

An Efficient Meta-Platform for Providing Expert Medical Help to Italian and Slovenian Users

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When dealing with medical issues, Google and similar search engines can be of great help. A user inputs a couple of words about a particular medical issue and receives a list of replies that hopefully provide also the desired answer. The problem is that it is far from easy and fast to find the most proper answer in the huge list of related web pages, with some of them even misleading or harmful. Experience shows that a large proportion of the population falls for inadequate medical advices, some alternative and some even dangerous. This paper presents a novel meta-platform for electronic and mobile health-related services with its main purpose to provide proper quality information to a user with a medical issue, kind of an expert medical “doctor Google”. The platform is centered around “services” and human help. A “service” is an intermediate medical concept between a user and the expert of related feed-backs which redirects a user to another website, video, or other multimedia item that contains important more detailed information of proper quality for a user. A user can also search for the related medical issues, e.g., further-links through a local search upon services, and also ask a human or an AI chatbot/assistant. The platform is dedicated to Italian and Slovenian users in Italian, Slovenian and English language.

Povzetek: Članek predstavlja učinkovito meta-platfomo za zdravstveno pomoč italijanskih in slovenskih uporabnikov.

1 Introduction

Digital health-related platforms are transforming the way humans deal with health issues and in this way also society. Patients and physicians are adapting to the new digital mechanisms, which are becoming a prevalent way of providing information in the COVID-19 times. At the same time, it is desired that the platforms are lean, lightweight, and efficient. “Efficient” means that an average person who seeks crucial information about relevant health-related topic receives the correct and medically accurate information in the smallest amount of time. By this, the person who might be unfamiliar with the medical topic should still grasp the new information/knowledge on how to deal with the related issue. Because the system informs the patients (average users or advanced users), and provide advice and general directions thus unloading part of the current overload from health-related workers (doctors, nurses, caregivers, and also pharmacists), they can work in a non-stressful environment where they can dedicate more time to quality treatment of patients. In this article we explore new ways of delivering the correct information to the users by describing our Insieme platform, which stores and

aggregates contributions from companies, associations, organizations, and also individuals.

The article is organized as follows. In Section 2 we present related work. Section 3 describes the Insieme project that aims to develop the Insieme platform. Section 4 concludes the paper with the summary of our work.

2 Related work

The rise of health platforms is an emerging activity that become particularly widespread in the time of the COVID-19 pandemic [2], [4]. People have got information by the world wide web, radio, television, and also by phone, but not as much by physical contact. The pandemic sped up the ICT revolution in healthcare sector [13]. The key feature of the platforms or ecosystems is that the information is available online, where everybody can access it by computer, laptop, tablet, or smartphone. One of the drawbacks of health platforms today is that they are mostly operated by private companies for profit, which raises concerns about privacy and integrity of data [1], [2]. In this article, we first describe some alternative health-related ecosystems, after that, we describe our Insieme platform, which is open to everybody, be it hospitals, health centers, companies, or individuals. The Insieme platform is one of the new Electronic and Mobile Health

platforms (EMH) aiming at providing quality information free of charge to everybody without storing any private data of any kind more than what is needed for providing advices to the users and for personalizing chatbot conversation.

Private and public platform providers are trying novel approaches for the development of the next (future) health-based platforms [3]. For example, they are adopting methods for telemedicine and remote monitoring of patients. Many platforms are collecting data from different sensors and wearable devices. They can detect abnormal cholesterol and glucose blood levels, heart rhythm and falls [11]. In this section, we shortly describe two platforms similar to Insieme. First is the EkoSmart smart city platform with the EMH module, developed within the same project name in Slovenia. It was developed with the cooperation of Jožef Stefan Institute, Faculty of computer science, Faculty of electric and computer science, and 12 private companies from Slovenia. The second platform is Arcadia.

2.1 EkoSmart

The purpose of the EkoSmart project was to develop an ecosystem for smart cities with all the support mechanisms. The result of the project was a distributed ecosystem of tools and systems that one could use on its own, or combine them into a larger system from the existing blocks. EkoSmart originally consisted of six major blocks, with one of them being EMH, i.e., the health ecosystem focusing on flexible architecture for connecting people, based on open data, semantic connection, self-adaptiveness, and self-regulation [7], [9]. Within the project development, the idea for the next-generation platform emerged, resulting in the Insieme project. The idea was to start designing and programming a new only the EMH module of the EkoSmart system, all along consistently building on the expertise obtained through the 3-year project.

2.2 Arcadia

Arcadia is a private company that develops a similar data aggregation ecosystem for health with several interesting functionalities, but unfortunately, it is not open [8]. Also, the functionality of Arcadia is somehow different since they are using and extracting data from Electronic Health Records (EHRs). EHRs are stored on different servers in different formats. They developed very fast procedures for extracting these data from servers (in total around 2 billion records [8]) and displaying it in their application. As a consequence, there is a permanent issue with privacy since the algorithms for searching, recommending, and connecting different data are of the company [10]. Nevertheless, the platform demonstrates several modern concepts and orientations that are somehow shared with those in the Insieme platform.

2.3 Summary

In the Table 1, we show a summary of features for other more popular health platforms which we did not describe

in previous subsections. We also included the Insieme platform for better comparison. We can see that Insieme platform has all three features, while other have at most two of them.

Web platform	Services	Videos	Products
Mayo Clinic	X	X	
Orphanet	X		
WebMD	X		
MedScape	X	X	
Insieme	X	X	X

Table 1: Summary table.

3 Description of the Insieme platform

To understand the “philosophy” of the Insieme platform, the following rule provides the main utility function:

“The golden rule of the platform is that it provides short, precise, and easy to understand information for an average person with a low health literacy level.”

All other design and application choices are heavily influenced by the golden Insieme rule.

The second major concept is that it is an open aggregation platform which means that an open professional community (crowd community) of doctors, nurses, caregivers, companies, and individuals can use and contribute to the platform by adding new services and other modules, as long as they are verified by the editorial board. Service is probably one of the essential building blocks of the system. It is an independent piece of information with the title, description, and other accompanying data, which point to other websites or multimedia information where the user can get more detailed information about products, applications, and user stories of that specific service. Also, in the upgraded version of the platform (version 2.0), one can add other elements in addition to services, such as videos, articles, prototypes, domains, and datasets. By this, the community helps develop and improve people’ health literacy.

One of the key motivations of the Insieme platform is to help the users find the relevant information in much less time and of more quality than if they use Google, Bing, Duckduckgo, or any other search engines. As a consequence, it is efficient in the sense of consuming time to find specific quality information. To guarantee quality information the partners pay attention to the basic health quality information criteria: accuracy, accessibility, relevancy, interpretability [14]. It is a fairly new concept that connects people in all possible ways and not only in the classical doctor-patient framework, while at the same time providing only the trustworthy information doctors and health information professionals find relevant for an average user. The information provided on INSIEME platform is designed to complement, not replace, the

relationship between a patient and his/her own physician (HONcode principles [15]). The platform does not store any personal information on the platform.

The Insieme platform consists of two basic screens. On the first screen, there are:

- Services, presenting basic information about a specific health issue and potential solutions and useful opportunities to deal with it
- Partners, consisting of partners on the project and any Italian or Slovenian partner that provides an EMH service of any kind, be it free of charge or commercial
- Search, for all information in the Insieme platform
- Chatbot assistants, providing natural communication and search through natural language queries
- Recommendation module, recommending future actions
- Contacts with (online) experts who provide expert and trustworthy help in real-time

3.1 Search bot – virtual assistant

The main purpose of the search assistants is that they provide information through human communication, similar to Siri or Google assistant. The developed assistant performs similarly to the search module, i.e., finds proper connections to the Insieme modules, and can also execute some additional communication in the assistant way. For example, it can call external assistants, such as the assistant for waiting queues, JSI assistant, and in the near future will have access to the assistant for stress, anxiety, and depression [12]. Figures 1, 2, and 3 show an example where a user asks “X-ray of lungs” written in the Slovenian language. The query is in Slovene because it fetches the data from the Slovenian National institute for public health website, containing the list of all medical procedures available from all the hospitals and medical centers in the country. Figure 2 shows the buttons where the user can select a Slovenian region. Also, the user selects the level of urgency (not shown).

At the end (Figure 3) the bot answers with a list of medical centers that provide the searched medical procedure. An example is MEDILAB – diagnostic radiological center and UKC Ljubljana.



Figure 1: Search string: “X-ray of lungs” in Slovenian. The answer consists of a list of possible replies since the assistant is not sure what the user wants, and therefore lists potential answers that somehow fit the question.



Figure 2: Selection of the region in Slovenia.

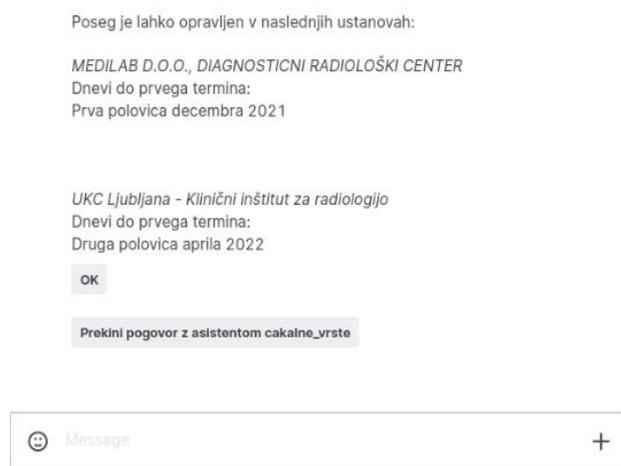


Figure 3: The final result from the bot: best proposed institutions for that particular medical help needed.

3.2 Services

A service presents the basic information about a specific medical problem and potential solutions. Services are connected to medical fields and subfields (such as dermatology and oncology). The structure of a service is the following:

- 1) Title
- 2) Description
- 3) Professional help
- 4) Web and smartphone applications
- 5) Associations
- 6) Articles
- 7) Products
- 8) Forums/User stories
- 9) Videos
- 10) Additional information

This is the advised structure where not all items are included for each service. Also, additional information can be included. The services follow the same core rule of the Insieme platform:

“Provide the most relevant information in the shortest possible time.”

As a consequence, the service structure that was empirically observed to be most efficient as a generalization of previous attempts was summarized in the structure proposed.

The title, description, and professional help as the most relevant information are obligatory data, while other sections can be omitted.

3.3 Example of a service for Rosacea

This is an example of a service Rosacea saved into the field of dermatology. All examples are in English, providing some information for Slovenian and some for Italian Resources.

Description:

Rosacea is a common chronic inflammatory disease that presents with recurrent flushing, erythema, telangiectasia, papules, or pustules on the nose, chin, cheeks, and forehead. Both a prompt diagnosis and appropriate therapeutic interventions are required to prevent permanent scarring, persistent erythema, and ocular sequelae. The incidence of rosacea is estimated to be greater than 5% in the general population, shows a female predominance, and generally occurs in adults between 30 and 50 years of age.

It is advised to omit the triggers (heat, sun exposure, stress, alcohol, etc.). The use of SPF and moisturizing skincare is recommended.

Professional help:

- (SLO) Dermatovenerološka ambulanta, UKC Ljubljana, T: 01 522 37 44, e-pošta: derma.narocanje@kclj.si
- (SLO) Splošna dermatološka ambulanta, UKC Maribor, T: 02 321 27 18, e-pošta: derma.narocanje@ukc-mb.si
- (SLO) Medicinski center Cardial, Ljubljana, T: 01 548 40 80, e-pošta: info@cardial.net
- (ITA) Azienda sanitaria universitaria Giuliano Isontina: SC (UCO) Clinica di Chirurgia Plastica, Trieste, Ospedale di Cattinara, Strada di Fiume 447, Torre Chirurgica, 9° piano. T. 040 3994258.
- (ITA) Istituto Dermatologico Europeo
- (ITA) Skin Doctors' Center

Associations:

- (ITA) Faccia a Faccia con la Rosacea
- (ITA) AITER onlus
- (ENG) National Rosacea Society

Application:

- *Diary for disease monitoring (DE)*

Additional information:

- *Rosacea*
- (ITA) *Rosacea*

3.4 Example of a service for Testicular cancer

This is the second example of a service “testicular cancer”, in the field of oncology.

Description:

Testicular is one of the most common types of cancer in men aged 15 to 35. In previous years the incidence of testicular cancer in developed countries has been rising. It is thought that changes that happen in the early developmental stages of the embryo may cause testicular cancer to develop. The risk factors for developing testicular cancer are undescended testicles at birth, infertility, smaller testicular volume, anomalies of the urinary tract, and previous testicular cancer. In the beginning stages, it manifests as a hard painless lump in the testicles. As the disease progresses symptoms like bone pain, especially back pain, fatigue, weight loss.

Early detection and diagnosis are important for a better prognosis. Men should perform testicular self-examination once a month. It is advised to do the exam after a warm shower or bath. If a hard lump is detected, it is important to visit your family doctor.

Professional help:

- (SLO) KO za urologijo, Univerzitetni klinični center Ljubljana, T: 01 522 26 89, e-pošta: urologija.ambulanta@kclj.si;
- (SLO) Oddelek za urologijo, Univerzitetni klinični center Maribor; T: 02 321 14 47, e-pošta: marjeta.deicman@ukc-mb.si;
- (SLO) Onkološki inštitut Ljubljana, T: 01 587 91 63 ali klicni center OI: T: 080 29 00, e-pošta: info@onko-i.si, triaza@onko-i.si;
- Onkofon za pogovor in svetovanje onkološkim bolnikom, T: 080 23 55;

Applications:

- Ball Checker

Associations:

- testicularcancersociety.org

Video:

- Dr. Oz Teaches Testicular Cancer Self-Check At Home In 3 Easy Steps | TODAY
- What is NOT Testicular Cancer?

Additional information:

- clevelandclinic.org: Testicular Cancer

- testicularcancersociety.org: Testicular self-exam
- Video: How To Check Yourself For Testicular Cancer. Testicular Cancer Society

3.5 Recommendation system

A recommendation system is a mechanism that filters information that is stored in the database and predicts for an individual user the best-rated recommendation. For example, someone who is searching on the booking.com website for a hotel in Ljubljana should have similar recommendations as somebody performing a similar task in the same city. When a person looks for a hotel only in Ljubljana and is not interested in finding one in Koper, Maribor, or any other city in Slovenia, this narrows the space of potential answers. The recommendation system uses attributes of each item, previous searching behaviors, and the collection of data from many users to predict the next item. It utilizes machine learning algorithms and/or hybrid methods. Machine learning is very successful for such tasks, proven in thousands of similar applications. We used the popular Python library “LightFM” [4]. LightFM implements many variations of methods for recommendation systems. The implementation problem with the recommendation system is at the start of its operation, known as “cold start” [6]. In other words, in the beginning, there are no data stored in the database when deploying a fresh application. There are some solutions to this problem, e.g., described in [6], [7]. For the services on the Insieme platform, there are two tables that are a subset of the entire system. Table 2 shows services and their attributes. For simulation purposes, we created a table with users (Table 3). Here one can see that “User 1” searched and visited services that are connected with infections. “User 2” visited services that are connected with cancer and “User 3” with services connected with lungs. By this, it is possible to conclude that for “User 1” we would recommend more services/diseases which are infections, e.g., flu, hepatitis, tetanus. For “User 2” one would recommend cancers, e.g., skin cancer, liver cancer, brain cancer, while for “User 3” lung diseases e.g. asthma, bronchitis, should be recommended.

Table 2: Services and their attributes.

Service/Attributes	Cancer	Infections	Lung
Pneumonia		X	X
Lung cancer	X		
Covid-19		X	X
Skin cancer	X		

Table 3: Services and user choices.

Service/User choice	User 1	User 2	User 3
Pneumonia	X		X
Lung cancer		X	X
Covid-19	X		X
Skin cancer		X	

As presented in this example, the machine learning algorithms are connecting attributes and user choices by using conditional reasoning and cross-sections of sets.

4 Discussion

By comparing Insieme platform to other meta medical platforms available online (gathered in Table 1) there is one crucial difference. The Insieme platform offers direct connection between medical practitioners or medical data and users (patients). Essentially it helps people to get the correct medical information in very short time. It is an aggregating platform with products, videos, services, faculties, sellers and manufacturers. This is a novelty in the electronic and mobile health domain.

5 Conclusion

This article described a new way of making connections of users with medical problems to their solutions via the Insieme (EMH) platform. All the functionality of the platform is dedicated to this issue using a variety of approaches to accommodate the user as much as possible. For example, Insieme stories a large and heterogeneous set of replies and connections provided to the users, provides human help from online experts, presents lists of institutions providing relevant services or help, and shows further links, videos, and other multimedia functions.

Insieme also provides search and conversation with the bot in natural language regarding the services, partners, or appointments for specialists. We provided the text of two randomly chosen services as an example. Each service aggregates all the carefully chosen information a medical expert would provide as advice to a general audience with a particular problem. Data aggregation websites are not new, but we used this concept in a new way in a particularly demanding field, which is medicine. The platform is open, meaning that everyone who has an internet connection and has some professional medical knowledge can contribute to the platform. In addition, the platform has administrators and moderators with the main task of evaluating and accepting quality new services.

The essential question is whether the two countries or at least one of them will be able to find proper use of the Insieme platform. The best would be if a particular national or municipality institution would support the transition of the designed system into actual massive use.

Based on the major efforts taken to provide as fast, reliable, and precise information to general health issues

and the years-long experience with similar platforms and services the team expects that such a system would be of great help to citizens.

In our initial tests, the Insieme platform on average enables finding a proper information in a couple of minutes, while it took about ten to a couple of ten minutes for an average user to find similar information through a general search engine.

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