the environment. Background often refers to naturally occurring or uncontaminated levels. Background levels in one region of the state may be different than those in other areas.

Biological monitoring

Analyzing chemicals, hormone levels or other substances in biological materials (blood, urine, breath, etc.) as a measure of chemical exposure, health status, etc. in humans or animals. A blood test for lead is an example of biological monitoring.

Body burden

The total amount of a chemical in the body. Some chemicals build up in the body because they are stored in body organs like fat or bone or are eliminated very slowly.

Case control study

A study in which people with a disease (cases) are compared to people without the disease (controls) to see if their past exposures to chemicals or other risk factors were different.

Chronic

Occurring over a long period of time, several weeks, months or years.

Cohort study

A study in which a group of people with a past exposure to chemicals or other risk factors are followed over time and their disease experience compared to that of a group of people without the exposure.

Concentration

The amount of one substance dissolved or contained in a given amount of another substance or medium. For example, sea water has a higher concentration of salt than fresh water does.

Contaminant

Any substance that enters a system (the environment, human body, food, etc.) where it is not normally found. Contaminants are usually referred to in a "negative" sense and include substances that spoil food, pollute the environment or cause other adverse effects.

Detection limit

The smallest amount of substance that a laboratory test can reliably measure in a sample of air, water, soil or other medium.

Dose

The amount of substance to which a person is exposed.

Epidemiology

The study of the occurrence and causes of health effects in human populations. An epidemiological study often compares two groups of people who are alike except for one factor such as exposure to a chemical or the presence of a health effect. The investigators try to determine if the factor is associated with the health effect.

Exposure

Contact with a chemical by swallowing, by breathing or by direct contact (such as through the skin or eyes). Exposure may be either short term (acute) or long term (chronic).

Exposure assessment

A process that estimates the amount of a chemical that enters or comes into contact with people or animals. An exposure assessment also describes how often and for how long an exposure occurred, and the nature and size of a population exposed to a chemical.

Health assessment for contaminated sites

Determination of actual or possible health effects due to environmental contamination or exposure. It includes a health-based interpretation of all the information known about the situation. The information may come from site investigations (environmental sampling and studies), exposure assessments, risk assessments, biological monitoring or health effects studies. The health assessment is used to advise people how to prevent or reduce their exposures, to determine remedial actions or the need for additional studies.

Health effects studies related to contaminants

Studies of the health of people who may have been exposed to contaminants. They include, but are not limited to, epidemiological studies, reviews of health status of people in exposure or disease registries, and doing medical tests.

Health registry

A record of people exposed to a specific substance (such as a heavy metal), or having a specific health condition (such as cancer or a communicable disease). New York State maintains several health registries.

Indoor air pollution

Chemical, physical, or biological contaminants in indoor air.

Ingestion

Swallowing (such as eating or drinking). Chemicals in or on food, drink, utensils, cigarettes, hands, etc. can be ingested. After ingestion, chemicals may be absorbed into the blood and distributed throughout the body.

Inhalation

Breathing. People can take in chemicals by breathing contaminated air.

Maximum Contaminant Level (MCL)

The highest (maximum) level of a contaminant allowed to go uncorrected by a public water system under federal or state regulations. Depending on the contaminant, allowable levels might be calculated as an average over time, or might be based on individual test results. Corrective steps are implemented if the MCL is exceeded.

Media

Elements of a surrounding environment that can be sampled for contamination; usually soil, water, or air. Plants, as well as humans (when sampling blood, urine, etc) and animals (such as sampling fish to update fish consumption advisories) can also be considered media. The singular of "media" is "medium".

Metabolism

All the chemical reactions that enable the body to work. For example, food is metabolized (chemically changed) to supply the body with energy. Chemicals can be metabolized by the body and made either more or less harmful.

Monitoring

Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

Morbidity

Illness or disease. A morbidity rate for a certain illness is the number of people with that illness divided by the number of people in the population from which the illnesses were counted.

Mutagen/mutagenicity

An agent that causes a permanent genetic change in a cell other than that which occurs during normal genetic recombination. Mutagenicity is the capacity of a chemical or physical agent to cause such permanent alteration.

Persistence

The quality of remaining for a long period of time (such as in the environment or the body). Persistent chemicals (such as DDT and PCBs) are not easily broken down.

Pollution

Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Polychlorinated biphenyls (PCBs)

A series of isomers and compounds used mainly as plasticizers, flame retardants and insulating materials. PCBs are potentially toxic and carcinogenic. Toxic effects generally involve damage to the skin and liver. PCBs have been found to cause reproductive problems in humans and cancer in laboratory animals.

Population at risk

A population subgroup that is more likely to be exposed to a chemical, or is more sensitive to the chemical, than is the general population.

Protocol

The detailed plan for conducting a scientific procedure. A protocol for measuring a chemical in soil, water or air describes the way in which samples should be collected and analyzed.

Quality assurance and quality control (QA/QC)

A system of procedures, checks and audits to judge and control the quality of measurements and reduce the uncertainty of data. Some quality control procedures include having more than one person review the findings and analyzing a sample at different times or laboratories to see if the findings are similar.

Remediation

Correction or improvement of a problem, such as work that is done to clean up or stop the release of chemicals from a contaminated site. After investigation of a site, remedial work

may include removing soil and/or drums, capping the site or collecting and treating the contaminated fluids.

Risk

Risk is the possibility of injury, disease or death. For example, for a person who has measles, the risk of death is one in one million.

Risk assessment

A process which estimates the likelihood that exposed people may have health effects. The four steps of a risk assessment are: hazard identification (Can this substance damage health?); dose-response assessment (What dose causes what effect?); exposure assessment (How and how much do people contact it?); and risk characterization (combining the other three steps to characterize risk and describe the limitations and uncertainties).

Risk communication

The exchange of information about health or environmental risks among risk assessors and managers, the general public, news media, interest groups, etc.

Risk factor

Characteristic (e.g., race, sex, age, obesity) or variable (e.g., smoking, occupational exposure level) associated with increased probability of a toxic effect.

Risk management

The process of deciding how and to what extent to reduce or eliminate risk factors by considering the risk assessment, engineering factors (Can procedures or equipment do the job, for how long and how well?), social, economic and political concerns.

Route of exposure

The way in which a person may contact a chemical substance. For example, drinking (ingestion) and bathing (skin contact) are two different routes of exposure to contaminants that may be found in water.

Safe

Strictly, free from harm or risk. Exposure to a chemical usually has some risk associated with it, although the risk may be very small. However, many people use the word safe to mean something that has a very low risk or one that is acceptable to them.

Target organ

An organ (such as the liver or kidney) that is specifically affected by a toxic chemical.

Volatile organic compound (VOC)

An organic chemical that evaporates readily. Petroleum products such as kerosene, gasoline and mineral spirits contain VOCs. Chlorinated solvents such as those used by dry cleaners or contained in paint strippers are also VOCs.

Source: http://www.cehn.org/resources/resource_guide_glossary_terms#Moniring and http://www.health.ny.gov/environmental/glossary/