

## Perspective

# The Role of General Practices for Monitoring and Protecting the Environment and Health. Results and Proposals of the Italian Project Aimed at Creating an “Italian Network of Sentinel Physicians for the Environment” (Rimsa) within an International Perspective

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**Abstract**

Health effects due to the environment are among the most challenging concerns faced by our future. In particular global climate changes. However, the connection between the environment and human health as part of clinician's activities is rather undeveloped. We performed a literature review, finding that many *Sentinel Physician Networks* have been developed, but very few have dealt with environmental health issues, and almost none have considered the opportunities of targeting Family Doctors (FDs). Beginning with the Italian context, we are committed to developing a structured system, named RIMSA – *Rete Italiana Medici Sentinella per l'Ambiente* – (Sentinel Physicians for the Environment) as a pilot experience. Moreover, we would like to share our experience to raise interest of this model internationally. The aim is to monitor the effects of critical environmental public health issues, help raise awareness of environmental health risks among doctors, patients, and the general public, and learn how to report sentinel diagnoses or critical situations. We believe FDs can play an important role in connecting global concerns with local actions. The project has already made significant strides; three 2-day courses have been staged, training 61 FDs from across Italy; a website, a Moodle platform and an online survey have been implemented and the *Sentinel Physicians for the Environment (SPE) Manual* is currently being compiled. Other actions have been planned to consolidate and develop the project; the training process should be sustained and disseminated and a standard plan for reporting an environmental health concern is underway. This will represent the foundation for setting up the overall SPE network in Italy and possibly in connection with other Sentinel Practitioners Networks in Europe and globally.

**INTRODUCTION****Major and minor effects of the environment on health: how to track them?**

According to the World Health Organisation (WHO), about

12.6 million deaths and disabilities were attributed to the environment in 2012. About a quarter of the global burden of diseases is linked to environmental factors (22%; 95% CI 12%-32%) [1].

In particular, the health effects due to climate change will

be the most challenging concern in coming years [2], with the WHO estimating an additional 250,000 deaths/year between 2030 and 2050 due to the negative effects of climate change [3]. These figures are an underestimate of the overall health impacts of climate change, since the estimates do not include the indirect impacts of climate change on other major determinants of health, such as migration and conflict.

In addition to the health effects usually quantified through the number of deaths, emergency admissions and hospitalizations, there are many other indicators linked to climate change that could provide figures of the true impact in terms of the day-to-day life of people and on the overall organisation of healthcare services. Possible health consequences could be secondary to a number of clinical conditions that are neither necessarily lethal nor require hospitalisation such as, allergic diseases and asthma [4], hypertension [5], fluid and electrolyte disorders [6], child and adult obesity [7], type 2 diabetes and its complications [8-10], panic attacks [11], and Parkinson's disease [12]. Moreover, different countries may have their own specific concerns such as arthropod-borne infectious diseases, as in the case of disease transmitted by *Aedes albopictus*, a permanently present vector throughout Italy [13,14].

Such diseases are generally treated by Family Doctors (FDs), and are therefore not always linked with environmental health (EH) threats. This drawback can be overcome by implementing a surveillance system aimed at systematically collecting, analysing, interpreting and reporting health and environmental data, thereby translating into public health actions.

### The importance of FDs as Health System gatekeepers and sentinels of the Environment and Health

In 2003 and 2009, the World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians, (WONCA) organized two international conferences on how to promote research in Family Medicine. On those occasions, it was assessed that in primary care led healthcare, 90–95% of patients were initially cared for by FDs, with 80% of health problems being managed entirely within primary care. WONCA also stated that FDs played an influential role on individual patients and communities, both in terms of individual attitudes and collective planning and choices [15].

FDs could be a very valuable source of useful data, helping inform decisions leading to effective global climate change (GCC) adaptation measures at the national and local level. With paradigmatic examples such as vector-borne diseases (VBD), which are highly variable geographically and are known as “focal diseases” [16,17], global strategies addressing GCC should be implemented locally.

As such, FDs could play a helpful role in connecting global concerns with local actions through the information they provide and their influence on individual attitudes and policy [18]. Nevertheless, it must be emphasised that a gap still exists in the activities of physicians with regard to the relationship between health and the environment in which their patients work and live.

It is therefore necessary to guarantee:

Sound science and evidence base, both to determine the proposed processes, and to evaluate their future outcomes; Clear and effective communication strategies among all stakeholders, including FDs, communities, individuals and policy-makers; Actions aimed at raising and strengthening EH awareness among physicians; Specific, effective, and motivating training of existing and future FDs in the field of EH.

### Sentinel Physicians worldwide: a literature review

Traditionally “a sentinel general practice network - or sentinel network of general practitioners - can be defined as a system that keeps a watchful eye on a sample of the (overall<sup>1</sup>) population by supplying regular and standardized reports on the incidence and the main epidemiological characteristics of specific diseases and of procedures in primary health care” [19]. More recently, sentinel FDs provide data to a central database via electronic medical records (EMRs) to work out meaningful epidemiological information.

We reviewed the literature involving *Sentinel Physician Networks*, using the Medline search strategy shown in Figure 1. Initially, 6691 articles matched the research criteria, with an increasing rate of publications over the past 20 years.

Most studies focused on clinical and organizational issues. Only a handful of studies (15) were related to EH, suggesting that only sporadic experience, based on some specific circumstances, has been acquired (Table 1). These findings show that knowledge and recognition of EH issues may not be a common practice amongst physicians, likely due to lack of training and/or awareness.

Nevertheless, some physicians have highlighted EH-related issues and shown how the environmental sensitivity of individual physicians and knowledge of their area, together with clinical expertise, can help detect critical situations and encourage appropriate actions to prevent recurrent threats (Table 2).

In summary, a real systematic initiative promoting clinical expertise in EH, including GCC and planetary health associated risks has not yet been developed. Hence, we believe it is time to act.

### PROPOSAL OF A FRAMEWORK OF A NETWORK OF SENTINEL PHYSICIANS

We are committed to developing a surveillance system comprised of sentinel FDs (including General Practitioners –GP- and Primary Care Paediatricians –PCPEDs-) in Italy, named *RIMSA* (*Rete Italiana Medici Sentinella per l'Ambiente- Italian Network of Sentinel Physicians for the Environment*), aimed at studying and monitoring the effects of environmental issues on population health, both to make a significant contribution towards raising awareness and informing the public, and to report any critical situations. It is well known that citizens strongly rely on FDs; thus there are good prospects that FDs, embedded within the social context where they practice, and within a professional network devoted to EH issues, can enhance their capacity to induce health promoting behaviour in the population.

- Furthermore, this proposal could: Promote a more

**Table 1:** List of publications and presentations dealing with Sentinel Practitioners and Environment.

Author/s	Year	Country	Topic
BS. Levy <sup>20</sup>	1996	USA	Editorial: Holistic Approach to Surveillance
I Devoux <sup>21</sup>	2001	France	Wastewater reuse raises the question of health risk and the epidemiological surveys needed.
J Litt et al. <sup>22</sup>	2004	USA	Survey of public health and environmental practitioners to uncover state and local health tracking needs and priorities
A Husa et al. <sup>23</sup>	2004	Switzerland	Estimates the scale of environmental medicine counselling in Switzerland by using two different data sources. The main source was the frequency of medical consultations due to environmental exposures in general practice the second using medical, psychological and environmental tools
BS Schwartz et al. <sup>24</sup>	2005	USA	Editorial: community-based primary care providers must possess biomedical, epidemiologic, and environmental medicine skills.
A Flahault et al. <sup>25</sup>	2006	France	Description of <i>Réseau Sentinelles</i> : Database linkage with environmental information (e.g., remote sensing, surface variables, environmental factors) will be facilitated, allowing for the evaluation of the role of climate change, or pollution involvement in disease.
FH Johnston et al. <sup>26</sup>	2006	Australia	Investigates the relationship between particulate matter (PMPM10 and PM2.5) generated by vegetation fires and daily health outcomes in 251 adults and children with asthma over a 7-month period also recruited by GPs
AJ Elliot et al. <sup>27</sup>	2006	UK	Investigates the association between impetigo, insect bites and air temperature: a retrospective 5-year study (1999-2003) using morbidity data collected from a sentinel general practice network database.
SC Chen et al. <sup>28</sup>	2010	Taiwan	How to use a probability-based transmission modeling approach to examine the influenza risk of infection virus in indoor environments. This was based on 10 years of data gathered from influenza-like illness sentinel physician and laboratory surveillance, and experimental viral shedding data in Taiwan.
A Kolovos et al. <sup>29</sup>	2010	France	Development of model within an environmental health context which can be particularly important for prediction and decision-making in environmental health and risk studies, management, and planning, etc. Based on aggregated observations recorded by general physicians through the <i>Réseau Sentinelles</i>
S. Medina <sup>30</sup>	2014	France	The analysis of drug consumption estimated an excess of about 5000 treatments by psychotropic drugs as a consequence of the explosion of a chemical plant (AZF) in Toulouse (2001)
K Sebec et al. <sup>31</sup>	2014	USA	This experience allowed exploring the strengths and weaknesses of ambulatory Electronic Health Record (HER) data in post-disaster settings. Data from ambulatory EHR networks can augment existing surveillance streams by providing sentinel population snapshots on clinically available indicators in near real time.
GL Nichols <sup>32</sup>	2014	Europe	They describe the surveillance systems (GP ones included), tracking tools, communication channels, information exchange and outputs in the light of environmental and climatic drivers of infectious diseases
C Klier et al. <sup>33</sup>	2016	Europe	This overview is aimed at providing current data on the incidence of Tick Borne Disease on longitudinal trends according to the environmental settings. Based on Sentinel physician results e.g. France, Netherlands, Switzerland. They indicate high reliability of collected data
F Giroud et al. <sup>34</sup>	2017	Madagascar	This study describes a system using various environmental and meteorological data with the support of new technologies to improve the performance of a sentinel Malaria-related data from 21 sentinel sites collected by Short Message Service which are automatically analysed to detect and forecast malaria trends and malaria outbreak alerts with automated feedback reports

effective profile of FDs in Italy in the context of EH prevention. This is particularly relevant in Italy since it represents one of the areas of greatest impact due to GCC in Europe [44];

- Promote the integration of Departments of Primary Care and Prevention of the Local Health Authorities (LHA) with the Regional Agencies for the Environment (REPA);
- Re-affirm the role of FDs in promoting healthy and sustainable behaviours and lifestyles to cope with GCC health effects or any other kinds of EH threats.

We believe that our experience will be of value if shared

internationally with other Sentinel Practitioners Networks (see conclusions).

## DESCRIPTION OF THE PROJECT CARRIED OUT IN ITALY

### Goals achieved: a brief description of the results

Taking the opportunity offered by the project funded by the Italian Ministry of Health (MoH), within the preparatory process of the G7 health experts working group [45], a project aimed at promoting the definition and implementation of RIMSA has been developed.

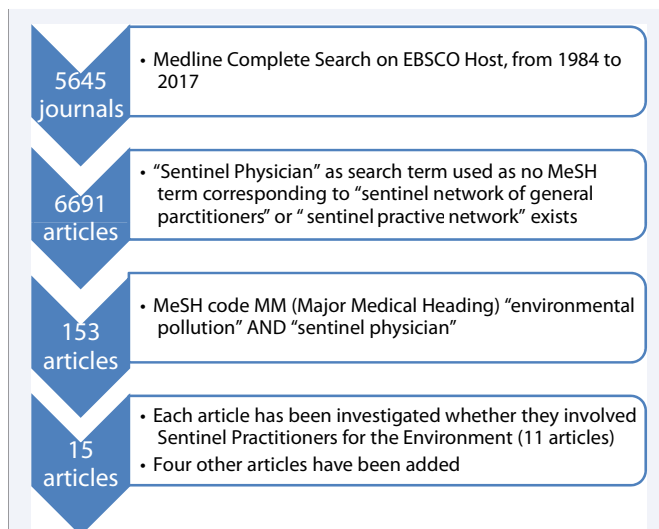


Figure 1 Literature review search strategy.

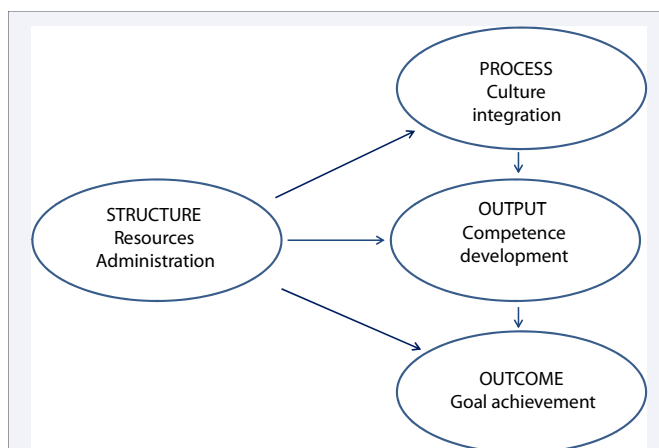


Figure 2 Issues on which QA will be based.

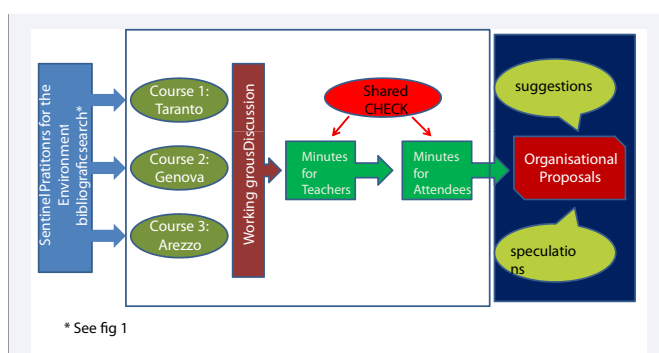


Figure 3 Study phases design.

An illustration of the overall project is provided in Figure 3.

A web site has been implemented [46], together with 3 courses in the south, centre and north of Italy (Taranto, Arezzo, Genova), having trained 61 FDs from across the country.

An electronic survey to assess the trainees' learning needs

and wishes for future training initiatives has been carried out. A Moodle (acronym for *modular object-oriented dynamic*) platform for other training initiatives and an e-learning community of practice have been implemented [47].

A manual devoted to EH physicians willing to be involved in RIMSA is also being compiled.

It is noteworthy to point out that most of the professionals who attended the courses are now coordinating local actions, demonstrating the efficiency of the implementation of such a network. The final goal is to integrate these local experiences within a national and hopefully international context.

### Sentinel Physician for the Environment (SPE): a professional profile.

- One critical issue has been properly investigated: the SPE must have a professional role and specific skills to fill the existing gap between health and environment at the community level. These skills can be summarised into two groups **Clinical and epidemiological**: To extrapolate significant signals of an environmentally-driven threat from patient reports; to select the most appropriate human biomarkers in the investigation of health problems, preferably choosing biomarkers of early subclinical effects; to know the main diseases related to local environmental threats.

- **Advocacy towards prevention**: to adopt the precautionary [48] and responsibility [49] principles dealing with EH threats; to influence and support the decision-making authorities; to inform the LHA about possible environmental problems that could represent risks for their patients' health; to collaborate with other disciplines/institutions; to educate his/her patients and their own family to promote an healthy lifestyle behaviour to cope with GCC and EH threats as a whole; to reduce the environmental impact of their medical activities as recommended by the green-health policy [50];

### Information flows within the SPE network

A crucial effort will be devoted to defining the organized flow of information, to give a comprehensive answer to local environmental threats (e.g. incinerators, coke energy plants etc.) and/or global threats (e.g. GCC). As such, the following standard procedure has been conceived, according to a US-CDC guideline [51]:

1. Consulting the available bibliographic databases;
2. Involvement of the RIMSA reference centre (RIMSA-RC) to check the "problem";
3. Thereafter, the RIMSA-RC will ask for the collaboration of LHA and REPA;
4. If the "problem" is confirmed, a study will be designed with local RIMSA;
5. Finally, to reach conclusions on the presence of a local EH risk and make recommendations for action.

To achieve these goals without burdening the daily work of physicians, it will be necessary:



**Table 2:** Sentinel Physicians and Environment: some significant anecdotes.

Name	Job	Year	Location	Outcomes	Due to	Alert consequences
J. Snow <sup>35-37</sup>	Anesthesiologist	1854	London (UK)	V.Cholerae mortality	Drinkable water contaminated by sewage system	Change of tapping point upstream of London
G.Franco <sup>38,39</sup>	Pediatrician	1980	Augusta-Priolo (SR) (I)	Birth malformations	industries leaking Mercury in the sea	Industry closure
G. Porcile,	Oncologist	1980	Genoa (I)	Cancers	Incinerator	Incinerator closure
MJ Gardner <sup>40</sup>	Professor Medical Science	1993	Sellafield (UK)	Lymphoma	Nuclear Plant	Nuclear Plant Closure
G. Costani <sup>41</sup>	Family Doctor	1998	Mantova (I)	Soft tissue sarcoma	Industrial waste incinerator	Environmental Surveillance ongoing
V. Cordiano <sup>42,43</sup>	Hematologist	2016	Treviso (I)	Higher mortality levels for some causes of death.	Teflon and Goretex production	Water safety limits set up

- To set up a uniform data collection process, defining protocols, processes, standards, and core datasets, accounting for the ethical aspects of data collection, storage, consent and confidentiality, such as General Data Protection Regulation (GDPR) compliance;
- To implement a common EMR software, or at least procedures to allow comparable data extractions;
- To carry out geo-referencing (through GIS-based systems) of patients' addresses and accordingly of environmental data, which will be effectively managed (i.e., block chain; see below)

In line with Donabedian's principles [52], a continuous and systematic process of RIMSA Quality Assurance (QA) in terms of *structure, process, output and outcome indicators* will be established and implemented (Figure 3).

**In conclusion, we emphasise that scientifically sound practice is key to supporting the strength of FDs' advocacy efforts.**

## General organizational criteria to develop and consolidate the network

**The main challenge of the next phase of the SPE project will be to develop a framework to interact with other organisations.**

One essential feature of RIMSA will be collaboration with other institutions and disciplines such as: LHA, REPA, Academia, municipalities and regional authorities, enterprises and trade unions, Inail (*Italian National Institute for Insurance against Accidents at Work*), the Italian Civil Protection and the media.

## CONCLUSIONS

### Lessons learned: RIMSA as a challenging exercise

Despite the definitions of the General Practice Network mentioned above (see page 8), whereby the aim of Sentinel networks is essentially of an epidemiological nature, the experience we are pursuing in Italy is quite challenging, because:

- The health effects of environmentally-driven phenomena are extremely complex in terms of how they can be

interpreted (i.e. health risks and protective factors directly and indirectly linked to the environment);

- One essential facet of the General Practice Network is to couple the epidemiological mission with the opportunity to put in place the role of FDs in their community either at the individual or collective level, in the case of global threats (i.e. GCC).
- There are many organizations collecting and handling data not dealing with health (as was the case of the traditional Sentinel Practitioners network) but with environment [53,54], meteorology [55,56], occupation [57,58], etc.

### What's next?

The ideas described here must now be implemented, which requires strong collaboration with institutional and professional bodies.

An active collaboration with the specialist training programmes (mainly in the field of General Practice and Paediatrics) must be pursued to develop the following didactic issues:

- What are the environmental-driven diseases? Which diseases could be identified at the local level by integrating epidemiological, toxicological, environmental knowledge?
- The concepts of hazard, risk and impact;
- Role of GPs and PCPEDs in promoting and protecting environmental health at an individual and collective level.

With reference to surveillance systems they may be enhanced through innovative approaches such as block chain technology [59-61].

Block chain could support the tracking of climate change and environmental health related health risks through electronic health records linked to other sources of data, such as indoor, outdoor and patient-wearable sensors, sensors that track the frequency, time and geo code of pharmacotherapy (e.g., Propeller Health: <https://www.propellerhealth.com/>), as well as patient-reported symptoms through smart phone or

smart watch applications directly linked to health records and disease-management software [62,63,64,65,66]. Furthermore, this initiative aims to be a forerunner also focusing on concerns that involve low-middle income countries. In particular, as it is essentially based on the socioeconomic, capacity and cultural/historical features in which the sentinel physicians operates, such an approach might be effectively implemented by coping it with other tragic conditions (i.e. malnutrition, waterborne diseases, infectious diseases, etc.), which should be taken into account not only for their direct health effects but also for others which indirectly influence the life and the health of people (ie migrations). Consequently, the WHO Department of Public Health and the Environmental and Social Determinants of Health declared its intention to collaborate in developing such an experience in an international perspective.

We would like to share our experience to raise interest in this field and to promote a “community” of experts and institutions to promote and support the essence of this concept.

Along this line, we involved some existing Sentinel Physician Networks operating across the world (in particular in Europe) such as in The Netherland, the UK, Germany and France (Brussels June 27<sup>th</sup>, 2018). Collectively, we will develop an international clearinghouse for FDs, public health practitioners and researchers on how to advance and enhance national SPEs’ capacity. In other words we aim to create an international network to support this network.

In conclusion, it is noteworthy to recall what Van Royen et al., stated in 2010: “further research in the area of person-centred care, comprehensive and holistic approach, should focus on: understanding how social, cultural and environmental circumstances that may have an effect on different aspects of health.” [67].

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## COLLABORATION

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