Service-Oriented Architecture and model for GIS Health Management: Case of cancer in Morocco

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Abstract

In morocco, the prevalence on cancer cases increased and became ranked as the second cause of death. Therefore, forming a cancer control program and putting strategic action plans into practice became an important matter for health industry. The correlation of variations in different societies and environmental factors should be examined spatially with reliable data. To do this, cancer occurrence density maps have to be created. In this study, a database was built with the use of GIS to examine the distribution of cancer cases, and maps relating to cancer events in allocation units were created. Cancer cases data registered in 2010 by Ministry of health, and lalla Salma Association to fight against cancer and National Cancer Prevention and Control Plan were used. Using ArcGIS 10 [1],

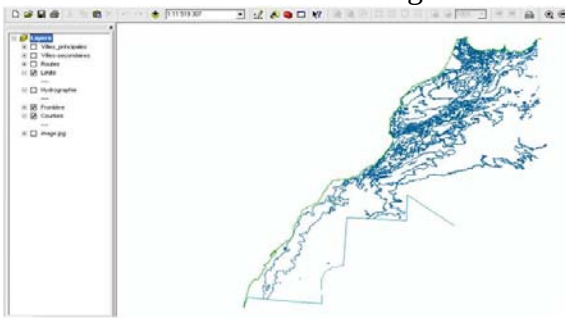


Figure 0: Moroccan map region prevalence

The distribution of cancer cases was presented on cancer maps including allocation units and incidence values, which were calculated for each town-based region. According to the world standards, cancer rates were determined by the special analysis power of GIS.

Keywords: Oriented Service Architecture; GIS Health, profiles, Cancer, Morocco

1. Introduction

Nowadays according to the National Cancer Prevention and Control Plan 2010-2019; 30 000 new cancer cases per year are registered including 1200 cases of childhood cancer which means 4% of the overall rate. Among Women: breast cancer is the most common cancer representing 36% of cases. Rates of cervical cancer are substantially lower than breast cancer with a ratio of 13%. Among Men: lung cancer represents 24% of cases and prostate cancer represents 8%of the overall rate [3].

Geographical Information Systems (GIS) has strong capabilities in mapping, analyzing not only spatial data, but also non-spatial data, and integrating many kinds of data to greatly enhance disease surveillance. It can render disease data along with other kinds of data like environmental data, representing distribution contagious disease with various cartographical styles.

Meanwhile, the rapid development of the internet influences the popularity of web-based GIS, which itself shows a great potential for sharing disease information trough distributed networks.

1-1 GIS and decision making

Distributing and sharing disease maps via the web could help decision makers across health jurisdictions and authorities collaborate in preventing[2], controlling and responding to a specific disease outbreak and it's time factor analyzing. By comparing the thematic maps at different time intervals, the spatial-temporal change of disease could be projected, including temporal cluster shit and vector transmission rates and mobility of susceptible populations.

2. Related Work

There are a number of research projects related to telemedicine. Here we will focus on works proposing context-aware systems to support assistance of patients outside hospital. Most attempts have focused on such as health status monitoring and alert (e.g. medicine taking, training activities, etc.), patient behavior and daily activities modeling. Our reference scenarios include management and immediate accounting of cases for predicting risk [1].
Main objectives of pilot project are: defining a model for early detection of breast cancer fully adapted to Moroccan specifications, and defining each component of this model.

3. Method

This method has 8 steps. Firstly the study of a breast cancer registry: ages 45 to 65 years. Then identify recruitment strategy via primary health providers. After, a method is choosing for screening adapted to our resources: Clinical Breast Examination. Then develop a curriculum for CBE by organizing training for health workers: doctors and nurses. Then a diagnostic with mammography must be done. Then organize a taking charge at the third health level from an oncology center for women with a positive diagnostic. After, developing an Information system, including GIS functionalities to automate the process of early detection of breast cancer and provide relevant data to each step respecting the frame work presented in figure 1.

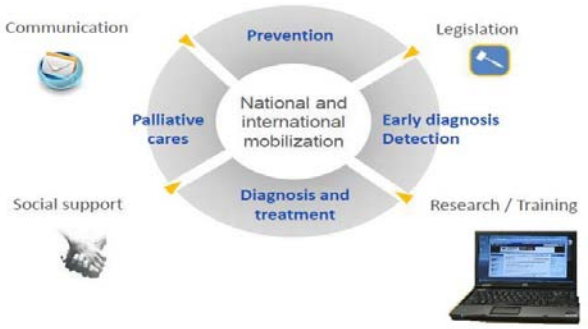


Figure 1: Conceptual frame work .

The last step consists to develop a strategic health communication tools based on an architecture oriented services [11] like exposed on figure 2.

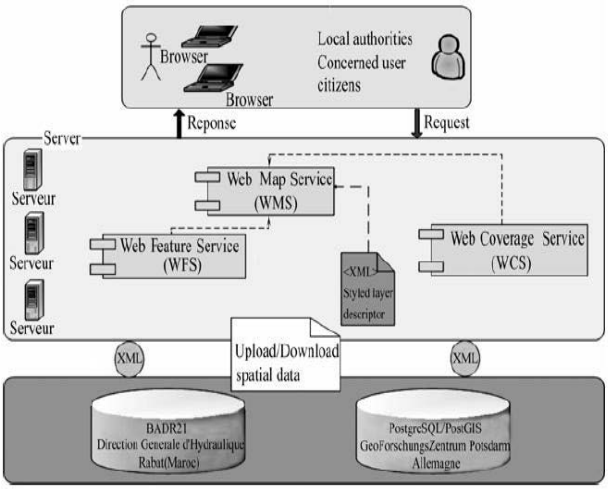


Figure 2: project program for early detection [7].

To identify vulnerable populations and areas at risk of tuberculosis in morocco and in order to

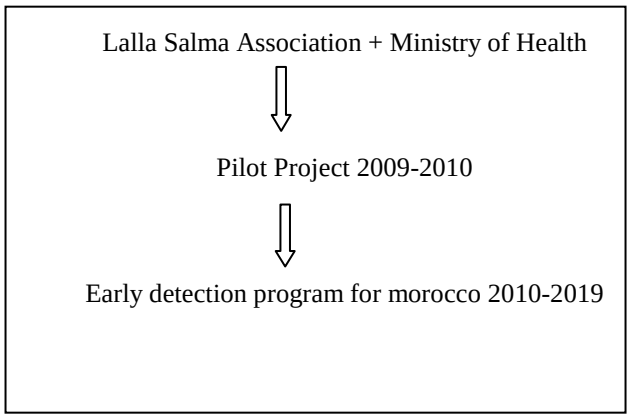
optimize the surveillance and prevention in relation to populations and medical human resources and cancer cases. The aim is to understand the geographic distribution and dynamic of this pandemic of cases, to characterize risk factors and human environmental impact that may explain this distribution and to identify these sensitive areas.

3-1 Ontology based cancer modeling

In this section, we will describe the main concepts of the ontology-based disease modeling approach for patient assistance and awareness scenario. In morocco and especially in fez, no geographical parameter is taken into account according to a standard sheet UHC Hassan II of fez [4].

Over 10 years (2010 to 2019) the National cancer prevention Control Plan envisages 74 operational measures.

In Morocco the breast cancer is the most frequent cancer. Women arrive at the late stage of this disease. Unfortunately , there is no early detection program in Morocco, that is why it gives high priority for the NCPCP 2010-2019 according to the below schema :



As already mentioned, we extend an ontology-based cancer representing main general concepts and relations for context representation. Our work moves from the widely accepted definition of context, provided in [3]:"Context is any information that can be used to characterize the situation of an entity." Therefore, an entity is a patient, place, computational entity, or object which is considered relevant for determining the behavior of an application [5].

Hereafter we describe the following ontologies: Patient personal domain ontology and awareness ontology. This tatter ontology represent care networks resources coming from different organizations (health teams, social community members,
etc.).

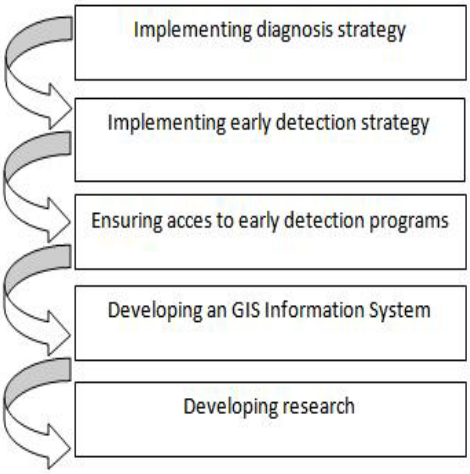


Figure 3: general context ontology

In this application scenario, context includes data items describing patient geographical localization and disease context. Context reasoning is used mainly for awareness, and management and fight.

As already mentioned, we extend an ontology-based context model representing main general concepts and relations for context representation. Our work consists of defining a model for early detection of breast cancer and defining each component for this model fully adapted to Morocco:

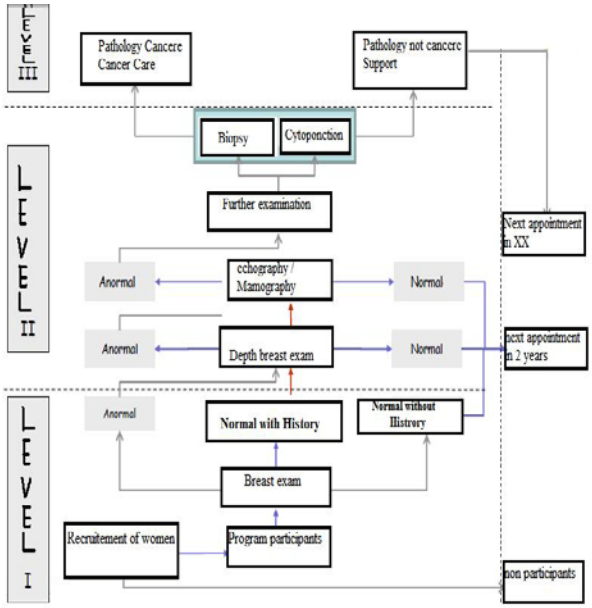


Figure 4: Model for early detection of cancers

The context model has been written in OWL (web Ontology Language) [4] . OWL fragments are hereafter represented by means of UML class diagrams. UML classes represent OWL classes, attributes represent OWL data-type properties and associations among classes are used for OWL Object Properties representation [8].

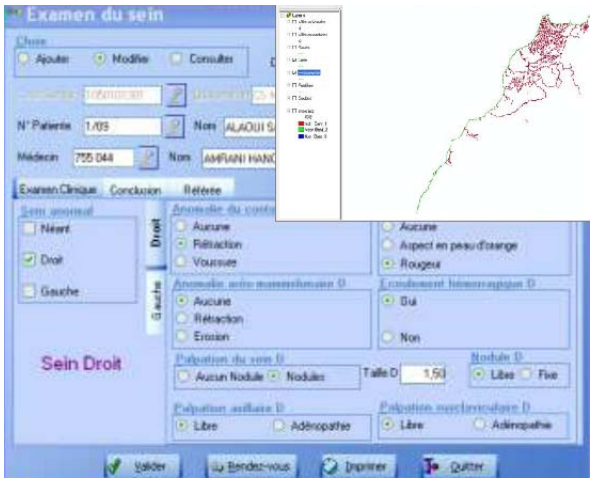
Figure 4 illustrates a fragment in the context of ontology specialized for the patient personal domain. A specialization of medical treatments which are monitored (tests and positions) is sufficient for early detection of breast cancer ,but model can be easily extended to include further levels and used for other type of cancers and diseases. In order to overcome user context requirement, we focused on preference-driven formalization: In fact, users are described in terms of profile and preferences. User Profile is composed of both dynamic and static metadata [9]. Dynamic properties include, for example user locality and town, while static properties are grouped into three categories: identification such as an ID code, a string or an URL, is used to name and identify the user. Capabilities: represent the user's abilities and capacities. User requirements: describe user's parameters that must be always satisfied during service provisioning like presented in figure 5:

```
<rdf:RDF>
<profile:User rdf:ID="med">
   <profile:hasProfile>
     <profile:Profile rdf:ID= "med_Profile">
       <profile:profile_id>
          <id:Name
          rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
          Alice Brown</id:Name>
       </profile:profile_id>
       <profile:profile_cap>
          <user_cap:LanguageCapability rdf:ID="LanguageCap_1">
            <user_cap:speaks rdf:resource="&language-ont;arabic "/>
            <user_cap:speaks rdf:resource="&language-ont;french "/>
          </user_cap:LanguageCapability>
       </profile:profile_cap>
       <profile:profile_req>
          <user_cap:Requirement rdf:ID="Requirement_1">
            <profile:requires>...</profile:requires>
          </user_cap:Requirement>
       </profile:profile_req>
     </profile:Profile>
   </profile:hasProfile>
 </profile:User>
</rdf:RDF>
```

Figure 5: Static user profile specifications

4 . Results

This pilot project was launched in the témara-skhirat in September 2009. This region includes rural and urban population. All steps of the project were precisely implemented. After 3 months, 1200 women were screened, and 4 women were diagnosed and treated for breast cancer. It was too early to have accurate statistics, but the process was triggered and the health workers involved and used software tools as shown in Figure 6.



Cervical cancer is the leading cause of cancer-related mortality among women in developing

countries and accounts for more than 290,000 deaths worldwide each year. In Morocco, mortality is presented in the below figure [13]

Indicator	Morocco	Northern Africa	World
Crude mortality rate[1]	7.2	3.0	8.2
Age-standardized mortality rate[1]	8.4	4.0	7.8
Cumulative risk (%) ages 0-74 years[1]	0.9	0.5	0.9
Annual number of deaths	1152	3101	275128

Standardized rates have been estimated using the direct method and the World population as the reference.
[1] Rates per 100,000 women per year.
Data sources:
IARC: Globocan 2008. (Specific methodology for Morocco: The number of cancer deaths in 2008 was estimated from incidence estimates and site specific survival, estimated by the GDP method. For further details refer to http://globocan.iarc.fr/DataSource_and_methods.asp and http://globocan.iarc.fr/method/method.asp?country=504.)

Figure 6: Mortality of cervical cancer in morocco, northern Africa and the world

5. Conclusion

Health authorities in Morocco have begun a campaign to fight cancer by opening new treatment centres and expanding health-care coverage. Morocco launched the 8-billion dirham campaign, which aims to make treatment, detection and preventive care more accessible, on March the 23rd. Four regional health-care centres will be opened in Safi, Laayoune, Meknes and Tangier, in addition to two special cancer centres for women in Rabat and Casablanca, and two paediatric cancer centres in Fes and Marrakech. Palliative care units will be added to several provincial hospitals, while existing oncology centres in Morocco will be expanded. Morocco currently has five state-run cancer centres and four private-sector facilities to treat the disease, which accounts for 7.2% of all deaths annually, with 30,000 new cases diagnosed each year. "The plan has come at just the right time to address the growing need to combat cancer at the national and regional level, and reflects Morocco's commitment to adopting a regional strategy on the issue," said the WHO regional director for the Eastern Mediterranean, Hussein Gezairy.

The anti-cancer campaign will also expand cancer patients' right to receive health-care benefits to offset the high costs of treatment, which is especially critical in a country where two-thirds of citizens have no health-care coverage. According to the Health Ministry, up to 90% of the treatment costs for certain types of cancer are borne by the patient, which in turn impoverishes them and their families. Fatiha, a 52-year-old housekeeper, knows first-hand how steep the costs of treatment can be after undergoing a mastectomy and chemotherapy. "Each session costs me 2,600 dirham," she told Magharebia. "Benefactors are helping me to get treatment. Without them, I'd have been dead long ago." A significant portion of the anti-cancer campaign will focus on prevention and early detection. To further this aim, the Health Ministry will build more than 30 screening centres throughout the country over the next 10 years to screen women for early signs of breast and cervical cancers. The campaign will also highlight preventive measures individuals can take to prevent the onset of the disease by living a healthier lifestyle, stopping smoking and avoiding other carcinogenic products. Around 40% of all cancers are preventable, cancer specialists claim. Health Minister Yasmina Baddou praised the plan for its "ambitious yet realistic response to cancer" and its efforts to provide affordable, high-quality care for those who suffer from long-term illnesses.

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