3RD INTERNATIONAL ACADEMIC CONFERENCE ON PLACES AND TECHNOLOGIES

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MILENA VUKMIROVIĆ
ALEKSANDRA KRSTIĆ-FURUNDŽIĆ
AND ALEKSANDRA ĐUKIĆ

CONFERENCE PROCEEDINGS

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PLACES AND TECHNOLOGIES 2016

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URBAN MOBILITY, TRANSPORT AND TRAFFIC SOLUTIONS

BOOSTING THE RESILIENCE OF THE HEALTHCARE SYSTEM IN BELGRADE: THE ROLE OF ICT NETWORKS

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ABSTRACT

Medicine is evolving under economical, commercial and technological pressures but the resilience of healthcare systems remains questionable, especially in the age of intensive climate changes. The vulnerability of existing healthcare facilities is increasing and it becomes necessary to deal efficiently with different problems - from the growing number of patients, management of healthcare continuity and quality, to the maintenance of physical integrity of facilities and available financial resources.

Focusing on the case of Belgrade, this paper will analyse the relationship between healthcare facilities research and Information and Communication Technologies (ICT) networks. It will elaborate possible approaches in adapting to climate changes and boosting overall resilience of hospitals, within existing limitations imposed by socio-economic and technological conditions. The contextual framework for the research is based on the review of literature and the data collected from recent reports and strategies. In addition, the paper will use information collected through extensive online surveys among patients and staff from major hospitals in Belgrade. The resilience of existing Belgrade healthcare facilities will be assessed in accordance with prevailing technological, organizational and individual factors, as well as the impact of climate changes, which influenced their poor performances. This paper will present both advantages and disadvantages of using ICT in Healthcare research.

Keywords: Resilience, Healthcare facilities, Climate Changes, Adaptation Strategies, ICT

INTRODUCTION

Development of Healthcare (HC) facilities and infrastructure is ever changing. Different approaches in design and reconstruction are dictated by economical and technological demands. At the same time, the existing HC infrastructure is facing critical problems concerning sustainability and resilience. Large-scale monoblock hospitals built in the 1970s are under big influence of changing climate conditions. As the vulnerability of these HC facilities increases, plethora of problems arises and demands to our attention and fast solutions. The issues related to the growing number of patients are certainly an imperative, as well as the continuity and quality

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of healthcare management, but it is also important to make health care more accessible and more successful.

In this paper, the resilience of existing HC hospitals in Belgrade is analysed and evaluated, while the available ICT infrastructure was used as the main methodological support.

HEALTHCARE RESILIENCE – DEFINING THE CONCEPT

The concept of resiliencies first defined by C.S. Holling (1973) as "*the capacity of a system to absorb disturbance and reorganize while undergoing change to still retain function, structure, identity, and capacity for learning and adaptation*" (Resilience Alliance, 2014). Considering HC, resilience could be determined from different perspectives. Revising existing literature on this topic, two main aspects have emerged: adaptation to climate change and providing adequate conditions and care for both patients and staff working at HC facilities.

Climate Change is recognised as the biggest public health threat in this century (Costello et al., 2009). When climate impacts occur, the first to respond are facilities providing health and social care. In order to respond properly, it is necessary for such facilities to be adaptive and prepared for the predicted changes. Needless to say, these changes affect our ability of providing adequate care, and will increasingly continue to do so in the future. The key to a successful response is to comprehend the aftermath, but also to act accordingly prior to, during and after such climate occurrences (Rockefeller Foundation, 2009).

Today, when climate changes and their impacts are inevitable, the continuity of health services and developing action plans designed for these occasions are crucial to resilience (American Meteorological Society, 2014).Consequently, the up-to-date strategies and instruction mechanisms represent a necessary foundation for all health care facilities.

The growth of discontent expressed by patients as well as working staff is another occurring problem nowadays. Health care facilities themselves influence gravely the patients' healing process, and the employees' performance. That is why the concept for renovation and reconstruction of these facilities becomes a popular sphere of research, which is expected to endow both key stakeholders and prevailing healthcare results (Dilani, 2008).

Based on previous statements, existing HC infrastructure is far from resilient, so the first step in resolving these problems is assessing and defining key problems/objectives through extensive research.

ICT AS A RESEARCH METHOD?

"*The revolution in ICT makes knowledge the new competitive resource*" – Webber, *Harvard Business Review*, 1993.

Technology has significantly influenced the way in which people interact with one another and perceive the world surrounding them. Digital technologies have become a part of everyday activities, making each task easier to achieve. The importance of ICT is without a doubt visible in numerous domains, such as education, business development and different scientific researches including the aspect of health care. Therefore, the ICT infrastructure is perceived as an engine for global revolution and advance and its role in research becomes crucial in modern society. In other words, the ICTs are beneficial for researchers in the sense that they enhance and simplify their work completely. Even though the use of ICT in research process focused mostly on the reinforcement of productiveness, the ICT networks also represent imperative for scientific advancement. Therefore, they are a tool for resolving problems emerged along with the growth of international research networks. (Stupar, Djukic, 2015)

Since it is the ICTs that portray globalisation most evidently, it is necessary to tackle all research from a global angle, with the goal of establishing unity between local and nationwide calibrating tendencies. Regarding methodology, the ICT has various applications. Every methodology is based on collecting and processing data using different mechanisms. Involving ICT in the research procress is beneficial for many reasons, which has made their application inevitable in diverse research methods. What certain ICTs permit is a plethora of imaged, verbal as well as non-verbal reciprocity (Salmons, 2010). ICT mechanisms for research can be divided into two sorts: synchronous and asynchronous – network interviews and network inquiry. Salmons goes further on by dividing the synchronous dialogue technologies onto four categories: established by texting, visual discussion - videoconference, session of diverse channels and enveloping 3-D surroundings. Salmons also divide asynchronous mechanisms onto online inquiries and studies.

In the sense of participative and collaborative research, using asynchronous methods, such as online questionnaires, provides opportunities for including wide range of different stakeholders in the same time. The methods for gathering data via ICT have been described by many authors (Fraley, 2004). Buchanan and Schmidt (1999) described beneficial role of collecting information using Internet: increasing the range of participants, efficiency, transparency and low cost research.. Benefits of using ICT: ICT allows more time for observation, discussion and analysis, using ICT increases opportunities for communication and collaboration.

Another advantage of using ICTs in research is its characteristic to utilise authentic information regarding a distinct and precise research requirement (Hewson, 2010). However, the disadvantages such as the obligatory internet connection, the lack of focus and necessary knowledge in informatics, prevent many participants from being involved in researches conducted via ICT.

Questionnaire designers frequently use the Internet – online services as a research tool, and there is growing evidence that it is an effective method (Hunt, Mc Hale, 2009). In this paper, we use online questioners and surveys as a research tool.

ICT IN HEALTHCARE

What is nowadays perceived not only as an advantage, but also as an endeavour in the domain of health is – data; which circulates all around the world, from patients, working staff, research facilities, medication prescriptions and social records, just to name a few. The data received by ICT experts is endless; therefore, every individual user has its proper application, with its own rules and regulations.

Firstly, due to the constant progressing of ICT in healthcare systems, it is impossible to reach an ultimate denouement. The ICT is important for the healthcare facilities for its primary function in conglomerations, management and health care strategies, but it is also a link among patients and the working staff. Moreover, in order to enhance the collaboration of diverse healthcare departments, the EPF (Electronic Patient File), has been established, as well as a Care Identification Number. Part of the cares that was provided by humans, nowadays can be provided by ICTs, which results in employees being more autonomous regarding their working surroundings, and are therefore more productive.

ICT presents a solution for many healthcare problems, especially in a domain of the specialist medical care, which will also serve as a mechanism for the collaboration among diverse methods, namely the primary and secondary care. Regarding patients on one hand, the ICT serves as a provider of demanded data (about treatments, diseases, prescriptions), but also as a guide and advisor. On the other hand, ICT influences the working staff by providing analogue images saving, as well as the management of information storing and telemedicine.

HEALTHCARE INFRASTRUCTURE IN SERBIA-BELGRADE

Developing countries such as Serbia, are thought to be especially sensitive to the weather changes (UNECE, 2007), are characterized by poor responses to climate changes, weak dynamism, mostly expressed through late responses and reactions (Albern, Kern, 2008).

Serbia has no observation and control of the effects of climate changes, nor are the healthcare facilities adaptive to such changes. An attempt to form a strategy for enhancing HC maintenance was made in 2003, by a group of authors, under the leadership of the Ministry of Health. It embodies the crucial problems of the present situation, such as low productivity, absence of quantitative assessments, as well as the absence of necessary equipment and aged facilities (Mitrovic, 2003).

The unfortunate flooding that happened in Serbia in early 2014, accentuated the poorly adjusted national strategies regarding severe climate changes, namely the absence of preparation of the strategy and procedures in case of such events. As for healthcare facilities, their constant resistance to development and adjustment on substantial, commanding and legislative levels lead to these facilities being extremely sensitive to climate changes (Loosemore at al., 2011).

Considering current economical and social state in Belgrade - chronic lack of funds, low level of development and lack of knowledge - the unsustainable condition of HC systems is not ruprising. On the other hand, the topic of health infrastructure adaptation to climate change is also not considered adequately in the local context.

It is also important to mention the discontent of patients and the working staff in healthcare facilities in Belgrade, caused by aged infrastructure and design, which is regarded in their present condition - being unsuitable and unsustainable in ecological, economical and social terms. Serbian healthcare facilities are in urgent need of reconstruction.

The first step towards planning a strategy for redesigning healthcare facilities is to develop a research method for assessing the key problems for reaching healthcare resilience. In the following chapters, an attempt to address these issues will be presented.

EVALUATING THE HEALTHCARE RESILIENCE

In order to improve resilience of HC facilities in Belgrade, we need to develop a strategic approach, which will define possibilities and main objectives for re-designing existing HC infrastructure. Furthermore, an appropriate research methodology for evaluating current state and key problems and objectives needs to be established and applied. In this chapter, we will present the assessment of current resilience of HC facilities, conducted with the use of ICTs as a main research Infrastructure.

Focusing on the case of Belgrade, two major large-scale hospitals are chosen as case studies. This research is based on users' opinion, therefore, a group of key stakeholders from these hospitals were asked to participate by filling an online questionnaire, consisted of specific set of predefined criteria, concerning HC resilience.

Because of their significance for HC system in Serbia, HC facility called Clinical Center of Serbia and Medical Military Academy were chosen as subjects for this research. Clinical Center of Serbia, located in Belgrade, is a unique medical institution, created by joining the clinic and the Institute of Medicine in Belgrade. With more than seven thousand employees, it is the largest provider of health services in Serbia and one of the largest in Europe, which annually treats more than one million patients. This hospital complex is situated on an area of 38 hectares and approximately 280.000 m2. Occupying the area of 21 hectares and 180.000 square meters, with more than 3000 employees and capacity of 1200 beds, Medical Military Academy is also, one of

the biggest large-scale hospitals in Serbia.However, based on simple observation analysis, both of these hospitals are in need of major reconstruction.

Questionnaire for evaluation of hospital resilience

The oral consent script has been read and consent given?

- ☐ **yes**

Would you mind telling me if you are:

- ☐ **patient / family or friend of a patient**
- ☐ **employed in hospital (doctor, nurse, supplier, engineer)**

Please evaluate the resilience of the hospital by answering to following questions:

***(mark your level of satisfaction by choosing grades from 1 to 5, 1 being the least satisfied and 5 being the most satisfied)**

How are you satisfied with:

1. sustainability of the hospital?	**1 2 3 4 5**
2. accessibility of the hospital?	**1 2 3 4 5**
3. flexibility of hospital indoor spaces?	**1 2 3 4 5**
4. coordination and communication mechanisms?	**1 2 3 4 5**
5. indoor and outdoor signalization system?	**1 2 3 4 5**
6. usage of new technologies in hospital treatments?	**1 2 3 4 5**
7. building capacity?	**1 2 3 4 5**
8. risk and emergency plans and strategies?	**1 2 3 4 5**
9. supply systems?	**1 2 3 4 5**
10. connection between hospital and the city?	**1 2 3 4 5**
11. connections between this and nearby hospitals?	**1 2 3 4 5**
12. comfort of hospital spaces?	**1 2 3 4 5**
13. natural lightning inside of the hospital?	**1 2 3 4 5**
14. air quality inside of the hospital?	**1 2 3 4 5**
15. hygiene?	**1 2 3 4 5**
16. room privacy and equipment?	**1 2 3 4 5**
17. security?	**1 2 3 4 5**
18. support places?	**1 2 3 4 5**
19. way finding system?	**1 2 3 4 5**
20. access to outdoor spaces?	**1 2 3 4 5**
21. landscape?	**1 2 3 4 5**
22. hospital image?	**1 2 3 4 5**

Image 1. Significant part of the online questionnaire used in this research

The process of the research was conducted in two stages. In the first part a specific set of criteria for evaluating resilience was established, based on background research - literature review, contextual framework, information gathered from different studies, and observation analysis of chosen hospitals in Belgrade. Criteria were defined by universally measurable indicators, and separated into two main categories, concerning HC resilience:

1. *adaptation to climate changes* (sustainability, accessibility, water and energy consumption, flexibility of indoor spaces,coordination and communication mechanisms,indoor and outdoor signalization system, usage of new technologies in hospital treatments, building capacity, workforce shortages, risk and emergency plans and strategies, supply systems, connections between hospital and the city ,connections between hospitals).
2. *user satisfaction* (comfort, noise, temperature, lightning inside of the hospital, air quality/air pollution, room privacy and equipment, hygiene, security, support places, way finding system, access to outdoor spaces, landscape, hospital image).

In the second part of the research, a group of stakeholders for the evaluation was chosen. In recent years, nearly all healthcare design work in developed countries has been done in some format of integrated and participative process. Collaborative approach is considered favourable because of its flexible nature, and possibility for including wide range of participants. In this research, chosen stakeholders were the most frequent users of these hospitals. They were divided into two groups:

1. patients (with their families and friends)
2. hospital staff (doctors, nurses, suppliers and experts-engineers employed in these hospitals).

Further analyses were conducted via ICT networks. All the participants were asked to fill online questionnaire. This questionnaire (Image 1) was consisted of 22 questions based on resilience criteria aforementioned, and stakeholders were asked to evaluate their satisfaction with grades from 1 to 5 (1 being the least satisfied, and 5 being the most satisfied with) for every question.

The online inquiry was conducted over a four weeks period, from November to December 2015, and a total of 200 people participated (60 members of hospital staff, and 140 patients from both Clinical Center of Serbia and Medical Military Academy). After this period the results were collected and processed.

RESULTS

The results of the online questionnaire clearly show main problems of the hospital resilience in Belgrade. Overall, participants are satisfied with certain elements, such as accessibility of the hospitals, connections, security, landscape, etc., but there are numerous criteria with grades bellow average. Participants from Clinical center of Serbia (both patients and employees) are unsatisfied with comfort and overall image of the hospital, as well as the lack of risk and emergency plans and strategies and support places. Patients from Medical Military Academy find indoor communication and signalization systems as most unsatisfying criteria, while they agree with employees on the lack of fresh air and natural lightning inside the hospital, and poor access to outdoor spaces of hospital complex.

Considering overall state of healthcare facilities in Serbia, within existing limitations imposed by socio-economic and technological conditions, these qualitative analyses revealed significant problems in existing design and adaptation to possible climate impacts.

These results certainly could contribute to better knowledge and understanding of key problems regarding hospital design and performance. Simultaneously, they suggest creatingadaptive management strategies that could be implemented not only for on selected case studies, but on all HC facilities in Belgrade.

	HOSPITAL	Clinice Center of Serbia		Medical Military Academy	
	questiones	average grade 1-5		average grade 1-5	
		patients	emplyoees	patients	employees
1	sustainability of the hospital	4	4	5	3
2	accessibility of the hospital	3	4	4	4
3	flexibility of hospital indoor spaces	4	4.5	3	4
4	coordination and communication mechanisms	3	5	2.5	4
5	indoor and outdoor signalization system	3	4	2	4
6	usage of new technologies in hospital treatments	4	3	4	3.5
7	building capacity	4	5	4	4
8	risk and emergency plans and strategies	2	2	3	2
9	supply systems	3.5	4	4	4
10	connection between hospital and the city	4	4.5	4	4
11	connections between this and nearby hospitals	4	5	4	5
12	comfort of hospital spaces	2.5	4	3	4
13	natural lightning inside of the hospital	4	4	3	2.5
14	air quality inside of the hospital	4	4	2	2
15	hygiene	3	4	4	5
16	room privacy and equipment	3	3.5	4	4.5
17	security	4	5	5	5
18	support places	2	2	2	2
19	way finding system	4	5	2	4
20	access to outdoor spaces	3	4	2.5	3
21	landscape	3	4	5	5
22	hospital image	2	2.5	5	5

Table 2. the results of research

Use of ICT in HC research has been associated with measurable improvement in healthcare facilities outcomes. This research presents first assessment of existing hospital resilience done in Serbia. The results of the research will contribute to improving knowledge and practice, as well as stimulate inclusion of ICT networks and tools into HC evaluation process. However, the applied methodology has revealed both significant advantages, and disadvantages of using online questionnaires (Table 1).

Advantages:	Disadvantages:
- Possibility for all interested stakeholders to participate	- Inacessible for participants with no internet access, computer or mobile devices
- Quick access to information in any time	
- Efficiency in reducing time spent for research	- Technical issues could affect the research, e.g. losing internet connection
- Enables simultaneous research in different places	- Older people, disabled, and children are less likely to participate
- Transparency of information and results	- People having difficulties to understand procedures for online questionnaires
- Low cost of research	- Participants lose focus easily

Table 3: Advantages and disadvantages in conducting research via ICT.

CONCLUSIONS

The This paper is focused on the present role of ICT and its potential in research. It aimed to find out how various digital technologies provide useful tools in different research fields and how ICT can improve research methodology. Introducing different kinds of techniques, e.g. video conferencing, online interviews, online questionnaires and surveys. The management and gathering of data, as well as analyses, monitoring and transfer, become definitely more efficient.

Although digital techniques are certainly upgrading research process, its success still depends on numerous elements. Certain disadvantages emerged while conducting research on HC facilities in Belgrade. Due to economic and social situation, the level of ICT use in developing countries, such as Serbia, is much lower. Additionally, the lack of experience and knowledge in using ICT, as well as technical issues (e.g. poor internet connections or inadequate equipment) significantly affect research process and results. Overcoming these obstacles should become an imperative for the future research processes in Serbia. Only then, it will be possible to upgrade and expand al areas of studies and apply full range of ICT possibilities.

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