

1ST AFRICA/MIDDLE-EAST EXPERT MEETING AND WORKSHOP ON THE HEALTH IMPACT OF AIRBORNE DUST

Nov 02 to Nov 05, 2015

CEHA - Amman , Jordan

CORRELATION STUDIES BETWEEN AIR POLLUTION AND HEALTH IN MOROCCO

SYNTHESIS AND MAIN RESULTS

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Envirenmental Health mission of the Moroccan MoH

- The MoH is organized by a decree adopted in 1994. by this decree , the MoH have to “ implement and realize interventions to protect health against risks related to the environment”
- This decree has also established the Environmental Health Department with 5 units : Water and Sanitation Surveillance ; Food Safety ; Vector Control ; Action intersectorielle et Salubrité de l'environnement
- The recent law “Offre de soins” precise that "the Gvnmt has to implement prevention actions against risks to health”
- The future law on public health should devote Environment Health Mission to the MoH and establish regulatory provisions for its implementation.

Organization and HR of the Environmental Health Department

□ 5 SERVICES / PROGRAMMES :

1. DW and Sanitation control
2. Food Hygiene
3. Vector Control
4. Intersectoral action / Support to Labs
5. Air Pollution / Environmental and Health impactst (National Committee)

□ Human Resources :

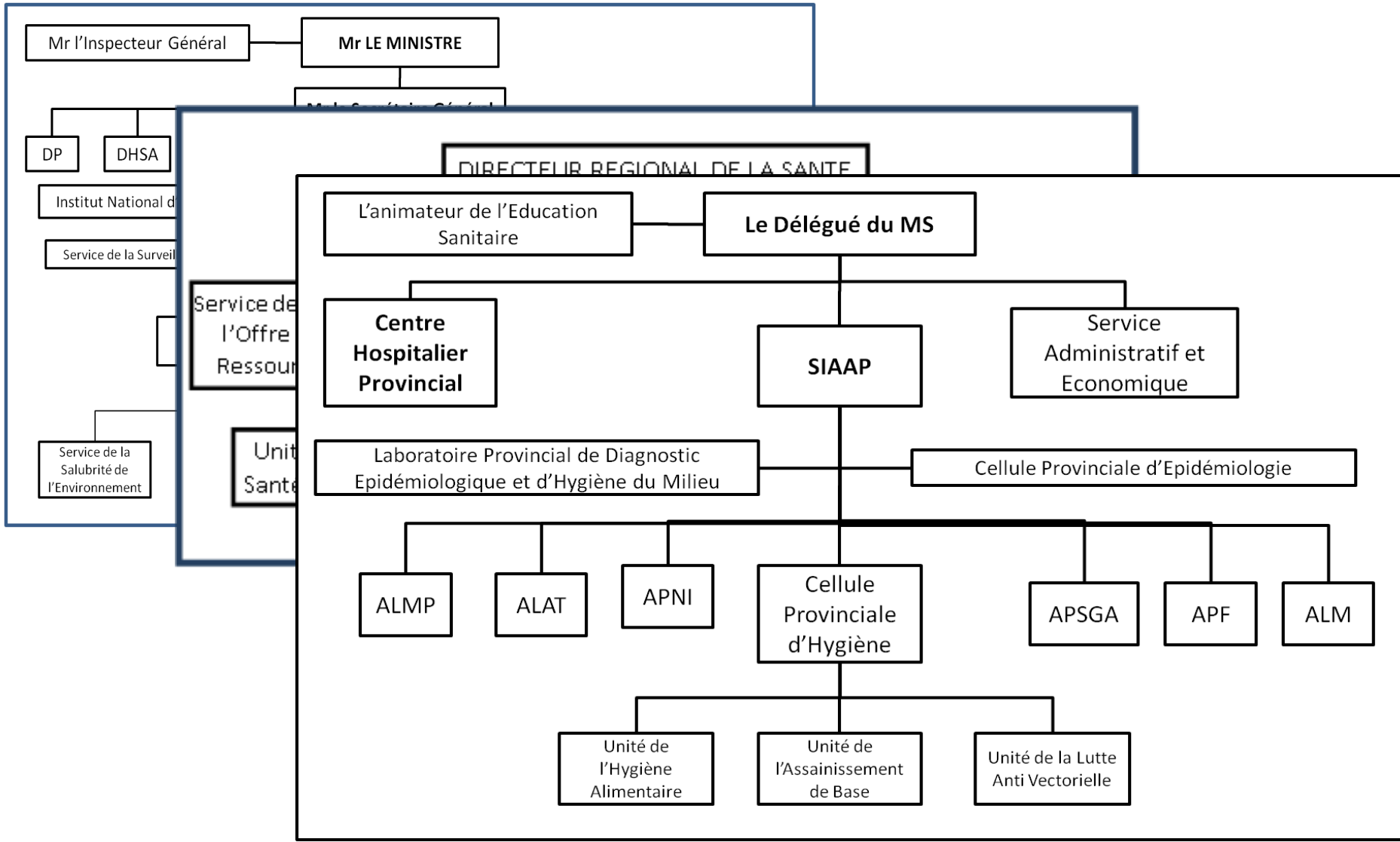
At Central level :

■ Engineers	:	7
■ Scientists	:	4
■ Hygiene Technicians	:	15
■ support staff	:	5

At decentralized level

- 600 Hygiene Technicians and
- 130 Scientists and Labs Technicians affected to the Labs network

Organization of work



Réseau des laboratoires de diagnostic épidémiologique et d'hygiène du milieu (LDEHM)

- In addition to the central lab (NIH) , the MoH has a network of 41 laboratories working in the Environmental Health field including 16 regional labs.
- This labs :
 - ▣ Perform about 30,000 analysis/year on DW, food, surface water and wastewater:
 - ▣ Species identification and monitoring of the sensitivity of mosquito pesticides



AIRPOL CASA-2000
**Study of air pollution and its
impact on human health in
Casablanca**

Objectives

General Objective :

Assessing the impact of air pollution on the health of the population of Casablanca.

Specific Objectives :

- 1. Measure the short-term links between pollutants measured and a number of mortality and morbidity indicators collected from the population of Casablanca.*
- 2. Create a dynamic exchange between different levels of expertise*
- 3. Test the feasibility of an eco-epidemiological surveillance system in Morocco.*

Method and Study Design

- **Technical support from CREDES** (French Research Centre for Study and Documentation in Health Economics)
- **Prospective study eco-epidemiological temporal (time series study)**
 - ▣ Association between daily variations in air pollutants measured by substantive action stations and daily variations of health indicators defined below
- Study duration: 18 months
- Implementation period : completed in 2000
- Area and target population: Casablanca, urban population of Casablanca

Monitoring stations and selection of pollutants

- **One station:** Near the School of Arts of Casablanca
- **Parameters:** the daily average values calculated for
 - ▣ **SO₂ (sulfur dioxide)**
 - ▣ **NO₂ (Nitrogen Oxides)**
 - ▣ **Fine particles (black smoke)**
- **And some meteorological parameters**

Health indicators collected

- **Crude mortality**, excluding accidental death
- **Admissions for asthma** (diagnosed morbidity) **emergency**
- **Consultations for a number of reasons** (diagnosed morbidity) :
 - **For more than 5 years and adults**
 - Syndrome bronchial cough + sputum or purulent or mucous purulent or wheezing and / or wheezing gasps from sounding less than 10 days
 - Rhinitis
 - Asthma Crisis: wheezing for less than 48 hours
 - Conjunctivitis: Red Eye with or without flow for less than 5 days
 - **For Children under 5 years: Acute Respiratory Affection**

Healthcare institutions involved

- 21 Urban Health Centers in seven prefectures of Casablanca
- 7 Diagnostic Centres of Tuberculosis and Lung Disease
- 5 Emergency Services
- 7 Delegations of the Ministry of Health that provide monthly summary data
- 8 Divisions Civil Status which collect data mortality

Results

Only Black Smokes (BS) were considered to study correlations between air pollution and health indicators monitored.

- **When moving from low level of pollution (9 g/m^3 of BS) at a high level of pollution (87 g/m^3 of BS), are observed (significant at the 5%) :**
 - ▣ **+ 42.5% consultations for conjunctivitis for +5 years**
 - ▣ **+14.6% of consultations for upper respiratory infections for children under 5 years**
 - ▣ **+ 37.8% consultations to lower respiratory infections in children under 5 years**

Mohammedia-Airpol 2001-2002

***Study of air pollution and its impact on
the health of children with asthma in
Mohammedia city***

General Objective



The overall objective of the study is to measure short-term relationships between air pollutants on the one hand and asthma and respiratory symptoms on the other hand in a population of asthmatic children.



This study was conducted with the support of a national expert

- **Pollution indicators monitored** : Calculated daily mean values for :
 - ▣ SO₂ (sulfur dioxide) and
 - ▣ NO₂ (Nitrogen oxides)

Health indicators

- Number of Daily:
 - Asthma attacks,
 - Wheezing in the chest,
 - Wake nocturnal cough,
 - Difficult Breathing
 - Respiratory infections,
 - Taking anti-asthmatic drugs.

Main Results

- When moving **from** pollution low level ($1 \mu\text{g}/\text{m}^3 \text{SO}_2$) to the average level of pollution ($11.9 \mu\text{g}/\text{m}^3 \text{SO}_2$), are observed increases in the incidence of symptoms up to:
 - ❑ **5.1 % of asthma attacks**
 - ❑ **+ 6.5% of the nocturnal cough**
- While the passage of the low pollution level ($1 \mu\text{g}/\text{m}^3 \text{SO}_2$) to the high level of pollution ($70.5 \mu\text{g}/\text{m}^3 \text{SO}_2$), increases the occurrence of symptoms can be achieved:
 - ❑ **+ 41.3% of asthma attacks**
 - ❑ **+ 53.9% of the nocturnal cough.**

Eco-epidemiological study
"Air Quality and Health"
Casablanca - 2014

General Objective

Assess the impact of air pollution on the health of the population of the Greater Casablanca Region in preparation for **the establishment of a permanent system of eco-epidemiological surveillance**

Secondary Objectives

- Establish an epidemiological surveillance model in conjunction with the air quality to be duplicated in other regions
- Make available to the public authorities and local players an aid to decision making for the management of air quality
- Create a dynamic exchange between different levels of expertise
- Have a tool for prevention and awareness of the effects of air quality and health

Method and Study Design

- Study conducted with national capacities (a Moroccan expert) and the support of the **Mohammed VI Foundation for the Protection of the Environment (FM6E)**
- **Prospective and temporal eco-epidemiological study temporal (time series study) :**
 - Short term relationship between two sets of observations collected continuously over time, in daily intervals.
 - The association between daily changes in air pollutants measured by base stations and measures the daily variations of health indicators
- Study duration: **2 years** (Nov. 2011 to Oct.2013)
- **Pilot study** to test the collection routes

Study area - Target Population

- The **Greater Casablanca: 4,270,750 inhabitants**
- **Diversity** of urban air pollution (industrial sources and mobile sources)
- Dense urbanization
- The majority of the population remains there permanently
- **Availability** of air quality monitoring networks
- Daily **sufficient number** of health events for data modeling
- The study area was divided into **four homogeneous zones**

Selection of pollutants monitored

- **SO₂** (sulfur dioxide)
- **NO_x** (Nitrogen Oxides)
- **PM₁₀**
- **O₃** (Ozone)
- CO (carbon monoxide)
- VOC (Volatile Organic Compounds)

Measuring network of the air quality in Casablanca

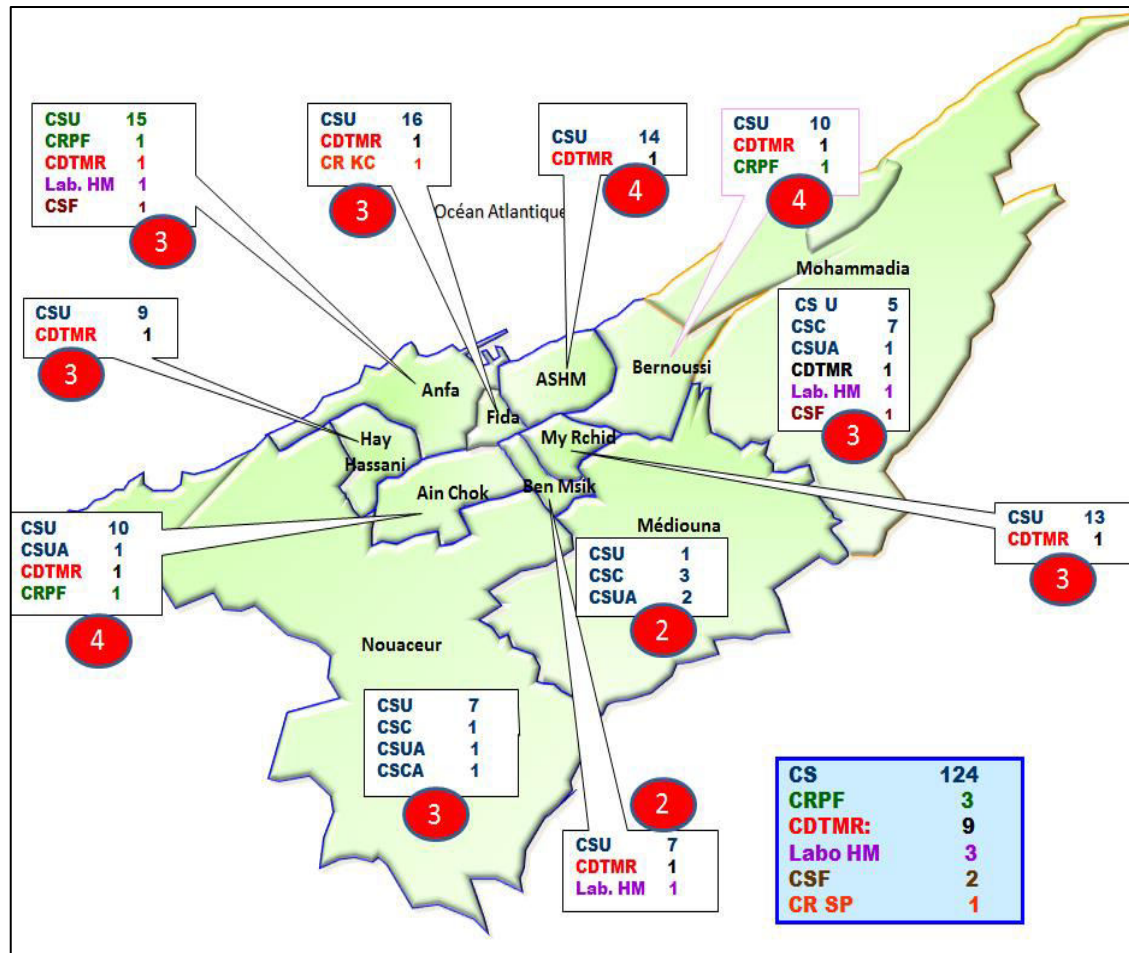


Health Indicators

Selection criteria :

- ❑ Normally collected by the epidemiological surveillance system
- ❑ Simple and specific
- ❑ Reproducible and comparable over time
- ❑ Sensitive
- ❑ Used in the scientific literature

Sites for the collection of health data (hospital network and primary health care network)



Mortality indicators collected and Sites of collection

	MOH	HC	DCTRD	AHC and PH	Privates Clinics
All non-accidental causes	X				
Respiratory causes	X				
Cardiovascular causes	X				
Cardiac causes	X				
Cerebrovascular accidents (CVA)	X				
Intra-hospital mortality				X	X

- MOH : Municipal Offices of Hygiene
- HC : Health Centers
- DCTRD : Diagnostic Centers for Tuberculosis and Respiratory Diseases
- AHC : Academic Health Centers
- PH : Provincial Hospitals
- PC : Private Clinics

Morbidity indicators collected and Sites of collection

	CS	CDTMR	CHU Hôpitaux	Cliniques privés	Cabinets privés	Ecoles	CNSS
Admission en hospitalisation							
Causes respiratoires			X	X			
Causes cardiaques			X	X			
Accidents vasculaires cérébraux (AVC)			X	X			
Admission aux urgences							
Causes respiratoires			X	X			
Causes cardiaques			X	X			
Accidents vasculaires cérébraux (AVC)			X	X			
Consultations de l'adulte et enfant de plus de 5 ans							
Total des consultations (tout motif)	X				X		
Nouvelles consultations respiratoires	X	X			X		
Consultations pour affections respiratoires aiguës	X	X			X		
Consultations pour asthme	X	X			X		
Exacerbation de BPCO	X	X			X		
Consultations pour motif cardiovasculaire	X				X		
Conjonctivites	X				X		
Prescription d'antibiotiques	X				X		
Consultations de l'enfant de moins de 5 ans							
Infections respiratoires aiguës basses							
Nombre journalier des maladies très graves	X				X		
Nombre journalier de pneumonies sévères	X				X		
Nombre journalier de pneumonies	X				X		
Infections respiratoires hautes							
Nombre journalier de problèmes de gorge	X				X		
Nombre journalier de problèmes d'oreille	X				X		
Le nombre journalier de consultations pour asthme							
Prescription d'antibiotiques	X				X		
Prescription de Bronchodilatateurs	X				X		
Absentéisme scolaire						X	
Absentéisme au travail							X

Other factors taken into account

□ **Meteorological data**

- minimum and maximum temperature
- minimum relative humidity in percent
- the average temperature of the dew point
- the minimum pressure at sea level

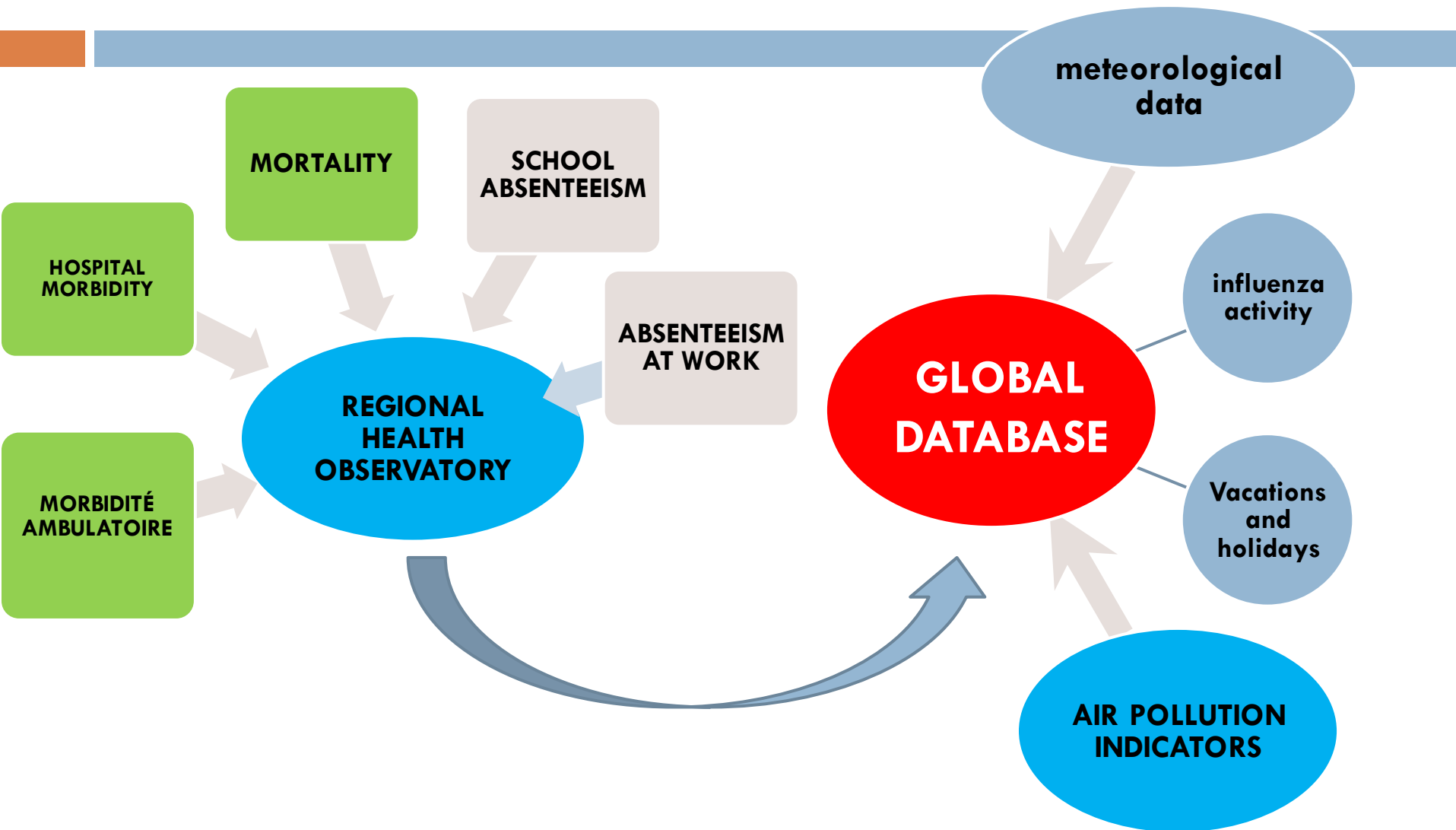
□ **Influenza Activity Data**

- ILI (Influenza-like illness) consultations
- Validation of the presence of the influenza virus in samples taken from patients in a reference center

□ **Vacations and holidays**

- Holiday dates and days or special events will be collected and taken into account in the analysis during the two years of the study

Global Database



Statistical model

“Generalized Additive Models” :

- ▣ Extension of generalized linear models
- ▣ Poisson regression taking into account the over-dispersion data
- ▣ Principle : to study the links between changes from one day to the other of air pollution levels and changes from one day to the other hospitalizations, consultation or death in this area

Statistical model (2)


Potential confounders were taken into account as described in the European study “APHEA2” :

- ▣ Seasonality
- ▣ Day of the week
- ▣ Holidays
- ▣ School vacation
- ▣ Minimum temperature of the day and maximum temperature of the day
- ▣ Influenza Epidemics

Main Results

- The study found a significant correlation between air pollution levels and infant/adult morbidity :
 - ▣ Risk due to NO₂ and O₃ in Casablanca
 - ▣ Risk due to SO₂ and PM₁₀ in Ain Sebaa and Mohammedia
- Also, with regard to mortality, the results also showed an overall correlation between the non-accidental death and atmospheric pollution levels.
- Interest the results to establish a dynamic eco-epidemiological surveillance system

General Conclusions

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- **These studies have had the merit to alert decision-makers and public opinion on the situation of air pollution in Morocco and its real impact on the health of populations in Casablanca and Mohamadia and of all of the Moroccan population in general**
 - **The results allowed to have tools and guidelines for to implement the information and warning system required by national regulations**
 - **Since this type of study requires specific expertise and learning benefit to national capacity, it will be very helpful to duplicate in time and space**

**Thank You for your
attention**

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